

Command 1C: WUI Command Operations for the Company Officer

**Student Manual
January 2013**



California Department of Forestry and Fire Protection
Office of the State Fire Marshal
State Fire Training

COMMAND 1C

WUI Command Operations For The Company Officer



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Acknowledgments

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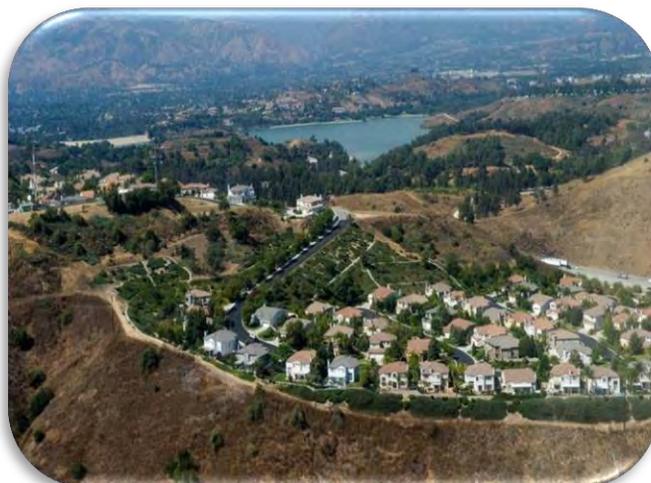
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Topic 1-1: Fire Suppression in the Wildland Urban Interface Environment

Defining the WUI

The wildland urban interface is commonly described as the zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Wildland fires have been destroying structures for centuries, but it was not until recently that the term “**wildland urban interface fire**” was coined. This problem does not occur just in California; major structural losses have occurred worldwide. Fire departments routinely respond to wildland fires and commonly protect threatened structures. In some areas of California, this is a daily occurrence. These situations require special strategies and tactics. There are two basic structure environments in the wildland.

- ❑ **Interface** – a condition where structures abut the wildland
 - There is a clear line of demarcation between the structures and the wildland fuels along roads or back fences
 - Usually identified as housing tracts or developments adjacent to a wildland area
 - There is a greater potential for house to house ignition
- ❑ **Intermix** – a condition where structures are scattered throughout a wildland area
 - There is no clear line of demarcation; wildland fuels are continuous outside of and within the developed area
 - Each structure must be assessed independently
 - Usually more complex to triage than an interface condition
 - Usually more complex to defend than an interface condition
 - Usually requires a higher ratio of engines to structures than an interface condition



The Interface



The Intermix



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Topic 1-1: Fire Suppression in the Wildland Urban Interface Environment

WUI Hazards

Firefighters must realize their limitations as well as the limitations of their equipment when engaged in structure defense operations. The impulse to take action, coupled with a “can do” attitude has contributed to numerous deaths, injuries, and near misses on WUI incidents. While no agency demands or suggests that firefighters take extraordinary risks during WUI incidents, firefighters have a natural tendency to “push the envelope” when lives and structures are threatened.

The addition of structures as part of the fuel load in the WUI can alter a firefighter’s perception of what is acceptably safe. The presence of civilians and the destruction of structures during WUI fires can cause firefighters to place additional pressure upon them, leading to increased risk taking. WUI incidents also generate tremendous political and media interest, which may exert undue pressure on firefighters. Despite these pressures, prudent action on a defensible structure should be the rule; taking an unnecessary risk just because a structure is threatened is unacceptable. Initiate structure defense actions only after an evaluation of the fire environment.

You must temper a “can do” attitude with real-time intelligence and a determination to mitigate the structure defense problem with acceptable risk to firefighters. When structures are unsafe to defend due to the current and forecasted fire behavior, firefighters should utilize other options such as “Check and Go” or “Prep and Go” tactics. Later topics in the manual will discuss these options in detail.

In addition to the usual safety hazards firefighters’ encounter on a wildfire, the WUI setting creates many unique safety concerns. On a WUI incident, firefighters may encounter:

- Panicked, angry, or trapped residents remaining at defensible/nondefensible structures
- Uncoordinated actions by other firefighters including firing operations, aircraft drops, futile hose lays, and line construction or spontaneous volunteer firefighters
- Firefighting on multiple fronts or firefighters making a frontal assault
- Poor ingress or egress to threatened structures or road grade and surfaces not designed for large fire equipment
- Little or no defensible space around structures, poor visibility, inadequate water sources, extreme fire behavior
- Shortage of resources for both structure defense and perimeter control operations
- Limited number of safety zones, long escape routes that are used by multiple engines, limited number of temporary refuge areas
- Frightened animals, downed power lines, fuel storage tanks, LPG tanks, explosives, and other hazardous materials

While many of these safety issues are not present on every WUI incident, firefighters must prepare for the possibility that they may encounter a number of them.

Key Points from Historical Fires

Historical fires have had a significant impact on the fire service and have modified our firefighting practices. In California, CAL FIRE and most local agencies adopted fire shelters after the Spanish Ranch Fire in San Luis Obispo in 1979. In 1994, the South Canyon Fire in Colorado the deaths of 14 firefighters led to a change in fire shelter design. The South Canyon Fire also brought forth the need to look not just at current fire behavior but to forecast the worst-case scenario. At this fire, firefighters experienced a timber litter fire under heavy brush, a dirty (incomplete) burn that had the potential to reburn, and the desire to get the job done in which they underestimated the potential that caught highly experienced crews off-guard. Hand crews did not establish adequate escape routes and safety zones, and weather reports and communication breakdowns were contributing factors to this awful accident.

Another significant fire was the Thirtymile Fire that occurred in the State of Washington on July 10, 2001. In the Chewuch River Canyon, about 30 miles north of Winthrop, Washington four USFS fire suppression personnel died after the fire entrapped them and burned over their fire shelter deployment zone. This fire brought about a federal standard for turning down assignments, accountability for a lack of leadership, and negligent command. The final report indicated the need for good leadership, crew continuity, and situational awareness. They also reexamined deployment choices and training on fire shelters. For each of these fires we will look at the impact the fire had on the following areas: training standards, qualifications, tactical changes, philosophical changes, fire behavior forecasting, and equipment modifications/enhancements.

These fires have influenced how we fight fires in California. There are many more case studies that can be reviewed. It is important that we continue to learn from these examples. Let us look at some wildland urban interface fires that have occurred in California and made an impact on how we respond and prepare for future fires. For each of these fires, we will look at the impact the fire had on the following areas: training standards, qualifications, tactical changes, philosophical changes, fire behavior forecasting, and equipment modifications/enhancements.

Tunnel Fire

This 1,520-acre fire, also known as the Oakland Hills Firestorm or the East Bay Hills Fire, ultimately destroyed 3,354 single-family dwellings and 437 apartment and condominium units with an economic loss estimated at \$1.5 billion. At the time, it was the largest dollar fire loss in the United States. In addition, 25 lives were lost, including a police officer and a Battalion Chief, and injuring 150 others. The fire completely overwhelmed the firefighting forces of the area, consuming everything in its path. It was only when the



The Tunnel Fire

North winds decreased that the fire stopped. The wind had threatened to drive the fire across the entire City of Oakland.

References: 1) Oakland/Berkeley Hills Fire, October 20, 1991, NFPA Fire Investigations 2) The East Bay Hills Fire, A Multiagency Review of the October 1991 Fire in the Oakland/Berkeley Hills, East Bay Hills Fire Operations Review Group, State of California, Governor's Office of Emergency Services, February 27, 1992 3) The Tunnel Incident – Oakland 1991 Ten Years After, October 3, 2001, The Hills Emergency Forum 4) The East Bay Hills Fire Oakland-Berkeley, California, FEMA – USFA – National Fire Data Center, Technical Report Series 060 ,TriData Corporation, J. Gordon Routley

Training Standards

After the legislature adopted ICS, all city and county personnel must complete mandated ICS training. The mandate stresses that ICS training and drills should include opportunities to learn and practice the transition from single resource to multiagency incidents and have exercises designed to allow Company Officers to gain experience in all operational roles. It states that wildland fire control should become a component of scheduled in-service training including all aspects of tactics and wildland fire mop-up techniques. The training should also include real-time mutual aid mobilization exercises conducted at least annually.

Qualifications

Provide training to all local emergency response personnel in ICS. Expand operational level command staff to meet recognized standards for span of control in firefighting. Effective span of control is between three and seven resources per supervisor with five resources being the optimum. Include a qualified Strike Team Leader in all prearranged strike teams.

Tactical Considerations

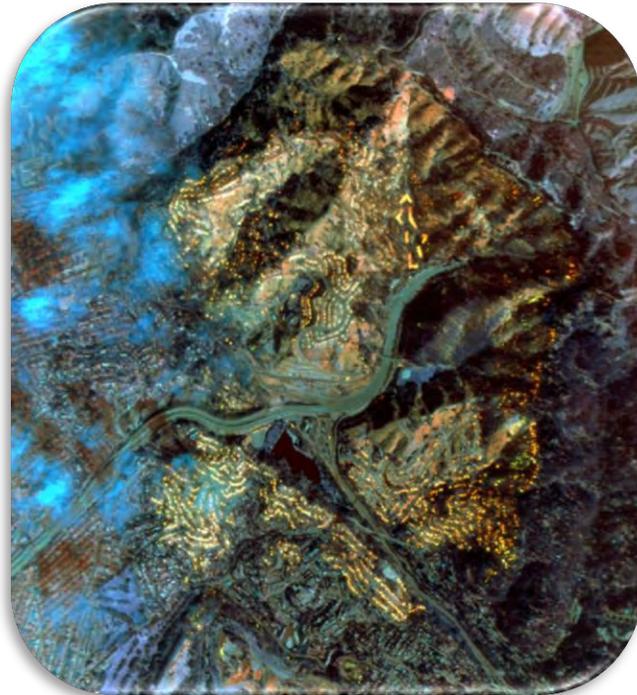
Recognize the need to request air tankers and water-dropping helicopters early. Provide all urban fire departments with guidelines for safe and effective air operations. Institute staffing pattern changes to strengthen companies in hazardous fire areas during red flag warnings.

Philosophical Considerations

Enhance multidiscipline coordination, particularly between fire, law, and emergency services agencies at all levels. Establish automatic mutual aid, boundary drops, and interagency response for mutual threat zones, including multidisciplinary incidents.

Fire Behavior Forecasting

Improve public safety agencies' understanding of the national fire danger rating system. Develop local emergency action plans that deal effectively with "red flag" program.



Aerial View of the Tunnel Fire

Equipment Modifications and Enhancements

Adapt standard hydrant outlets. Equip all fire vehicles with loudspeakers so that firefighters can inform citizens of need for evacuations. Reduce incompatibility in communications systems at all levels, and between local and state agencies.

Calabasas Fire

The Calabasas Fire began on October 22, 1996 in Los Angeles County. This fire was historic in that it changed the way California local agencies trained and qualified their personnel to respond to WUI fires. This fire was the beginning of the California Incident Command Certification System (CICCS). The Calabasas fire consumed 12,758 acres.

References: 1) Calabasas Incident Entrapment Analysis Summary, October 1991, Compiled by Battalion Chief John P. Harris, Entrapment Analysis Team Leader, Los Angeles County Fire Department, Malibu California, Los Angeles County 2) Calabasas Incident Entrapment Analysis, October 22, 1996, Interagency Analysis Team, Los Angeles County and Malibu, California

Training Standards

CICCS was proposed and brought to FIRESCOPE after this fire.

Qualifications

CICCS started using the federal guidelines for local agencies. Strike Team Leaders needed to take additional classes and go out with qualified leaders and have task books signed off.

Tactical Changes

One change recommended placing the house between the crew and the fire. This fire also demonstrated the need for all crews at the head of a fire to be in a safety zone when the fire approaches. Strike Team Leaders should lead in and check midslope roads to make sure they are clear prior to sending Engines through.



The Calabasas Fire

Philosophical Changes

Initiate mandatory evacuations sooner. Management team needed to assigned more resources ahead of the fire behavior.

Fire Behavior Forecasting

This fire initially burned under Santa Ana wind conditions but later on the wind died down. What followed were low intensity flames burning at night with incomplete combustion of the vegetation. The next day the fire relocated to the bottom of a slope putting it in full alignment of fuel, weather, and topography, it then spotted creating an area on fire that produced extreme flame lengths. Hand crews

did not recognize the potential impact of the extreme fire behavior below their position and the implications of the forecasted and observed wind change.

Equipment Modifications and Enhancements

Wearing PPE reduces injuries and deaths. Utilizing a fully enclosed engine cab and staying inside protects firefighters from the external environment.

Cedar Fire

The Cedar Fire report came in on Saturday, October 25, 2003, at approximately 5:37 pm. The fire, burning under a Santa Ana wind condition, eventually consumed 280,278 acres and destroyed 2,232 structures, 22 commercial buildings, and 566 outbuildings, damaging another 53 structures and 10 outbuildings. There was 1 firefighter fatality, 13 civilian fatalities, and 107 injuries.

References: 1) Cal Fire Review Report of Serious Injuries, Illnesses, Accident, and Near-Miss Incident: Cedar Fire, Engine Crew Entrapment, Fatality, and Burn Injuries, October 29, 2003, CA-CNF-003056 2) Novato Fire Protection District: Investigation Analysis of the Cedar Fire Incident, Engine 6162 Crew Entrapment, Fatality, and Burn Injuries, October 29, 2003, 1st Edition 3) NIOSH F2003-36, July 15, 2005, Fire Fighter Fatality Investigation and Prevention Program, A Career Fire Fighter was Killed and a Career Captain was Severely Injured During a Wildland/Urban Interface Operation (California), 4) Cal Fire Green Sheet: Preliminary Summary Report, Engine Crew Entrapment, Fatality, and Burn Injuries, October 29, 2003, Cedar Fire, CA-CNF-003056

Training Standards

The investigative team looked at training qualifications from the IC down the chain of command to the firefighter that died. This fire did not change any standards, but reinforced the need for crews to meet the training standards that are currently in place.

Qualifications

This Cedar Fire did not produce any qualification modifications or enhancements.

Tactical Changes

The need to communicate with adjoining resources and establish a look out was evident. A major issue was that the Division Supervisor did not approve a burn plan that was uncoordinated with other resources. Freelancing and the ability to place fire on the ground were major issues addressed after this fire. It is not clear if this contributed to the fatality but was in close proximity and condemned.

Philosophical Changes

Houses are clearly not Safety Zones. The need to forecast fire coming from more than one or all sides of the structure threatened.



The Cedar Fire



Fire Behavior Forecasting

This fire burned understory on the opposite hillside flanking the crew's location. As the fire established itself lower and in more alignment with the fuel, wind and topography it became a head fire crowning through the brush with a rapid rate of spread, from a different direction than the crew had first anticipated.

Equipment Modifications and Enhancements

One VHF portable radio is inadequate. The recommendation is to have one VHF radio for each crewmember in order to have a level of adequate redundant communications with the crew and incident.

Esperanza Fire

On October 26, 2006, the fire entrapped five USFS firefighters while engaged in structure protection operations on the Esperanza Fire in Riverside County, California. Three firefighters died at the scene, one died en route to the hospital, and the fifth died on 10/31/06. All deaths were the result of burns received at the incident. The Esperanza fire consumed 40,200 acres.

References: 1) Esperanza Fire Accident Investigation Factual Report, October 26, 2006, USFS/CAL FIRE Riverside County, California 2) Esperanza Factual Report Analysis, September 10, 2007, USFS-BDF Analysis of the Esperanza Factual Report of the interagency Serious Accident Investigation Team 3) Cal Fire Green Sheet: Preliminary Summary Report, Fire Fighter Burn Over: Five Fatalities, October 26, 2006, Esperanza Fire, CA-RRU-091190

Training Standards

No training standards changed. The USFS Washington Office questioned the Federal policy on allowing any federal resources to defend structures in the future, but did not make a policy change at the federal level.

Qualifications

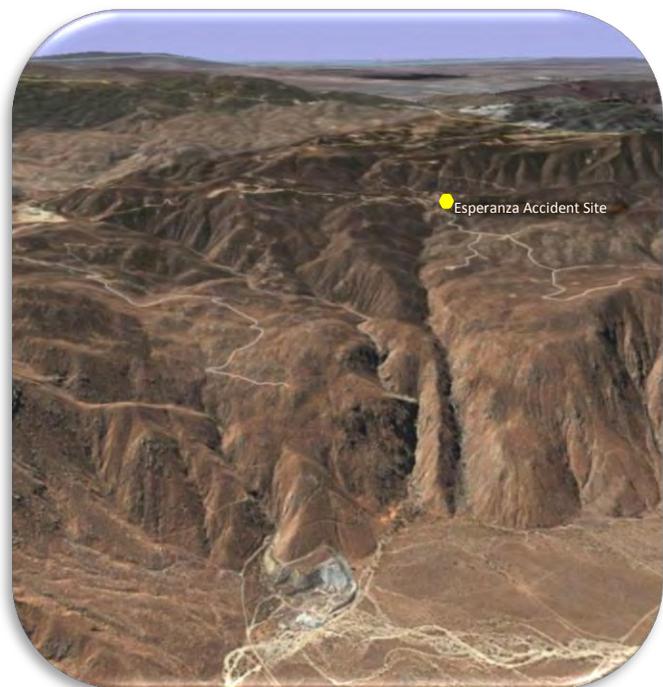
The Esperanza Fire did not produce any qualification modifications or enhancements.

Tactical Changes

Decisions to attempt structure protection at structures that were nondefendable due to fire behavior and unsurvivable for firefighters will no longer be tolerated. Philosophical and tactical changes regarding structure defense will be solely based on firefighter safety and survival.

Philosophical Changes

All resources are to monitor and communicate on incident approved and assigned frequencies.



The Esperanza Fire

Fire Behavior Forecasting

The fire had been burning for six hours under a Santa Ana wind with single digit humidity. The crew was at the top of a chimney on a prominent knob attempting structure defense operations at a vacant structure. The fire became established below them in the chimney due to spotting. There was an inversion in place. Due to preheating from the main fire, the inversion was penetrated and the spot fires drawn at an extreme rate of spread through the steep chimney. The fire behavior that killed the crew came from below in full alignment with fuel, weather, and topography. It was at a speed, intensity, and direction that made the entire area inadequate for firefighter survival.

Equipment Modifications/Enhancements

The Esperanza Fire did not produce any equipment modifications or enhancements.

Jesusita Fire

On Tuesday, May 5, 2009, at 1:45 pm, a report came in of a wildland fire in the foothills north of the City of Santa Barbara along the “Jesusita” hiking trail within the Los Padres National Forest/Santa Barbara Ranger District. Los Padres National Forest, Santa Barbara County Fire Department, and Santa Barbara City Fire Department initiated a coordinated wildland fire dispatch of fire suppression resources to the incident. The Jesusita Fire consumed 8,700 acres.

References: 1) Cal Fire Blue Sheet: Preliminary Summary Report, Firefighter Burn Injury, May 6, 2009, Jesusita Fire, CA-LPF-001479 2) Cal Fire Review Report of Serious Injuries, Illnesses, Accident and Near-Miss Incident: Jesusita Fire Burnover, Firefighter Burn Injuries with Engine Burnover, and Additional Related Near Miss Incidents, May 6, 2009, CA-LPF-001479 3) Jesusita Fire Burnover – Lessons Learned, FIRESCOPE – State of California

Training Standards

The Jesusita Fire did not produce any training standards modifications or enhancements.

Qualifications

This Jesusita Fire did not produce any qualification modifications or enhancements.

Tactical Changes

Many recommended changes came out of the final report for this fire:

- The first and foremost intent during structure protection is to keep firefighters and the public safe
- Aggressively work towards keeping the wildland fire away from structures and communities once safety is ensured
- Temporary Refuge Areas (TRA) should be identified in the event that emergency egress to an established Safety Zone is compromised
- When providing exposure or structure protection, provide for adequate Safety Zones or direct resources to disengage when established decision points are reached



The Jesusita Fire

- Develop all strategies and tactics based on a risk management process to ensure firefighter safety
- When there is a need to engage in structure protection, firefighters should ensure that they are taking safe, appropriate, and reasonable tactical actions for which they are trained and equipped

Philosophical Changes

Divisions and Groups need to communicate tactics when working in close proximity. To maintain unity of command, whenever possible incorporate structure protection as a control objective of respective branches and divisions. Structure Defense Groups should be discouraged, incorporating both structure defense and perimeter control tactics into geographic branches and divisions.

Fire Behavior Forecasting

Consider fire behavior that indicates disengagement or movement to a Safety Zone for all resources, not just those engaged in perimeter control. Protecting structures from a wildland fire will not be possible in every situation due to firefighter safety and survival. Risk to firefighters, fire behavior and availability of resources will dictate the strategies that are used.

Equipment Modifications/Enhancements

The Jesusita Fire did not produce any equipment modifications or enhancements.

Station Fire

On Wednesday August 26, 2009 the Station Fire started. This large fire burned over Camp 16 on Sunday August 30, 2009 resulting in the deaths of two Los Angeles County Fire Department firefighters, numerous minor injuries, and extensive damage to Camp 16. The station fire consumed 160,577 acres.

References: 1) Camp 16 Incident: Burnover and Fatal Vehicle Accident, Los Angeles County Fire Department, Factual Report, Serious Accident Review Team, CA-LAC-09196997, August 30, 2009 2) ORC Strike Team 1400C: Structure Protection and Extreme Fire Behavior Event, Orange County Fire Authority, After Action Review, 2nd Edition, Station Fire, Big Tujunga Canyon, Angeles National Forest, August 29, 2009

Training Standards

The Station Fire did not produce any training standards modifications or enhancements.

Qualifications

This Station Fire did not produce any qualification modifications or enhancements.

Tactical Changes

Consider conducting burnout operations before the fire is a direct threat. Ensure adequate trigger points are in place to move away from the intense fire behavior.

Philosophical Changes

Consider evacuations early and get all nonessential personnel out. The incident management team should be involved in the decision and protection of all infrastructures ahead of the fire.



The Station Fire

Fire Behavior Forecasting

Although there was a predication of extreme fire behavior with full alignment of fuel, weather, and topography, the collapse of the plume was greater than anticipated. Due to the location of the structures and given the full alignment of wildland fire behavior factors, the decision to stay and defend may have been different if it was normal structure defense.

Equipment Modifications and Enhancements

The Station Fire did not produce any equipment modifications or enhancements.

Firefighting Challenges

Defending Infrastructure

Defending infrastructure during a WUI fire is always a high priority. When infrastructures are threatened or lost, communities suffer. Defending infrastructure is an important management and operational objective in the WUI.

Critical infrastructure may include:

- Major power transmission lines
- Water distribution networks (flumes, canals, sewer, and water treatment)
- Communication sites
- Underground pipelines, power grids, and communications
- Fuel depots and storage areas
- Power generation facilities

Two of the most common hazards firefighters encounter occurs while defending a power grid are downed power lines and heavy smoke columns since smoke is an excellent conductor of electricity.



Remote Radio Repeater



The Intermix



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Topic 1-1: Fire Suppression in the Wildland Urban Interface Environment

Local Conditions

Local conditions play an important role in understanding and forecasting fire behavior. California is unique when compared to many states in that it contains, deserts, mountains, valleys, coastal regions, and inland valleys. California has a wide variety of fuel types from timber and grasses to continuous brush fuel types throughout the state that create intense fire behavior often not experienced in many places outside of California. A proper forecast will allow you to apply proper strategy and tactics and employ appropriate decisions and firefighting activities. It is important for all firefighting personnel to understand local conditions that may affect fire behavior.

Southern California has the Santa Ana winds, Riverside County has the Elsinore Effect, Santa Barbara County has the Sundowner winds, and Northern California has the North winds. All of these examples of local conditions have a dramatic impact on fire behavior in their area. When you respond outside your local area, it is important to gain a quick understanding of the local factors that affect fire behavior.

Public Expectations

Public expectations are high for the fire service, and many expect a fast and efficient response even when large disasters occur. The fire service needs to actively engage the public, explain how fires are fought, and describe what the risk/benefit considerations are that lead to the decisions for defending property. The fire service needs to actively engage the public and get buy in to assist in controlling hazards on their own property as the single biggest factor to reducing fire loss and saving lives of civilians and firefighters.

The public (social and political) and firefighting communities expect and tolerate their firefighters to accept a notably higher risk for structure protection on wildland fires than when other resources/values are threatened by wildfire. For example, a victim from the Cedar Fire in 2003 summarizes many of our public's unrealistic expectations by saying, "More firefighters would have lost their lives in this fire, if they were doing their jobs!"

The fire service does not have acceptable loss rates as in the military and should not conduct operations that violate standard industry safeguards in order to defend homes or put out fires. Without an effective risk management plan, emotions can draw Company Officers into wanting to do too much or getting overwhelmed with the situation, causing them to make poor decisions.

Another factor influencing public expectation is a fire department's budget constraints. Budgeting considerations drive service levels in all areas of the fire service. Reducing budgets and staffing levels may require modifications to service delivery and tactics in order to maintain safety.



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Topic 1-2: Community Partnership Initiatives

Topic 1-2: Community Partnership Initiatives

The dramatic expansion of development in the wildland urban interface places property, natural assets, and human life at increased risk of wildfire destruction. The appeal of natural vegetation attracts many residents to the wildland urban interface. Although the removal of trees and shrubs from private property facilitates the ability to protect a home in the event of a wildfire, such actions contradict the original impetus for moving to forested areas. There is a need for effective and persuasive communications to empower homeowners to reduce their vulnerability to wildfire with a mix of strategies focused on hazardous fuel reduction and fire safe structural enhancements. Informing residents about why and how to perform these actions is central to the mission of successful firefighting, wildland fire prevention, and community preparedness.

Fire Safe Council

The Fire Safe Council (FSC) provides resources for establishing and maintaining local Fire Safe Councils, such as the FSC Handbook, nonprofit, and funding information.

Mission – Mobilizing Californians to protect their homes, communities, and environments from wildfire

Vision – Together, people and communities have eliminated the impact of catastrophic wildfires on all they hold dear

Since its formation in April 1993, the Council has united its diverse membership to speak with one voice about fire safety. There are now over 100 around the State. The Council has distributed fire prevention education materials to industry leaders and their constituents, evaluated legislation pertaining to fire safety and empowered grassroots organizations to spearhead fire safety programs.

Fire Safe Councils are grassroots community-based organizations that share the objective of making California's communities less vulnerable to catastrophic wildfire. Fire Safe Councils accomplish this objective through education programs and projects such as shaded fuel breaks or firebreaks to protect area residents against an oncoming wildfire and to provide firefighters with a place to fight the oncoming fire.

Firewise Communities Program

We live on a fire planet. Wildland fire is, and always has been, as much an element of nature as weather, soils, minerals, plants, animals, and water. As long as there have been forests, prairies, and rangelands, they have periodically burned. Indeed, some natural landscapes depend on occasional fire to maintain a healthy existence. Fire, in its place, can replenish soil nutrients, remove dead and dying vegetation, and create the conditions for healthy regrowth. Some plants even require fire for seed propagation. Fire can be destructive as well, particularly where property and life are concerned, and in the past 100 years, we have tended to see it only in this role as a foe. During the past 60 years, we have aggressively battled to suppress all wildland fires.

We have developed the equipment, techniques, and tactics to be highly successful in this battle. As regular as the seasons, however, fires continue to occur. Although we have achieved remarkable



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success in keeping most fires small, some will always escape our best efforts. In the absence of any change in our development, building and landscaping practices, these escaped fires will continually lead to devastating losses of lives, homes, and other properties. As the population grows and our communities expand farther and farther into wildland areas, this situation may only grow worse.

Nevertheless, we have a choice! We can continue to accept serious losses, or we can adapt to living in these wildland fire environments. Reducing these losses is possible. There is no need for lives or homes to be lost. We can live with wildland fire while protecting our lives, homes, and natural areas by creating Firewise communities. Similar to Fire Safe Councils, Firewise and the national Firewise Communities/USA program are designed to reach beyond the fire service by involving homeowners, community leaders, planners, developers, and others in the effort to protect people, property, and natural resources from the risk of wildland fire – before a fire starts. Fire Safe Councils and Firewise Communities/USA both emphasize community responsibility for planning in the design of a safe community as well as effective emergency response, and individual responsibility for safer home construction and design, landscaping, and maintenance.

Ready, Set, Go!

The Ready, Set, Go! (RSG) program utilizes firefighters to teach individuals who live in high-risk wildfire areas and the wildland urban interface how to best prepare themselves and their properties against fire threats. Ready, Set, Go! works in complimentary and collaborative fashion with Firewise and other existing wildland fire public education efforts. It amplifies their messages to individuals to better achieve the common goal we all share of fire-adapted communities. The RSG Program provides the implementation guidance; background knowledge; and presentation tools to assist fire departments in delivering the program message:

- Ready – preparing for the fire threat
 - Be ready, be fire wise
 - Take personal responsibility and prepare long before the threat of a wildfire so your home is ready in case of a fire
 - Create defensible space by clearing brush away from your home
 - Use fire-resistant landscaping and harden your home with fire-safe construction measures
 - Assemble emergency supplies and belongings in a safe spot
 - Make sure all residents residing within the home are on the same page
 - Plan escape routes
- Set – situational awareness when a fire starts
 - Pack your vehicle with your emergency items
 - Stay aware of the latest news from local media and your local fire department for updated information on the fire
- Go – leave early!
 - Following your action plan makes you prepared and firefighters are now able to best maneuver the wildfire and ensuring you and your family's safety

Property/Structure Preparation

The Institute for Business and Home Safety Mega Fire Report (2008) on the Witch Fire in San Diego, California, reported the key to protecting lives and reducing property losses begins with hardening structures. Structures within the wildland are not lost from direct flame impingement, but rather from the ember environment. Embers may precede the flaming fire front, carried by the winds and distributing burning brands or embers over long distances. These embers fall, or are wind driven into receptive fuels at structures, often going undetected for some time. As the fire front passes, these small embers may ignite incipient fires that spread to the home and then from home to home in a neighborhood. Here is an example of a checklist to use for home preparation.

HOW TO MAKE THE OUTSIDE OF YOUR HOME FIRE SAFE

1 Design/Construction

- Use ignition resistant construction for roofs, roof assemblies, gutters, vents, decks, exterior walls, and exterior windows.
- Enclose the underside of eaves, balconies, and aboveground decks with fire-resistant materials.
- Show your 100 feet of defensible space on your plot plan.
- Build your home away from ridgetops, canyons, and areas between high points of a ridge.
- Consider installing residential sprinklers.
- Make sure that electric service lines, fuse boxes, and circuit breaker panels are installed and maintained per code.
- Contact qualified individuals to perform electrical maintenance and repairs.

2 Access

- Make sure that your street name sign is visibly posted at each street intersection.
- Post your house address so it is easily visible from the street, especially at night.
- Address numbers should be at least 3 inches tall and on a contrasting background.
- Identify at least two exit routes from your neighborhood.
- Identify at least two exit routes from your neighborhood.
- Clear flammable vegetation at least 10 feet from roads and five feet from driveways.
- Cut back overhanging tree branches above access roads.
- Construct roads that allow two-way traffic.
- Make sure dead-end roads and long driveways have turnaround areas wide enough for emergency vehicles.
- Design bridges to carry heavy emergency vehicles.
- Post clear road signs to show traffic restrictions such as dead-end roads and weight/height limitations.

3 Roof

- Install a fire-resistant roof. Contact your local fire department for current roofing requirements.
- Remove dead leaves and needles from your roof and gutters.
- Remove dead branches overhanging your roof and keep branches 10 feet from your chimney.
- Cover your chimney outlet and stovepipe with a nonflammable screen of ½" or smaller mesh.

4 Landscape

- Create a defensible space of 100 feet around your home. It is required by law.
- Create a "lean, clean, and green zone" by removing all flammable vegetation within 30 feet immediately surrounding your home.
- Then create a "reduced fuel zone" in the remaining 70 feet or to your property line. You have two options:
 1. Create horizontal and vertical spacing between plants. The amount of space will depend on how steep your property is and the size of your plants.
 2. Large trees do not have to be removed as long as all of the plants beneath them are removed.
- Remove lower tree branches at least six feet from the ground.
- Landscape with fire resistant plants.
- Maintain all plants with regular water and keep dead branches, leaves, and needles removed.
- When clearing vegetation, use care when operating equipment such as lawnmowers. One small spark may start a fire; a string trimmer is much safer.

5 Yard

- Stack woodpiles at least 30 feet from all structures and remove vegetation within 10 feet of woodpiles.
- Aboveground liquefied petroleum gas containers (500 gallons or less) shall be located a minimum of 10 feet with respect to buildings, public ways, and lot lines of adjoining property that can be built upon. CFC 3804.3
- Remove all stacks of construction materials, pine needles, leaves, and other debris from your yard.
- Contact your local fire department to see if debris burning is allowed in your area. If so, obtain a burning permit and follow all local air quality restrictions.

6 Emergency Water Supply

- Maintain an emergency water supply that meets fire department standards through of the following:
 1. Community water/hydrant system
 2. Cooperative emergency storage tank with neighbors
 3. Minimum storage supply of 2,500 gallons on your property (pond or pool)
- Clearly mark all emergency water sources.
- Create easy firefighter access to your closest emergency water source.
- If your water comes from a well, consider an emergency generator to operate the pump during a power failure.

Fire-safe roofs and vent rescreening to 1/8" mesh are key retrofits. In new developments, updated fire and building codes are addressing proper home locations and construction types. Older, existing residences need to make retrofits to improve the structure's survivability. These actions need to include defensible space areas, water supply, access, identification, and ornamental landscaping.

Maintenance issues are also involved in living within the WUI. Residents should reduce the ability of embers to start small fires by cleaning leaves, pine needles, twigs, and branches off roofs and rain gutters. They should also remove combustibles near the structure such as firewood stacked by the house, patio furniture, attached wood fences, and ornamental landscaping. Residents need to mentally prepare themselves to handle the stress of a wildfire. They need to create situational awareness of wildfires by understanding what the fire environment is like. Then they need to create their own wildfire action plan with a checklist to enhance their preparedness status.

Building Construction Features

Building construction features have drastically changed over the past 20 years. Initially codes and ordinances addressed combustible roofing materials, such as shake shingle roofs, and roadway issues such as width, turnarounds, and all weather surfaces.



Building Construction Features

In California, laws identifying is required in high hazard areas are in place. They include fuel modifications from homes, setbacks from canyons to buildings, attic vent ember screens, porch and decking material, and plant types.

Firewise Guide to Construction

“When considering improvements to reduce wildfire vulnerability, the key is to consider the home in relation to its immediate surroundings. The home’s vulnerability is determined by the exposure of its external materials and design to flames and firebrands during extreme wildfires. The higher the fire intensities near the home, the greater the need for nonflammable construction materials and a resistant building design.” – Jack Cohen, USDA-Forest Service

Use Rated Roofing Material - Roofing material with a Class A, B, or C rating is fire resistant and will help keep the flame from spreading. Examples include composition shingle, metal, clay, cement tile.



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Use Fire-Resistant Building Materials on Exterior Walls - Examples include cement, plaster, stucco, and masonry (concrete, stone, brick, or block). While vinyl is difficult to ignite, it can fall away or melt when exposed to extreme heat.

Use Double-Paned or Tempered Glass - Double-pane glass can help reduce the risk of fracture or collapse during an extreme wildfire. Tempered glass is the most effective. For skylights, glass is a better choice than plastic or fiberglass.

Enclose Eaves, Fasciae, Soffits, and Vents – Box or enclose eaves, fasciae, soffits, and vents with metal screens. Vent openings should be covered with 1/8” metal screen.

Protect Overhangs and Other Attachments - Remove all vegetation and other fuels from around overhangs and other attachments (room additions, bay windows, decks, porches, carports and fences). Box in the undersides of overhangs, decks, and balconies with noncombustible or fire resistant materials. Fences constructed of flammable materials like wood should not be attached directly to the house.

Anything attached to the house (decks, porches, fences and outbuildings) should be considered part of the house. These act as fuel bridges, particularly if constructed from flammable materials.

- If a wood fence is attached to the house, separate the fence from the house with a masonry or metal barrier.
- Decks and elevated porches should be kept free of combustible materials and debris.
- Elevated wooden decks should not be located at the top of a hill. Consider a terrace.

Defensible Space

Defensible space is the modifying of both landscaping and natural vegetation in order to reduce the risk of a wildland fire burning down the home. Defensible space is directly linked to structure survivability and firefighter safety. All buildings that receive direct flame impingement may burn to the ground with or without firefighting equipment present.

In order for you to determine if adequate safety zones are present, you need to compare forecasted fire behavior flame lengths with the clearance around a structure to make the proper determination. This affects the tactical engagement decisions made. In addition, studies have proven that most homes burn down do to embers collecting in corners, crevices, and under shake shingles. It is essential that firefighting equipment get into these areas quickly to put out these small fires.

Firewise Guide to Landscaping

The primary goal for Firewise landscaping is fuel reduction — limiting the level of flammable vegetation and materials surrounding the home and increasing the moisture content of remaining vegetation. This includes the entire ‘home ignition zone’ that extends up to 200 feet in high hazard areas.

Use the Zone Concept

Zone 1 is the 30 feet adjacent to the home and its attachments. Zone 2 is 30 to 100 feet from the home. Zone 3 is 100 to 200 feet from the home.



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Zone 1 (All Hazard Areas) – This well-irrigated area encircles the structure and all its attachments (wooden decks, fences, and boardwalks) for at least 30 feet on all sides.

- Plants should be carefully spaced, low growing, and free of resins, oils and waxes that burn easily
- Mow the lawn regularly
- Prune trees up six to ten feet from the ground
- Space conifer trees 30 feet between crowns. Trim back trees that overhang the house
- Create a fire-free area within five feet of the home, using nonflammable landscaping materials and/or high moisture content annuals and perennials
- Remove dead vegetation from under deck and within 10 feet of house
- Consider fire-resistant material for patio furniture, swing sets, etc.
- Firewood stacks and propane tanks should not be located in this zone
- Water plants, trees and mulch regularly
- Consider xeriscaping if you are affected by water-use restrictions

Zone 2 (Moderate and High Hazard Areas) – Plants in this zone should be low growing, well irrigated, and less flammable.

- Leave 30 feet between clusters of two to three trees, or 20 feet between individual trees
- Encourage a mixture of deciduous and coniferous trees
- Create fuel breaks (driveways, gravel walkways and lawns)
- Prune trees up six to ten feet from the ground

Zone 3 (High Hazard Areas) – Thin this area, although less space is required than in Zone 2. Remove smaller conifers that are growing between taller trees. Remove heavy accumulation of woody debris. Reduce the density of tall trees so canopies are not touching.

Maintaining the Firewise Landscape

- Keep trees and shrubs pruned six to ten feet from the ground
- Remove leaf clutter and dead or overhanging branches
- Mow the lawn regularly and dispose of cutting and debris promptly
- Store firewood away from the house
- Maintain the irrigation system regularly
- Familiarize yourself with local regulations regarding vegetative clearance, debris disposal, and fire safety requirements for equipment

Public Evacuation Preplanning

Evacuation planning is a local issue, based on many factors such as incident type, activity, number of people affected, fire preparedness level, road systems, and relocation centers. Advise the residents of the current situation, potential hazards, and any life threatening hazards. Convey this information honestly and in terms that residents will understand; emphasize that they should "Go while it is safe."

If there is a possibility for a mandatory evacuation in the future, advise the residents so they have some time to prepare. Give alternative considerations for travel routes, safe locations, and evacuation centers. Coordination with on-scene law enforcement, emergency services, and support personnel is important for a successful operation. Law enforcement has the primary responsibility for evacuation, but the fire service should assist to provide protection for the residents as they leave.

Evacuation planning minimizes fire emergency confusion and risk to residents who evacuate in the event of an advancing wildfire. Anticipate fuel and weather conditions. Use them to prepare for future evacuation events since extreme fire behavior at the time of the fire allows little time for evacuation planning. One way to prepare for an evacuation event is to determine landscape trigger points. When the wildfire reaches that designated trigger point, the IC would recommend an evacuation order.

Evacuation decision points have immense value for strategic evacuation planning and are designed for worst-case scenarios based on historic fire behavior patterns for a given area. These patterns will generally be stable for many years. Informing the public of evacuation plans before an evacuation is imminent is possible because of this long lead-time. Designate evacuation routes based on potential fire spread under worst-case scenarios and plan new evacuation routes as situations change.

100 Feet of Defensible Space is the Law

In January 2005, a new California law (PRC 4291) became effective that extended the defensible space clearance around homes and structures from 30 feet to 100 feet. Proper clearance to 100 feet dramatically increases the chance of your house surviving a wildfire. This defensible space also provides for firefighter safety when protecting homes during a wildland fire.

100' DEFENSIBLE SPACE Make Your Home FIRE SAFE

Why 100 Feet?

Following these simple steps can dramatically increase the chance of your home surviving a wildfire!

A Defensible Space of 100 feet around your home is required by law. The goal is to protect your home while providing a safe area for firefighters.

- 1 "Lean, Clean and Green Zone"**
 - Clearing an area of 30 feet immediately surrounding your home is critical. This area requires the greatest reduction in flammable vegetation.
- 2 "Reduced Fuel Zone"**
 - The fuel reduction zone in the remaining 70 feet (or to property line) will depend on the steepness of your property and the vegetation.

Spacing between plants improves the chance of stopping a wildfire before it destroys your home. You have two options in this area:

- 1** Create horizontal and vertical spacing between plants. The amount of space will depend on how steep the slope is and the size of the plants.
- 2** Large trees do not have to be cut and removed as long as all of the plants beneath them are removed. This eliminates a vertical "fire ladder."

When clearing vegetation, use care when operating equipment such as lawnmowers. One small spark may start a fire; a string trimmer is much safer.

Remove all build-up of needles and leaves from your roof and gutters. Keep tree limbs trimmed at least 10 feet from any chimneys and remove dead limbs that hang over your home or garage. The law also requires a screen over your chimney outlet of not more than 1/2 inch mesh.

1. These regulations affect most of the grass, brush, and timber-covered private lands in the State. Some fire department jurisdictions may have additional requirements. Some activities may require permits for tree removal. Also, some activities may require special precautions for: 1) threatened and endangered species, 2) avoiding erosion, and 3) protection of water quality. Check with local officials if in doubt. Current regulations allow an insurance company to require additional clearance. The area to be treated does not extend beyond your property. The State Board of Forestry and Fire Protection has approved Guidelines to assist you in complying with the new law. Contact your local CAL FIRE office for more details.

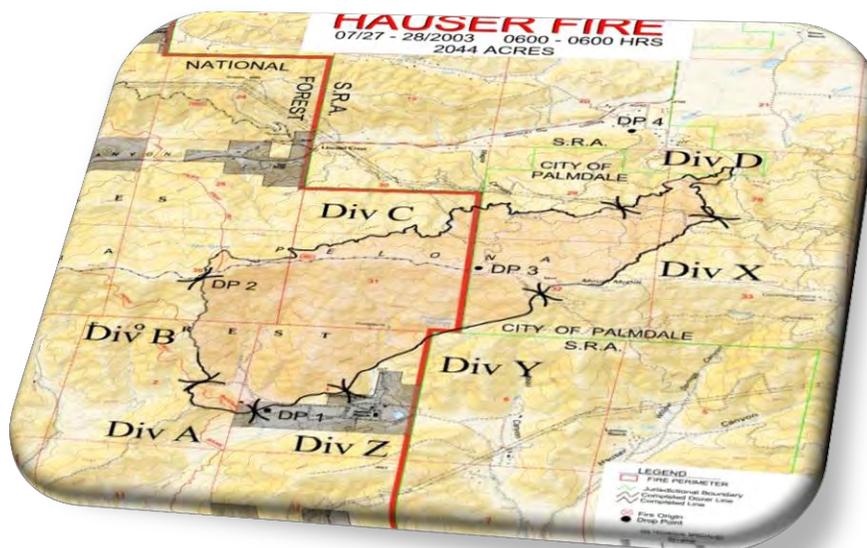
Contact your local CAL FIRE office, fire department, or Fire Safe Council for tips and assistance.
www.fire.ca.gov

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Topic 2-1: Jurisdictional Authority and Responsibility

Jurisdictional Responsibility Areas

The complexity of WUI incidents will usually involve multiple agencies with overlapping jurisdictions. Strong interagency cooperation practiced by all agencies involved in mitigating the emergency incident will have a direct positive impact. Agencies must seek opportunities to train together and learn to function more effectively in unified command. Early communication with assisting and cooperating agencies is critical for success in the WUI environment. Meetings, social interaction, tabletop exercises, and scenario driven training are valuable to building the trust essential to working together in a stressful environment.



In a state as large and populated as California, no one emergency response agency can do it all. That is why cooperative efforts via contracts and agreements between local, state, and federal agencies are essential in response to emergencies like WUI fires.

Federal Responsibility Area

The majority of California is federal land. The U.S. Forest Service (Department of Agriculture) has statutory responsibility for wildland fires on national forestland. The National Park Service, Bureau of Land Management, Bureau of Reclamation, and the Bureau of Indian Affairs are all under the Department of Interior and have statutory responsibility for wildland fires within their boundaries. Military bases, as a part of the Department of Defense, have responsibility for wildland fires on all federal military bases, including the U.S. Corp of Engineers.



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State Responsibility Area

State land makes up approximately one-third of California. The responsibility for combating wildland fires on timber, and brush, and grass-covered watershed land specifically designated as State Responsibility Area (SRA) belongs to the California Department of Forestry and Fire Protection (CAL FIRE).

Local Responsibility Area

Cities, counties, and fire protection districts are responsible for wildland fires on lands not designated FRA or SRA. These areas are designated Local Responsibility Areas (LRA). In some areas of the state, cities, counties, and fire protection districts contract with CAL FIRE for fire services. Some counties have agreements with the state to assume responsibility for fire protection on all SRA in the county. The counties currently under agreement for fire protection include Kern, Los Angeles, Marin, Santa Barbara, Orange, and Ventura counties.

Direct Protection Area

Wildland fires on adjacent lands managed by state and federal agencies present a communal threat. Long ago, state and federal agencies recognized a need to assist each other when fires occur on these lands. Delineated by boundaries regardless of statutory responsibility, state or federal administrative units assume the protection of these lands and commonly refer to them as a Direct Protection Area (DPA). The agency with the direct protection responsibility, known as the protecting agency, assumes both fire suppression and fiscal responsibilities.

Local, State, and Federal Mutual Aid Resource Agreements

Once you are given the authority, you will need to be responsible to meet the intent of the law. Responsibility determines who is financially liable for emergencies and who can set goals, policy, and limitations. In areas of multiple jurisdictions, unified command needs to be established before discussing responsibilities and setting incident objectives.

California Master Mutual Aid Agreement

This agreement, known as the *California Disaster and Civil Defense Master Mutual Aid Agreement*, provides that all resources and facilities of the state, its various departments and agencies, and all of its political subdivisions are available on a voluntary basis to provide assistance to each other in time of local disaster. Signatories to this agreement include most cities and counties in California. This agreement facilitates legal means of exchanging assistance between the numerous jurisdictions without the need for separate agreements. The aid is voluntary under a condition of local emergency, but it becomes obligatory under a State of Emergency or State of War. The Master Mutual Aid Agreement has no provisions for payment.

California Fire Assistance Agreement (CFAA)

At times of severe wildland fire conditions, forest agencies may have need of local government resources to provide structural protection or to supplement their respective agency-controlled resources to aid in the suppression effort. The *California Fire Assistance Agreement (CFAA)* is the

instrument that endorses this cooperation. The agreement makes the Governor's Office of Emergency Services (OES) and/or various local government jurisdictions emergency fire resources, in the spirit of cooperation, available for dispatch and use through the *State Fire and Rescue Mutual Aid System* to the Forest Agencies. Reimbursement begins 12 hours after the initial dispatch and is retroactive to the time of the initial dispatch. If the duration of the assignment is less than 12 hours, there is no reimbursement. The CFAA allows the forest agencies to tap into the pool of available resources through the *State Fire and Rescue Mutual Aid System*. In truest of terms, forest agencies are not signature to the *State Fire and Rescue Mutual Aid System* and do not actively participate by providing resources but are frequent users of the systems.

California Fire Management Agreement (CFMA)

This agreement allows the major forest agencies such as the CAL FIRE, U.S. Forest Service, National Park Service, Fish and Wildlife Service, Bureau of Land Management and Bureau of Indian Affairs to access local government resources. Under the agreement, assisting local government resources receive compensation at an annually adjusted fixed rate. OES receives a request from the forest agency, and forwards the request to the local government agency. OES follows up with documentation and processing to ensure proper compensation to the assisting agencies.

Local Agreements

It is usual for fire agencies to enter into agreements with neighboring agencies to create a seamless response for services regardless of jurisdictional boundaries. Automatic aid, mutual aid, mutual threat zone, and assistance by hire contract for services are some of the classifications for these local agreements. Some agreements involve payment and some are simply an agreement to exchange services without compensation.

Automatic Aid

Automatic aid is an agreement to provide service to another agency without first having to request permission. The resources of one agency may be dispatched "automatically" to respond to an incident in a neighboring jurisdiction. This is usually done under the closest resource concept. Auto aid agreements help adjoining agencies avoid duplicating services such as placing fire stations across the street from each other on opposite sides of a jurisdictional boundary. Auto aid agreements may be assistance by hire where money is exchanged or mutual aid where no money is exchanged.

Mutual Aid

Mutual aid is an agreement where one agency requests response assistance from another agency. The key is the agency must make the request for assistance. The requested agency may respond depending upon their current operational status. Usually, there is no money exchanged. Providing mutual aid has the understanding that the agency receiving assistance will return the favor in the future.

Mutual Threat Zone (MTZ)

Mutual threat zone is an agreement where adjoining agencies agree and acknowledge that each may have an incident within a predesignated zone in their jurisdiction that poses a threat to the adjoining



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jurisdiction. The agencies agree that when this occurs, the jurisdiction being threatened has the right to mount a coordinated resource response and enter into unified command in an effort to mitigate the threat to their jurisdiction. An example is the Mutual Threat Zone Agreement between the Los Angeles County Fire Department, and the Ventura County Fire Department. Whenever there is an incident within one mile of the county boundary, the threatened agency may dispatch resources to the incident, and enter into unified command in a coordinated effort to mitigate the incident before it enters their jurisdiction. Under an MTZ agreement, each agency is responsible for paying their separate costs.

Assistance by Hire Contract for Services

An agreement where one agency agrees to pay another agency pre-established rates for the services and resources they provide.

Working with Assisting/Cooperating Agencies

WUI incidents require significant resources and support from numerous diverse agencies to protect assets at risk, control the fire, provide for public safety, recover and restore services, protect the environment, and restore normalcy to the affected area. In many multiagency incidents, an agency or jurisdiction will send a representative to assist in coordination efforts.

Prior to the incident moving into their jurisdictions, request assisting and cooperating agencies to send an agency representative (AREP) to the Incident Command Post. An AREP is an individual assigned to an incident from an assisting or cooperating agency who has been delegated authority to make decisions on matters affecting that agency's participation at the incident.

Timely notification of all agencies affected by a WUI incident is crucial. Incident Commanders should consider a punch list for notifying assisting and cooperating agencies. A punch list is a pre-established resource order for a WUI incident in a given operating area. Avoid incremental resource ordering or compiling a resource order from memory, this invariably results in an agency not receiving timely notification of the incident. Failure to notify cooperating and assisting agencies having a stake in an incident may have a negative effect on interagency cooperation that could last well beyond the incident.

Some agencies incorporate checklists into their dispatch resource listings, which takes a tremendous burden off the IC at a time of intense incident activity when resource-ordering details are easily overlooked. For example: A first alarm may include the notification and response of law enforcement, while a second alarm may include notification and response of animal control, the Red Cross, Fish and Game, and utility companies. The dispatch center needs to notify and confirm with the IC when the punch list notifications have been completed, and provide the IC with the estimated arrival times of the various AREPs. Establish a predetermined period when this will be done and delegate this task to subordinate support personnel at the Incident Command Post (ICP). The addition of a Liaison Officer (LOFR) to the incident organization will relieve the IC of the need to deal with individual AREPs. The IC must fill this function until assigning a LOFR.

When contacting assisting and cooperating agencies, provide them with all necessary information needed to expedite their response to the incident. Indicate the type and location of the incident, the

location of the ICP or reporting location, reporting time, and the reason for their involvement in the incident. Sometimes this Communicate this information clearly; sometimes it is obvious, but other times it is not. It is always better to provide too much information rather than not enough. It is important to remember that different areas within an agency's jurisdiction may have different notification needs. The resource list for each area should reflect those differences. A notification list may include:

- Law enforcement
- Highway patrol
- Assisting fire agencies
- Animal control
- EMS
- Utility companies
- Civilian support agencies such as the Red Cross
- Local OES representative
- Timber industry representatives
- Affected special districts, agencies, and even businesses whose cooperation will be beneficial to a positive outcome



Law Enforcement

Law Enforcement

Law enforcement (LE) is one of the most important agencies on any WUI incident. An LE presence is critical for successful evacuations, traffic control, and security in evacuated areas. The IC must take positive steps to imbed LE into the incident organization rather than have them sitting on the sidelines waiting for direction, or worse, taking independent action adding to the confusion

The IC can take some simple steps to integrate successfully LE into the incident organization:

- Establish good preincident working relationships: Meet and discuss potential evacuation plans, communicate LE expectations at the incident command level, include LE in joint training exercises. Tabletop or sand table exercises are well suited for this purpose. The more preincident training and planning agencies participate in, the more effective interagency cooperation and performance will be during an incident. Preincident expectations developed during interagency training exercises will be carried into an actual incident by the individual agencies.
- Order LE immediately as part of the initial resource order to implement evacuations, initiate traffic control, and provide security. Request an LE representative with "Command Authority" to make direct command and control decisions regarding the incident and LE resource utilization. There is simply not enough time for patrol officers to call their supervisor for permission to make every decision. Every LE agency is different, but typically, a Sergeant or a higher-ranking officer is suitable for this role. LE representatives should report to the ICP and work closely with the IC or



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the Operations Section Chief. The LE agency with the largest jurisdictional responsibility should take the lead role in representing and coordinating all cooperating LE Agencies.

- Physically integrate LE at the ICP to provide real-time communications and coordination between LE field units and the IC or Operations Section Chief. Consider an LE branch, group, or task force to manage large numbers of LE personnel. Consider locating LE representatives with the Operations Section Chief and Branch Director vehicles for real-time intelligence gathering. Colocation in the same vehicle will enhance evacuation coordination, traffic control efforts, and situational awareness dramatically. It may be appropriate to consider integrating LE into unified command to ensure their agency jurisdictional needs are included in the incident objectives, and enable joint planning and execution of both fire and LE strategic objectives. Include LE in all planning meetings and operational briefing agendas and keep them fully engaged in the incident organization to highlight their participation.
- As with any form of interagency cooperation, there will be challenges and minor disagreements coordinating with LE. Most concerns should be resolved through prior planning and scenario driven training between the local fire agencies and LE agencies. It is critical to take the appropriate diplomatic steps to secure cooperation and participation prior to, and during the incident. If needed, consult higher levels of management if problems or disagreements persist. Agency administrators may provide assistance to bring unified agencies to the table while continuing to command the incident.

Animal Control

Animal control must be notified and included early in any WUI Incident and may be ordered either by the IC or by the LE AREP. It takes time for animal control to mobilize their volunteers, vehicles and trailers, and the resources they will need to respond to an incident. Animal control is often overlooked until the need becomes painfully obvious. At that point, it is too late to get ahead of the problem. Animal control's primary role is the evacuation and sheltering of larger animals such as horses, cows etc. Owners usually evacuate smaller, household pets and are typically less of a problem than larger animals. Animal control, however, may need to evacuate and care for the occasional stray household pet inadvertently left behind. Animal control may also provide shelter for household pets that not permitted in human evacuation shelters. However, the larger role for animal control will be coordinating the evacuation and sheltering of larger high value animals and exotic animals.

One key to successful coordination with animal control is preincident education and training. Animal control agencies can manage the animal's care and shelter, but they may not know how to coordinate and integrate with the incident organization. In addition, animal control must train and coordinate groups of enthusiastic volunteers with trucks and horse trailers, many of whom are unfamiliar with fire emergencies and the incident command system. Frequent training and planning with animal control will pay dividends when an actual incident occurs.

Another key to success is to include animal control in the incident organization where they can coordinate closely with both fire and law enforcement by placing them within the LE Branch. Animal



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trailers should utilize the same travel routes that LE is using to evacuate civilians. Close coordination between the two agencies is critical to avoid traffic jams along evacuation routes.

Animal control needs significant reflex time to accomplish their mission; they must notify volunteers, coordinate trucks and horse trailers and they often work with large, frightened animals that may be difficult to control, all of which will take time. Consider issuing an evacuation order for large animals simultaneously when issuing an evacuation warning for the human population. This timing scenario ensures that large animals, and the trucks and trailers used to move them, clear the evacuation area before people begin evacuating and resources enter the area.

Utility Companies

AREPs from utility companies are a valuable resource, providing assistance and expertise to the Incident Commander and the Operations Section Chief. Order utility company AREPs early and have them report directly to the ICP. Due to the number of AREPs that will be arriving, assign a Liaison Officer to coordinate their organization into the incident structure. The LOFR will reduce the span of control for the IC, relieving the IC of the necessity of dealing with numerous AREPs attached to the incident. Utility Company AREPs commonly used on an incident include:

- Water company
- Electric company
- Gas/Propane company
- Phone and cell company
- Cable company
- Waste water treatment
- Public works/road department
- CAL TRANS
- Railroad companies
- Pipeline companies
- Internet service providers

Utility company AREPs bring knowledge and expertise concerning the effects the incident has on their systems and infrastructure and how their system may affect the incident. For instance, it is critical for incident personnel to know the exact location of a buried 36" gas pipeline and the associated safety concerns for dozers and other heavy equipment working near the hazard. It is also helpful to have an AREP on scene that can cut power to downed electrical transmission lines and then confirm the power outage to ensure both firefighter and public safety.

Consider the potential impact on the incident prior to shutting down utilities. Will de-energizing power lines shut down the pumps supplying water to the fire suppression effort? What are the adverse effects on facilities such as hospitals? Some negative effects cannot be avoided, but should be given consideration when contemplating curtailing any utility service.



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Topic 2-1: Jurisdictional Authority and Responsibility

When contemplating repopulation of evacuated areas, utility company AREPs should play a pivotal role and should be included early in the planning process. Always consider the fire's impact on an evacuated neighborhood. It would be unwise and unsafe to simply remove roadblocks and allow residents to return to previously evacuated areas without addressing public safety. Address hazards such as damaged bridges and utility poles, unstable suppression damage, and power outages prior to repopulating evacuated residents. Public works, road departments, and utility companies will all play a role in assessing and correcting those hazards. Consult utility AREPs before allowing residents to return. Prior to signing a re-entry plan, the AREPs will most certainly ensure their utility is safe, especially before they re-energize or repressurize their service.

A utility company's priority is to gain access and repair services to the evacuated areas before reopening the area to the public. They should consult with the Operations Section Chief and Incident Commander to determine when they can enter an area. The objective of the utility companies include assessing the damage to their service, and beginning restoration work as soon as possible to have utilities restored before the public is allowed to re-enter an evacuated area. The Incident Commander and the Operations Section Chief must ensure the safety of the utility company personnel. The Operations Section Chief should allow utility companies to re-enter affected areas as soon as they determine that they can safely work in the area. The Operations Section Chief and Safety Officer should coordinate with LE to ensure that utility vehicles have access to the incident.

Team Building with Assisting/Cooperating Agencies

Team building, joint training, and networking are critical factors when working with assisting and cooperating agencies on a WUI incident. Pre-established relationships provide a level of trust, an understanding of common goals and expectations, and a simplified expansion of incident organization, roles, and responsibilities. The time to establish interagency relationships is prior to the start of an incident, not when the flame front threatens a housing development. To reduce doubt and confusion, have cooperating and assisting agency personnel get to know one another and understand the expectations for their involvement in the incident. Remember, familiarity instills calm in a chaotic situation.

County fire chief association meetings, joint tabletop exercises, drills, and planning efforts are just a few of the opportunities available to begin the preincident team building process. Informal meetings such as lunch or coffee can go a long way towards developing and maintaining strong jurisdictional and personal relationships. Consider the following objectives when meeting with cooperating and assisting agency leaders:

- Make the expectations of all agencies known before an incident. If all agencies make their needs and expectations known to each other before an incident, it minimizes the potential for confusion, surprise, and disappointment.
- All cooperators should be on a first name basis. This means meeting informally before an incident occurs. Chief Officers and Company Officers should build strong communications networks with cooperating and assisting agencies. Consider a monthly breakfast meeting or weekly get-

together on critiques of past incidents. Discuss the potential for future incidents, and discuss possible actions for incidents in at risk areas.

- ❑ All cooperators should know each agency's capabilities and limitations. Each person and agency has strengths, and weaknesses, and knowing these well in advance of an incident will foster the effective use of resources for the given situation. Conduct open and frank discussions regarding agency and management expectations when mitigating incidents of any magnitude.
- ❑ Agencies must train together before an incident occurs. Encourage daily, weekly, monthly, or annual interagency training exercises utilizing realistic scenarios. Consider interagency training as a prerequisite for successful command of multiagency incidents.
- ❑ Consider organizing after action reviews of recent multiagency incidents. After-action reviews give AREPs a chance to share each other's philosophies and experiences as well as develop an understanding of each agencies strengths and weaknesses.

Media Relations

The California Penal Code, Section 409.5(d) allows media access to scenes of disaster, riot, or civil disturbance but not to crime scenes. However, this statement does not imply that the news media can interfere with incident operations. Properly identified members of the news media should not be restricted from entering locations specified in Section 409.5(d). If entering such a location is hazardous, they should be advised; media access cannot be prevented for safety reasons unless their presence would impede fire personnel by blocking entrances and exits or disturbing evidence.

An incident must anticipate media contact. A Public Information Officer (PIO) should be assigned to process incident information and media contacts.

The Public Information Officer is responsible for developing and releasing information, approved by the IC, about the incident to the news media, to incident personnel, and to other appropriate organizations. Public Information Officers manage a number of contact points for media and public contact.



Talking to the Media

Private Industry Fire Response

Recently, private resources providing loss prevention services in the form of a fire response to homeowners who have subscribed to the service through their insurance companies has emerged. This issue has generated many questions concerning their impact on command and control, safety, and accountability on the fire ground. Line supervisors should anticipate that private resources providing loss prevention services to clients of insurance companies might be present if there is a threat to the homeowner subscriber's property. FIRESCOPE policy states that property owners who

are on their property have the right to protect their property during an emergency incident. However, property owners are not allowed to re-enter an area closed by authority of Penal Code Section 409.5 when an evacuation order is in place, nor are private insurance response resources hired to protect private property allowed to enter a closed area. If private fire response resources are issued an evacuation order, they must comply with the order. If they refuse, contact the appropriate law enforcement authority. The insurance industry has been encouraged to have these resources contact the IC to maintain accountability.

Private resources are not to be considered incident resources and should not be assigned any role in the incident

FIRESCOPE Private Resource Utilization Guidelines

To the California Fire Service:

The FIRESCOPE Board of Directors approved this document at its July 9, 2008 meeting. This document is intended to provide guidelines when encountering private fire resources, utility companies, etc. on incidents.

Recently, private fire resources have been on the Juliet and Sesnon fires. The caliber of these resources varies depending upon the insurance company that contracts with the private vendor. This ranges from a vendor that reports to the ICP, has fire qualified staff, attends briefings, has compatible radios, and complies with all road closures and motor vehicle rules to the "wildcat" vendors that do the opposite.

These guidelines are intended to provide general direction for command staff. FIRESCOPE supports the use of private vendors to perform presuppression fuels treatment and steps to protect structures prior to the fire's arrival, but they should not work within an area under evacuation orders.

Private Resource Utilization Guidelines

Issue

The issue before the fire service today is how to address the command, control, liability, and a safety issues associated with private resources.

Discussion

Private resources (contractors) may be allowed to operate on an emergency incident (within a restricted area) only if they are under contract to the AHJ or cooperating fire agency. Private fire brigades may also be integrated within the incident if they have legal authority and jurisdiction to operate, are fully qualified, and have a working relationship with neighboring fire agencies. These private resources are held to the same operational and training standards as public fire agencies. Initial legal review indicates that the AHJ has the authority to restrict resources that may enter a closed area. Private property owners have the legal right to protect their property if they are on-site during the emergency incident, but once evacuated are not allowed re-entry during said incident when a mandatory evacuation order is in place.

All other private resources utilized should be restricted to nonemergency activities outside of the evacuated or restricted area to ensure safety, command, and control and minimize potential

liability issues. Private resources may include utility companies, contractors, or laborers providing defensible space/ fire protection, etc. These resources have a role before, during, and after the emergency incident, but only within areas deemed safe and have the expressed authorization of the AHJ/IC. If they are given evacuation orders, they must comply.

The fire service needs to work with the insurance companies to utilize safely private fire protection resources. As the nation is witnessing, there are more fires and threatened structures today than public and private fire protection forces can respond to. Most of these services advertise that they will respond if a fire is within three miles of the insured property. With that said, it seems that the paramount marketing tool for the insurance companies should be that they endorse property owners adhering to Firewise or similar prevention/protection standards yearlong. A homeowner will be better off using private resources to create defensible space, retrofit structures to a modern wildland building code and installing fire suppression systems (internal & external) so the structure can survive a wildland fire even if a fire protection services cannot arrive prior to the fire. This is particularly important, as most structures are lost in the initial attack phase of wildland fires.

Command, Control, Liability, and Safety

The emerging private fire protection industry is not regulated and does not have any local, State, Federal, National standards, or enabling legal authority to follow while employing staff or responding to incidents. Many follow NWCG guidelines, employ off-duty/retired or experienced firefighters, but the AHJ/IC may not know their true ability/capability. Some vendors have already appeared unannounced on fires, violating road closures while trying to sell their services to homeowners during a developing crisis.

The AHJ/IC must be able to account for all resources under his/her command, especially when evacuation orders are given. The AHJ/IC is responsible and now proven to be liable for unsafe acts. Therefore, allowing additional resources within a closed hazard area without compatible communications, standardized training, certifications and qualifications, and so forth can compromise safety as well as obstruct ingress/egress of firefighters and public.

Background

Over the past few years, insurance companies have seen an increase in their insured property losses due to wildfires. This development has spawned a resurgence of interests from private vendors and the insurance industry to offer what they claim to be an augmentation of traditional public fire protection services. Further evaluations also indicate that the coordination of utility company resources and other private vendors is not well addressed on emergency incidents.

In order to insure the protection of the public, first responders, and the private resource operators themselves, it is incumbent on the fire service (local, state, and federal) today to clarify the potential impact of these operations and clearly establish command, control, liability, and safety parameters under which private resources can operate on incidents.

Appendix A

Private Resource Guidelines

The following guidelines serve as a tool for the AHJ/IC in managing private resources on incidents:

1. All private resources must respect the decision of the AHJ/IC, as they are the final decision makers in the command, control, liability, and safety of the incident.



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Topic 2-1: Jurisdictional Authority and Responsibility

2. The AHJ/IC and law enforcement has complete authority and legal right to control an emergency incident. Private resources are not first responders and are completely subject to the directions and limits set forth by public safety agency personnel. The private resource has no claim or stake in unified command and will not have any role in incident command.
3. Private resource vendors shall provide a representative that reports to the Incident Commander or the Liaison Officer and can communicate with their resources.
 - a. This representative shall attend all planning and operational briefings and should be available to represent said entity in regards to qualifications and specific interests to be involved, etc.
 - b. Private resources are responsible to communicate their location and movements through the private resource representative to the Incident Commander/Liaison Officer.
 - c. Failure to notify the Incident Commander/Liaison Officer of the location or movement of private resources could subject them to removal from the incident.
4. Private resources shall check-in with the Incident Commander prior to deployment within an emergency area. ICs need to maintain situational awareness regarding private resources and their compliance with evacuation orders.
5. A message should be included in the incident action plan and briefed at operational briefings regarding known private resources activity on or near the incident.
6. Private resources must be able to monitor incident radio traffic so they maintain situational awareness and know when an area is being evacuated/restricted. They shall refrain from using incident radio frequencies.
7. Private resources should focus their activities on prefire activities and pretreatment of values at risk prior to a road closure order.
 - a. Once a road closure is ordered, they must evacuate the area so safety is not compromised and cannot return until the area is reopened, or until they have received IC authorization to re-enter.
 - b. If the private resource does not evacuate the area, the private resource assumes full responsibility for the safety of the resource, personnel, and equipment.
 - c. The AHJ/IC should not be held liable for any loss, injury, or death.
8. The IC or local law enforcement officials having jurisdiction must authorize access to any community under evacuation/restriction.
9. Private fire protection resource contractors who are employed on an incident (as a local, State or Federal resource) are not allowed to sub contract with the insurance industry or freelance to local homeowners while mobilized on the incident.
10. Private resources not under contract to a public fire agency shall adhere to all local business license provisions.
11. All private fire protection resources should be identified (nonemergency) on the outside of the vehicle, to ensure they do not appear to be a public fire resource. This includes no red lights, sirens, or facsimile fire agency decal.
12. During fires where a community meeting is hosted by the AHJ/IC, a clear understanding must be created with the public as to the role of government in incident command and private resources.



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Topic 2-2: WUI Company Officer Responsibilities and Leadership Fundamentals



Topic 2-2: WUI Company Officer Responsibilities and Leadership Fundamentals

Leadership Expectations

Strong and competent leadership is the foundation for success in any emergency. This is especially true during a rapidly developing wildland urban interface incident. The fire service relies on competent leaders to motivate and direct firefighters during emergency incidents. It must be understood that without solid leadership during an already stressful event, both firefighters and civilian lives are increasingly at risk.

Leadership is a dynamic state that requires education, experience, and self-examination. Many great leaders have risen through the ranks and have performed all the jobs of their current subordinates; they present a strong command presence while maintaining composure during very stressful circumstances.

Firefighters in the field want and need strong, decisive leadership. Competent leaders recognize this and ensure that firefighters are being led from the front. Leading from the front means that incident personnel know that the IC is definitely in charge of the incident, i.e., looking, listening, and directing incident activities. Ask any firefighter what leadership quality is important on an incident, and the response will likely be "leading by a good example."

Leaders must know when to make tough decisions that will emphasize firefighter safety. Leaders must realize that when fire behavior dictates that the current tactics are unsafe, impractical or ineffective, withdraw may be the only prudent strategy. Leaders are responsible for the consequences of their decisions and with that responsibility; they are accountable for their subordinate's decisions and actions within the parameters of leader's intent.

Motivation

Firefighting is a team effort and lack of concurrence with an incident plan may result in dissention among the resources assigned to the incident, possibly derailing the success of the incident. This problem may be overcome by developing a competent plan ensuring that everyone on the incident is informed of the incident objectives, strategy, and tactics. Motivation is a tool that leaders must constantly use. Leadership and motivation must occur if the incident objectives are to be met.

Fire service leaders assume the responsibility of placing their subordinates in dangerous situations. Leaders must be willing to make decisions that profoundly affect citizens, communities, and assets at risk. Occasionally, leaders are called upon to act in an authoritative, autocratic manner, making unpopular decisions that require immediate compliance. Great leaders inspire, motivate, and support their subordinates, earning their respect and fostering a commitment to the task.

Listen to those you work with. Remember that the further you are removed from the tasks on the ground, the more reality tends to pale and fade from your memory

Empower subordinates and allow them to spread their wings

Achieve your goals and help those that work for you achieve theirs



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Demonstrate by being a role model, lead by example, and show them how it is done

Encourage others to achieve and reach for a higher standard

Responsive to the needs of peers, subordinates and the organization

Share knowledge

Help others meet their expectations

Inspire to lead and others will follow

Prepare peers and subordinates to succeed

Don Studebaker, Retired Deputy Chief, United States Forest Service

Levels of Leadership

Generally, the role and focus of a leader depends on the level in which they work. Organizations have four levels of leadership:

1. Leader of organizations
 - Primarily concerned with providing the vision, direction, and resources to guide the organization into the future
2. Leaders of leaders
 - Exercise direct leadership over subordinate leaders and indirect leadership over the organization below them
3. Leader of people
 - Exercise the direct, face-to-face supervisory skills required to accomplish tasks and facilitate team building
4. Follower
 - As a team member, a future leader develops a foundation of values, character, and proficiency
 - Effective leadership requires being a good follower. For this reason, leaders must strive to build good “followership” skills in their team members

Although the basic principles of leadership are the same at each level, their application and the techniques that must be used are different, depending upon where in the organization a leader is working. It is common for a leader to work in three or four levels at the same time.

Situational Leadership

Situational leadership is the ability to adapt and utilize different leadership styles to deal with an ever-changing work environment and the available follower skills. Leaders must continually adapt their leadership style to meet an ever-changing environment. They must be able to select the most effective leadership tools in a given situation; this strategy is known as situational leadership.

An essential element of successful wildland urban interface firefighting is competent and confident leadership. Leadership means providing purpose, direction, and motivation for firefighters working to accomplish difficult tasks under dangerous, stressful circumstances.

In confusing and uncertain situations, a good leader will:

- ❖ **Take charge** of assigned resources
- ❖ **Motivate** firefighters with a “can do safely” attitude
- ❖ **Demonstrate** initiative by taking action in the absence of orders
- ❖ **Communicate** by giving specific instructions and asking for feedback
- ❖ **Supervise** at the scene of action

Situational leadership holds that managers must use different leadership styles depending on the situation. A skilled leader will analyze the needs of the situation he or she is in, and then use the most appropriate leadership style. Depending on the crewmember’s competences in their task areas (knowledge and/or skills in the WUI environment), your leadership style may vary from one person to another. You may lead the same person one way sometimes and another way at other times. An example is in everyday competencies your firefighter is a good employee, while in a WUI pressure driven situation this person will need a more direct form of supervision. This is where command presence comes in. The ability to “read” the situation and the crewmembers and apply the proper leadership style is critical.

The Leadership Environment

Four critical elements that a successful leader considers in planning for effective action make up the leadership environment. The first is you, the leader. The second is your crew. The third element, the situation, has many variables to influence your decisions, including objectives, conditions, resources, and other organizational influences. The fourth and last element is the consequences, the short- and long-term effects of your action.

- You, the leader, must have an honest understanding of your strengths and weaknesses, your capabilities and limitations.
- Your crew represents all levels of followers within the framework of the team. Each follower will have a different skill mix and unique personality traits.
- Every task within the situation presents a different challenge: high consequences, time compression, special skill needs, and so on.
- Leaders must always keep the consequences in mind as they make decisions.

Sources of Power

Power is the ability to influence the actions of others. How you use power shapes the crew’s perception of your ability to lead.

Position power is based on the perception that your rank in the organization automatically gives you certain rights and authority.

Reward power is based on the perception that you control rewards that are valued by your team and are given for good performance.

Respect Power is based on the team identifying with you as a role model and an example to follow.

Discipline power is based on the perception that you can and will penalize team members who choose not to meet standards.

Expert power is based on the perception that you are highly competent in your job skills. Leaders have access to power based on who they are and who their followers perceive them to be. The need to use different sources of power constantly shifts as the environment changes.

Power paradox is the giving away of power to get power. If you want power, give it away. If you want respect as a leader, give respect to your crewmembers. If you want the trust of your crew, give trust to them first. You have to be willing to take the first step.

Leadership Values

Duty, respect, and integrity are the guiding values that leaders use to make their decisions.

VALUE	PRINCIPLES
Duty	<p><i>How leaders value their job. Duty begins with everything required by law and policy, but it is much more than that. A leader commits to excellence in all aspects of their professional responsibility so that when the job is done they can look back and say, "I couldn't have given any more."</i></p> <ul style="list-style-type: none"> ▪ Be proficient in your job, both technically and tactically as a leader <ul style="list-style-type: none"> • Take charge when in charge • Adhere to professional standard operating procedures • Develop a plan to accomplish given objectives ▪ Make sound and timely decisions <ul style="list-style-type: none"> • Maintain situational awareness in order to anticipate needed actions • Develop contingencies and consider consequences • Improvise within the leader's intent to handle a rapidly changing environment ▪ Ensure tasks are understood, supervised, and accomplished ▪ Develop subordinates for the future
Respect	<p><i>How leaders value their coworkers. Respect for the individual forms the very basis for the rule of law in America. This value reminds leaders that those who follow are their greatest resource. Not all followers will succeed equally, but they all deserve respect.</i></p> <ul style="list-style-type: none"> ▪ Know subordinates and look out for their well-being <ul style="list-style-type: none"> • Put the safety of subordinates above all other objectives • Take care of subordinate's needs • Resolve conflicts between individuals on the team ▪ Keep your people informed <ul style="list-style-type: none"> • Provide accurate and timely briefings • Give the reason (intent) for assignments and tasks • Be available to answer questions at appropriate times ▪ Build the team ▪ Employ subordinates in accordance with their capabilities
Integrity	<p><i>How a leader values herself or himself. An individual cannot be in charge of others unless they are in charge of their own actions. People of integrity separate what is right from what is wrong and act according to what they know is right, even at personal cost.</i></p> <ul style="list-style-type: none"> ▪ Know yourself and seek improvement ▪ Seek responsibility and accept responsibility for your actions ▪ Set the example



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Leadership Styles

Leadership styles are the various methods used to impart purpose and direction to followers. Directing, Delegating, and Participating are the three basic styles.

Directing — The leader provides all instructions and guidance to followers in order to accomplish the task. Followers have minimal opportunity for feedback and little decision-making responsibility.

Delegating — The leader gives specific responsibilities to followers and expects them to accomplish those delegated tasks without further guidance. Followers have moderate feedback opportunity and moderate to high levels of decision-making responsibility.

Participating — The leader asks followers to assist in determining best methods or solutions for accomplishing a task. Followers are expected to provide ideas and may have high levels of decision-making responsibility.

Just as you intentionally use a variety of tools for different jobs, you should also be able to use all three leadership styles for different situations. Knowing when to be directing, when to delegate, and when to invite participation from your crew is key to your long-term success as a leader.

Call on the tools for these leadership styles and sources of power when needed. Do not let them be dependent on your personality; relying on a favorite tool will limit your ability to lead effectively.

Command Presence

Command presence is one of the most important components of effective and successful command of an incident. Without strong command presence, suppression personnel throughout the incident organization will lack the confidence in leadership that is critical to incident success. Strong command presence sets the tone for the incident and suppression personnel to respond favorably. Command presence is how people see and react to a leader. Strong command presence instills a sense of security and competency that spreads throughout all levels of the incident organization. Great leaders look, act, and speak with authority and confidence.

Command presence is the bearing and/or demeanor of the person in charge. Command presence may have either a positive or a negative influence on the entire emergency organization. It is directly related to a leader's confidence in his or her ability to effectively manage an emergency scene to a successful conclusion.

Effective leaders project an image that is calm, organized, and focused. Command presence is part of daily life. Every day, subordinates gauge the demeanor of their command officers both on and off incidents. The way leaders carry themselves each day translates into their demeanor on an incident. Command presence is infectious; once confidence in leadership is established, subordinates will strive for excellence.

Several factors increase the challenges in all high-risk environments, creating barriers to effective leadership and positive command presence:

- ❖ **Time pressure**: The feeling that it must be done now or that it is taking too long
- ❖ **High stakes**: Political pressure, high profile incident, risky situations



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- ❖ **Incomplete and/or inadequate information:** Poor intelligence from field personnel, unfamiliar with the area
- ❖ **Ambiguous objectives:** No clear mission, vague or uncertain
- ❖ **Poor strategy and tactics:** Continuing to fight in the initial attack mode when the fire is obviously in the extended attack mode
- ❖ **Rapidly changing conditions:** Overwhelmed by the complexity and tempo of the incident
- ❖ **Coordination:** All elements of the organization are not working together

A lack of command presence, coupled with the failure to make decisions, may contribute to collapse of command. This lack of leadership leads to freelancing. Case studies have shown that when field personnel have lost confidence in the person in charge, the overall incident objectives become worthless. This is due to a lack of support from subordinate Company Officers implementing the tactics to meet the incident objectives. Without competent leadership and strong command presence, Company Officers, and firefighters tend to “do something,” which may or may not be coordinated or in support of the incident objectives and strategies. This is commonly referred to as independent action, or freelancing, which is unsafe and may be detrimental to the control effort.

Some examples of command collapse may include:

- Failure to answer the radio by the IC/Command Officers
- Lack of or no direction from the ICP/IC
- “Deer in the headlights” syndrome
- Failure to respond to changing conditions
- Tailboard syndrome; focusing on small tasks, but ignoring the big picture
- Doing nothing, failure to make decisions
- Failure to adjust plan that is not working
- Not monitoring and/or adjusting objectives

Some examples of freelancing may include:

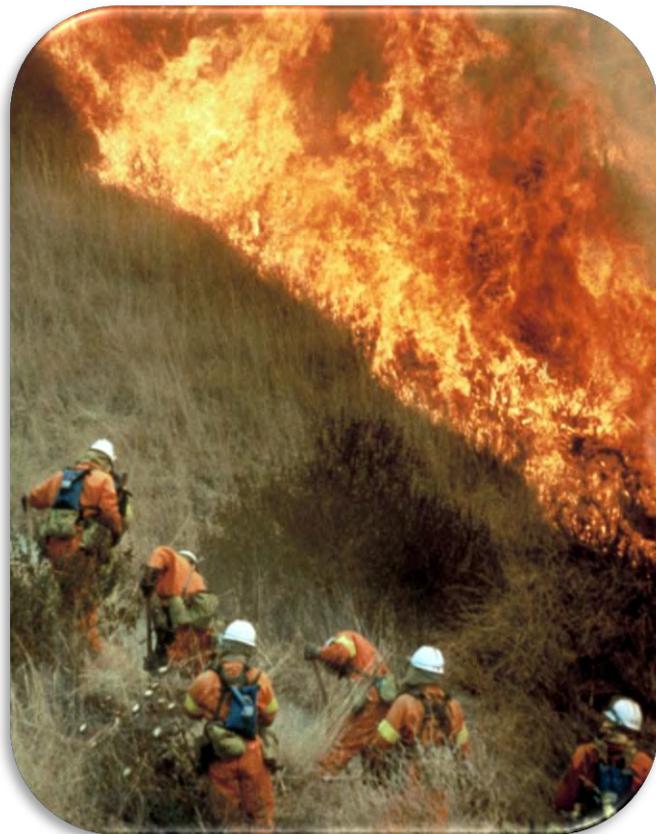
- Rogue firing
- Futile hose lays, hand lines, and retardant lines
- Hand line or dozer line construction that is not coordinated
- Independent resource ordering
- Failure or reluctance to engage

Crew Cohesion

Cohesion is defined as the social or professional integration of a crew in order to function together as a group. This integration can be based on training, leadership, or "chemistry." Cohesion is built upon established agreements about rules and regulations that govern the day-to-day work environment of the group.

Teamwork is an essential component of leadership. No one person can do everything by himself or herself. Once leaders realize this important fact, then leading becomes easier. Team building must start prior to any incident activity. Teamwork and team development should not be limited to lead agency personnel alone, but must include assisting and cooperating agency personnel as well. Interagency team building ensures that all personnel will better understand each other's strengths and weaknesses and are more apt to support one another.

The three phases of team building are formation, development, and sustainment. All teams, whether they are long-standing or short-lived, go through these predictable phases. Leaders who recognize team members' progress can better facilitate the process enabling a team to mature quickly, achieving greater synergy and cohesion. Communication is the foundation of the team building process. Communication builds trust, and trust builds cohesion.



Working Together

The Formation Phase

The formation phase begins when a group of strangers comes together with the expectation that they will function as a team. This phase is characterized by a lack of situational awareness: team members do not know each other or their leader; they do not know what to expect. Roles and responsibilities may be undefined. Standard policies and operating procedures may be unclear. Communication norms and acceptable methods of dealing with conflict may not be spelled out. Anxiety about the unknown is high. For the most part, people are simply trying to make sense of their environment and the new people in it. It is important to recognize that when a new person or group of people joins a team, they are in the formation phase regardless of the stage of development of the rest of the team. Newcomers may significantly affect team cohesion unless they quickly transition through the formation phase. The leader's primary responsibility during the formation phase is to turn the unknown into the known as quickly as possible, thereby reducing the level of anxiety within the team through effective communication.

The Development Phase

The development phase begins when concerns and anxieties have been reduced or eliminated. This phase is characterized by individual initiative, meaningful feedback, and conflict resolution. Team members are ready, willing, and able to get to work. Information moves through the team quickly and efficiently. Team members may not yet feel a collective ownership of the team's effort during the development phase and may often vacillate between individual and team identity. As a result, conflicts may erupt as individuals try to better define roles and responsibilities, jostle for position, and bump into each other while trying to achieve their perception of the common goal. In the development phase, teams begin to test what was communicated to them in the formation phase. They measure word against action and the more closely the match, the greater the trust. During the development phase, the leader should focus on providing the mechanisms and environment for trust to develop. As a first step, maintain consistency and enforce agreed upon policies, follow standards, reinforce intent, and practice open communication. Demonstrate trust in the group's outputs and products.

The Sustainment Phase

The sustainment phase begins when team member's sense of identity shifts from individuals to the team. It is characterized by creativity, adaptability, and precision. The team has become highly focused and effective. The communication and trust built in the previous phases is focused and brought to bear on the team's mission with precision. Team members demonstrate a willingness to support each other in achieving a common goal. They know how to back each other up and are willing to address the task.

Errors and problems are detected early and the team corrects them quickly when found. They see themselves as part of something larger than themselves. They are now a team and not individuals. Situational awareness about the team, team members, the leaders, and the mission is high.



Building Blocks of Effective Teamwork

The team, rather than the individual, accomplishes tasks. A leader’s biggest challenge during the sustainment phase is to avoid complacency and to persistently find ways to improve the process. A cohesive team does not stay that way by itself, so to prevent the team from losing ground, it must continuously improve. Ensure that all the groundwork laid in the formation and development phases remains intact. Communication, trust, and respect must be maintained to sustain a cohesive team.

Each level of the pyramid builds on the foundation below it. When one level of the pyramid is dysfunctional, the synergy of the team erodes, and it is almost impossible for the team to be effective at higher levels.

Types of Crew Cohesion

There are two types of crew cohesion - intracrew cohesion and intercrew cohesion. Intracrew cohesion is within a single crew, while intercrew cohesion includes several crews working in the same vicinity on the same fire. Several key issues are involved with both types of crew cohesion - command/control issues, personnel issues, and operational issues.

ISSUE	INTRACREW COHESION	INTERCREW COHESION
Command and Control	<ul style="list-style-type: none"> ▪ Poor accountability ▪ Communications ▪ Scattered crews ▪ Fight or flight reactions 	<ul style="list-style-type: none"> ▪ Change in command ▪ Communications ▪ Distrust of command decisions ▪ Self-dispatched crews ▪ Staggered arrival times ▪ Crew assignments ▪ Crew accountability ▪ Unqualified contract crews
Personnel	<ul style="list-style-type: none"> ▪ Cliques ▪ Disagreements among crewmembers ▪ Distrust among crewmembers ▪ Personal problems 	<ul style="list-style-type: none"> ▪ Incompetency ▪ Levels of experience ▪ Qualifications
Operational	<ul style="list-style-type: none"> ▪ Overtime ▪ Shift trades ▪ Call-back situations ▪ Mixed crews 	<ul style="list-style-type: none"> ▪ Multiple station responses ▪ Auto/mutual aid responses ▪ Multiagency responses
Transition Stage Operations	<p><i>When fire growth has grown beyond initial attack stage and is transitioning to extended attack stage</i></p> <ul style="list-style-type: none"> ▪ Additional resources not yet in place ▪ New strategies and tactics may to be communicated ▪ Time of greatest safety risk to hand crews ▪ Increased change of independent action ▪ Crew cohesion is stressed ▪ Most fatalities happen at this stage 	



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Common Cohesion Problems on Fires

- ❶ Firefighters not getting along
- ❷ Working with unfamiliar resources
- ❸ Fright and flight reaction
- ❹ Personal problems with crewmembers
- ❺ Poor communication
- ❻ Distrust of command decisions
- ❼ Lacking local knowledge
- ❽ Forming cliques

With the above common cohesion problems, it becomes imperative to ensure that solid team building and crew cohesion occurs prior to incidents.

Building Crew Cohesion

Be especially cautious until new crews and managers learn to work together cohesively.

- Command and control techniques
 - Give or receive a briefing when changing command
 - Assign duties based on skills and qualifications
 - Be attentive to workloads
 - Stay calm and in charge
- Personnel techniques
 - Rotate crewmembers through various positions
 - Communicate effectively
 - Listen and respond to complaints and concerns
 - Be truthful (even in dangerous situations)
 - Seek input when appropriate
 - Assess knowledge and skills of crewmembers
 - Become acquainted with crewmembers
- Special training required
 - To recognize the qualities of transition fires
 - To build crew cohesion prior to the emergency
 - To recognize that some individuals have more ability than others to promote crew cohesion

Crew Safety

Firefighter Right to Know

Under the California Labor Code and the California Occupational Safety and Health Act, all employers in California are legally obligated to provide and maintain a safe and healthful workplace for



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employees. The hazard communication regulation emphasizes workplace safety and requires employers to inform their employees of the hazardous substances to which they are exposed at the job site. Requirements for developing, implementing, and maintaining a hazard communication program are found in Title 8, California Code of Regulations, Section 5194. Subsection 5194(b)(6) contains the Safe Drinking Water and Toxic Enforcement Act (Proposition 65), which was added to the original hazard communication regulation in 1991.

Proposition 65 requires the governor to publish a list of chemicals known to the State of California to cause cancer, birth defects, or reproductive harm. Proposition 65 also requires that businesses provide a clear and reasonable warning before knowingly and intentionally exposing anyone to a listed chemical. An overview of Proposition 65 as it relates to the hazard communication regulation is noted throughout this guide. For complete details on the Proposition 65 regulation, refer to Title 22, California Code of Regulations, Section 12000 et seq., or contact the Office of Environmental Health Hazard Assessment. Compliance with Proposition 65 requirements for notifying employees of hazards can be achieved simply by complying with the provisions of California's hazard communication regulation.

Federal Government Thirtymile Hazard Abatement Plan

On July 10, 2001, four firefighters died in a burnover on the Thirtymile Fire on the Okanogan National Forest near Winthrop, WA. The Occupational Safety and Health Administration (OSHA) investigated the accident and cited the USDA Forest Service for five violations of the Code of Federal Regulations, part 1960—Elements for Federal Employee Occupational Safety and Health Programs. On February 7, 2002, as required by law, the Forest Service released an Initial Thirtymile Hazard Abatement Plan.

The full Thirtymile Hazard Abatement Plan can be found at the following website: www.fs.fed.us/fire. The Hazard Abatement Plan is national in scope and all line officers, fire program managers, Incident Commanders, and fireline supervisors must have a thorough understanding of their responsibilities associated with the abatement actions. All line officers, fire program managers, and Incident Commanders must ensure that it is followed.

- Incident Commanders shall manage fatigue and ensure firefighters comply with the USFS work/rest guidelines. Incident management shall plan for and ensure crews, overhead personnel, and support personnel are provided a 2-for-1 work-to-rest ratio. This means for every 2 hours of work or travel, 1 hour of sleep or rest is provided. ICs shall monitor compliance with these guidelines and document the following information in the daily record on all fires that exceed one operational period:
 - Descriptions of actions taken to monitor work/rest cycles
 - Justifications for work shifts exceeding 16 hours with mitigation measures
 - Actions taken to ensure compliance with the guidelines
- ICs shall conduct inspections on each of their fires for safety and health hazards, including compliance with the *10 Standard Firefighting Orders* and mitigation of the *18 Situations That Shout Watch Out*. At a minimum, these inspections shall be conducted personally by the IC on

Type 3, 4, and 5 fires, and accomplished by the IC and the Safety Officers on Type 1 and Type 2 fires. These inspections shall be documented on ICS Unit Logs and included in the daily incident records. In addition, line officers, fire program managers, and/or safety and health program managers shall conduct supplemental inspections on a minimum of 10 percent of their unit's Type 3, 4, and 5 fires and document their inspections in the incident records.

- ICs shall ensure personnel on their incident are only assigned to fireline positions for which they are fully qualified, unless they are assigned to training or qualifying assignments with a fully qualified mentor/coach available to monitor and assist.
- All after-action reports, individual overhead performance evaluations, and crew evaluations shall include compliance with the *10 Standard Firefighting Orders* and mitigation of the *18 Situations That Shout Watch Out*. Fireline supervisors shall complete performance evaluations on all out-of-forest crews on all Type 3, 4, and 5 fires. Include all corrective action, even if satisfactorily completed, in the documentation. Local units shall keep these records in the official files for the incident, and share them with the evaluated resource and the resource's home unit line officer and/or fire management officer.
- ICs shall monitor the effectiveness of planned strategies and tactics, and disengage when they cannot be implemented safely. Aggressive fire suppression activities may be reinitiated as soon as strategies and tactics are adjusted to ensure actions will be in full compliance of the *10 Standard Firefighting Orders* and mitigation of the *18 Situations That Shout Watch Out*.

Code of Conduct

A code of conduct is intended to be a guide and a reference for personnel in support of what they do in their regular activities and to help clarify the organization's mission and values. It connects the organization to standards of professional conduct and is an open disclosure of the way the organization will operate. The code of conduct should help employees deal with the ethical dilemmas in those gray areas that are encountered on the job. It is meant to complement relevant standards, policies, and rules, but it cannot be a substitute for common sense. A typical code of conduct to govern behavior on a fire in the WUI may include:

- Do not transport or consume alcohol or illegal drugs at any time
- Use normal radio procedures
 - Keep radio traffic between units to a minimum
- Know who you are working for
 - This is not a vacation
- Limit the procurement of equipment to what is needed
- Return all equipment issued before demobilization
 - Theft of equipment is a crime
- Maintain a state of readiness and professionalism when not assigned
 - Your actions are a reflection of your organization

- Wear clothing that reflects your agency appropriately
- Do not enter any residence without the owner's permission except to fight a fire in the structure
 - Respect the property of the residents
- Know and comply with proper procedures when assigned to commercial lodging for an off-shift rest

Leader's Intent

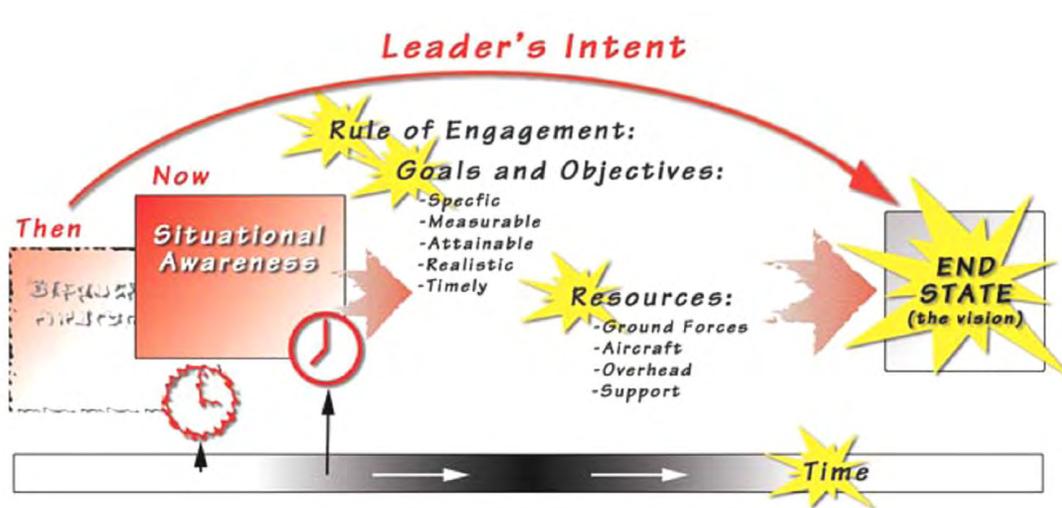
Leader's intent is a clear, concise statement about what people must do to succeed. Leaders provide leader's intent statements so subordinate leaders closest to the scene of action can adapt current incident plans to current incident situations taking appropriate action to accomplish the incident's objectives when unanticipated opportunities arise. It delineates three essential components:

Task – What is the objective or goal of the assignment?

Purpose – Why does the assignment need to be done?

End state – How should the situation look when the assignment is successfully completed?

Part of this concept called upon leaders to state their intent, and the phrase "leader's intent" was coined. The term is appropriate because it reflects the fact that while there may be only one Incident Commander's intent statement, there may also be many subordinate leader's intent statements that fall under the umbrella of the Incident Commander's intent statement.

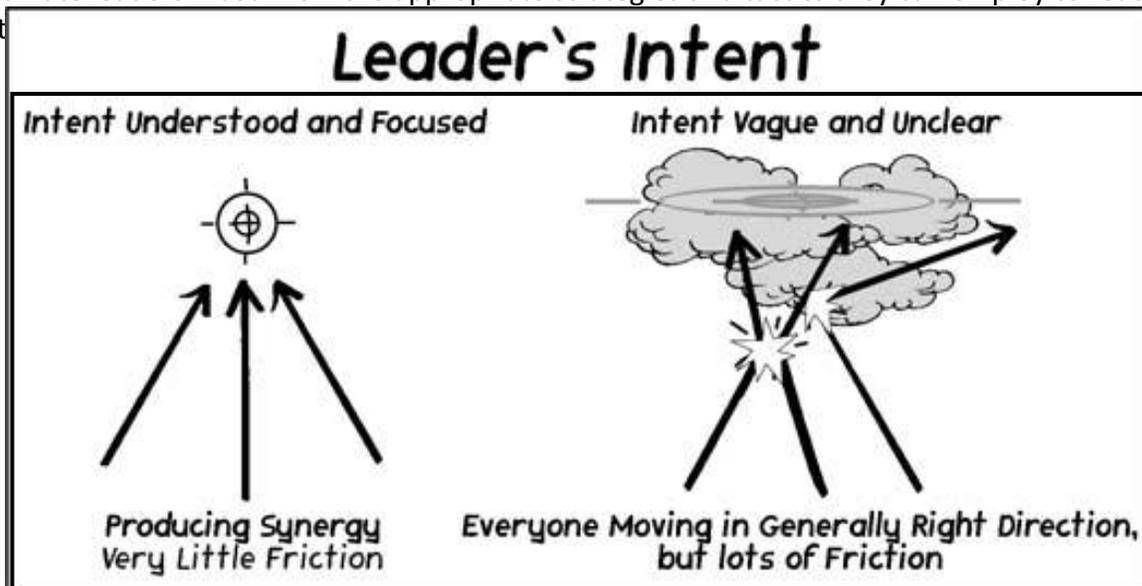


The end state is the IC's vision of what the fire will look like when it is controlled and everyone has gone home. The process, controlled by the rules of engagement, goals and objectives, and resources and time guides the firefighters. The end state varies with situational awareness, which is constantly changing.

As incident size and complexity increases, the effectiveness of centralized command, control, and communications decreases. In other words, when things go wrong, plans become less useful and centralized management cannot often keep pace with the real-time situation on the ground. The wildfire environment is an environment where events do not always go according to plan. Wildfire incidents inevitably create conditions in which centralized command and control over all actions and events cannot keep pace with incident complexity. In fast-moving, dynamic situations, top-level decision makers cannot always incorporate new information into a formal planning process and redirect personnel within a reasonable timeframe. To generate effective decision-making and to cope with the unpredictable nature of incidents, fire leaders must decentralize command. That is, we must empower subordinate leaders to make decisions based on their understanding of their leader's vision for success. Some examples of leader's intent:

- Setting and communicating broad control objectives that line personnel can translate into tactics and strategies without having to communicate with Command for approval.
- Setting and communicating management objectives that personnel know and understand, so that when communications fail or are overwhelmed line personnel can take appropriate actions to ensure that the said objectives are met.

One outcome of leader's intent is to counter, but not undermine, the ineffectiveness of centralized command. It is difficult to imagine Incident Commanders of major fires envisioning and communicating the end state of the disasters, they are responsible with mitigating. It's not the end state that's so important, but the process of reaching the end state that is critical. Subordinate leaders should recognize the end state when they achieve it. The key for Incident Commanders is to communicate the parameters for reaching the end state to subordinate leaders. Subordinate leaders must coordinate their efforts with adjoining forces when there is no immediate command and control system in place and the situation is different from originally anticipated. To accomplish these goals subordinate leaders must know the appropriate strategies and tactics they can employ to reach the end state.





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Leader's intent at the IC level should be a short, direct statement that clarifies the overall objectives of the mission and the rules of engagement when exercising appropriate action. Leader's intent is a statement that guides the decision-making process in the heat of a firefight, supporting the IC's intent, even if appropriate actions were not specifically outlined in the plan.

Successful operations are built on the ability of leaders to define and communicate their intent so that it empowers their subordinates to exercise their initiative. Everyone, from a Section Chief to the last firefighter, must be able to define the end state and have a shared understanding of the purpose behind the task.

Understanding the IC's intent is crucial if the fire is spreading rapidly or is difficult to control under the current plan. The goal is to ensure that what is expected of subordinate leaders is understood by them in order to reduce or eliminate misunderstandings. It is the Incident Commander's responsibility to communicate the leader's intent statement to all subordinate leaders, and it is the responsibility of subordinate leaders to understand and work within the scope of the leader's intent statement.

Leader's intent statements must include answers to such questions as:

- Why are we here?
 - Save human life
 - Protect property and natural resources
 - Construct a control line down this ridge to the river
- What is expected of us?
 - Be professional in your conduct
 - Minimize the loss of community infrastructure and homes
 - Minimize environmental damage
 - Cut a four-foot line to mineral soil
- What are the operational objectives?
 - Keep the fire out of wildland urban interface areas
 - Keep the fire on federal land
 - Keep the fire west of the ridge
- What are the rules of engagement for this incident?
 - Structures will only be defended if there is no danger to the firefighters or their equipment
 - Avoid archeological sites
- What is the end state vision of the incident?
 - Critical infrastructure was protected
 - Incident was contained within the control objective parameters

At the incident level, the end state places the values at risk within the context of the standing incident priorities: (1) life, (2) property, (3) natural resources, and (4) management goals and



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concerns for the area affected. Within the framework of the defined end state, leaders can develop plans that include incident objectives, priorities, strategies, decision points, and contingency plans.

At the geographic division level, Division Supervisors (DIVS) focus on the incident objectives affecting their division, using the same process to define task, purpose, and end state. At the crew level, leaders focus on the tactical objectives and vary those tactics as the situation dictates. Leaders narrow their focus at each level, identifying the objectives that apply to each level.

Translating vision into a clear leader's intent statement is at the core of incident command philosophy. Describing the task, purpose, and end state is the prerequisite for empowering subordinate leaders to exercise individual initiative and take the action the situation requires. This philosophy is based on the understanding that competent subordinate supervisors on-scene understand the current situation better than a senior supervisor located some distance away. This does not imply, however, that our actions are independent or uncoordinated. Incident commanders must continually work to ensure coordination, cooperation, and communication among all forces working toward a known objective.

Appropriate Action

Appropriate actions are actions necessary under the incident objectives when situations change or communication with command and control functions cannot be established. Appropriate actions result from a firefighter's perception of leader's intent based on incident objectives, normal policies, procedures, or accepted safety practices.

Leaders in the fire service are not only empowered by law and policy but are also duty-bound to act on a situation that is within their power to affect, even without a command and control structure in place, in other words, take appropriate action. This empowerment is not intended to encourage freelancing or independent action. In a high-risk environment, freelancing, or independent action, may be an unsafe and unpredictable element, causing more harm than good. On a chaotic and rapidly developing wildfire, taking the initiative by exercising appropriate action can make all the difference by taking advantage of an opportunity. Being hesitant, risk-averse, or indecisive can expose firefighters to greater long-term risks and translate into a waste of time, opportunity, energy, and money.

At times during an incident, one person may see something that must be done now, and then take the appropriate action to do it within the scope of the leader's intent. Time may not permit obtaining permission, communicating the problem and mitigation options, or informing the chain of command of an action before the opportunity is lost. In these time-critical situations, subordinate leaders must engage in appropriate action, that is, act within the leader's intent statement by:

- Utilizing acceptable and prudent suppression tactics
- Working in coordination with adjoining forces
- Developing and communicate an appropriate plan
- Informing the chain of command of the situation and mitigation actions as soon as possible
- Ensuring that the actions are within policy, procedure and accepted safety norms



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Examples of appropriate action:

1. An engine company is driving through another Division to get water when they come upon a spot fire. Based on the leader's intent of perimeter control, the Company Officer should take appropriate action to contain the spot fire.
2. A hand crew is conducting a planned firing operation. While doing the test burn they encounter spotting and holding problems because of a lack of resources. Realizing that continuing the firing operation would be risky and unable to contact the Division Supervisor, the crew supervisor suspends the firing operation.
3. While engaged in structure defense tactics with an engine company, the fire front lays down. The Company Officer changes to perimeter control tactics, initiating a progressive hose lay based on leaders intent of perimeter control and fire containment.
4. While assigned to a division as an engine Strike Team Leader conducting structure defense tactics, the Strike Team Leader observes the fire changing direction. The fire is now immediately threatening an area of homes that are populated and defensible. Unable to contact the division, the Strike Team Leader repositions the engines for structure defense tactics and initiates evacuations coordinating with law enforcement that is in the area.

Topic 3-1: Fire Behavior in California's Fire Environment

To be an effective Company Officer, you need to understand and be able to forecast what the fire is going to do under various conditions. Fire behavior is the result of the dynamic interaction of weather, topography, and fuels. It is important to understand how all three of these factors interact with each other. Based on these three factors, wildland fires will exhibit varying behaviors all throughout the United States.

Developing a fire behavior forecast will assist you in selecting appropriate suppression strategies and tactics for varying conditions. The key to success is to be able to recognize the factors, both present and forecasted, that will affect how a fire will behave and thus fought. The main goal is for you to develop an appreciation and understanding for what is happening around you as the fire progresses. It is important that all Company Officers that may find themselves in the WUI environment remain life-long students of fire behavior.

Locations

With so many distinct geographical areas in California, the variability of fire behavior in the State can be extreme. Most say that no other single State offers such a wide variety of fuels, weather, topography, and subsequent fire behavior. It is up to you and your crew, as participants in the statewide mutual aid system, to have a basic understanding of these areas and their corresponding primary drivers for fire behavior. Effects to consider in some of the areas are listed below:

- Cascade Range
 - Areas of topography dominated by large lava flows that create erratic winds, wide range of fuel type, moistures, and loading
- Coastal Ranges
 - Wide variety of fuel types, extreme diurnal wind shifts and sheltered valleys giving rise to multiple microclimate areas
- Basin and Range
 - Low fuel moistures, unstable atmospheres, varied topography, and dramatic wind changes often leading to vortex creation



- Sierra Nevada
 - Varied topography with narrow canyons, wide range of fuel characteristics, deep and developed nighttime inversions, and common unstable atmospheres in the afternoon
- Transverse Range
 - Steep topography creating barriers and gaps for Santa Ana wind events, low fuel moistures, and high occupancy loads

Significant Winds

Whirlwinds and Fire Whirls

One common characteristic of mechanical and thermal turbulent flow is eddy formation. Wind speed, wind direction, and the size and shape of the obstacle the wind encounters are determining factors in eddy size, shape, and motion. Dust devils and fire whirls are examples of vertical eddies, while mountain waves are examples of horizontal eddies.

Whirlwinds, or dust devils, are prime indicators of intense local heating that combined with eddy formation and atmospheric instability. They are innocuous in and of themselves. However, when generated inside or adjacent to the fire perimeter, the resulting fire whirl can spread firebrands, causing numerous spot fires over a wide area. Fire whirls may reach tremendous speeds and heights, carrying large brands and embers in unpredictable directions, and may topple fire-weakened trees and snags near the fire perimeter.

Whirlwinds and fire whirls may remain stationary or move with surface winds. Fire whirls are often generated in areas of concentrated heat within the fire perimeter and then triggered mechanically by the topographical influences on local winds. As a fire whirl leaves the fire perimeter it may lose its flaming appearance but retain its superheated center. When a fire whirl deteriorates rapidly, the super-heated air in the center can expand horizontally, potentially burning nearby personnel. It is important to remember that fire whirls can create strong winds that can not only transport firebrands but also pull vegetation and debris from the surface and throw them into nearby personnel.



Fire Whirl



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Topic 3-1: Fire Behavior in California's Fire Environment

Fire whirls can be mesmerizing to onlookers but they pose significant safety risks. Fire whirls should be respected by putting more distance between it and your personnel.

Frontal Winds

A change in air masses is marked by the passage of either a cold front or a warm front. A front is the boundary between two air masses with differing temperature and moisture characteristics. When a cold air mass replaces a warm air mass, it is called a cold front. Conversely, when a warm air mass replaces a cold air mass it is called a warm front.

Fronts are most often associated with thunderstorm activity and precipitation; however, occasionally frontal passage will cause neither. When this occurs, the main concern for firefighters is the wind shifts associated with the frontal passage. Changing wind direction is the hallmark of frontal passage. The wind behavior exhibited by a cold front or a warm front is influenced by the speed of the front, the difference in air temperature between the air masses and local conditions such as topography and surface heating.

The passage of a cold front is usually accompanied by sharp, distinct directional changes in the wind. Ahead of a cold front, the surface winds are generally out of the south or southwest. As the front nears, wind speeds increase and become gustier. As the cold front passes, directional changes may be abrupt and change from as much as 45 degrees to 180 degrees. After the cold front passes, the wind direction will change again and will usually be from the west to northwest or north. Winds may remain gusty for a while shortly after the front passes, but then will generally become steady.

A forecasted dry cold front should be of concern to every firefighter and should be announced at morning briefings or whenever the approaching front is detected. All firefighters should understand the significance of a dry cold front approaching and passing over their location because of the possibility of abrupt wind changes and their influence on fire behavior. In 1994, a dry cold front passed over the South Canyon fire in Colorado causing extreme fire behavior that contributed to the deaths of fourteen firefighters.

Foehn Winds

Foehn winds are usually associated with mountainous regions where a high-pressure system is on one side of the mountain range and a corresponding low-pressure system or trough is on the other side. Foehn winds are more common to the cooler months from September through April and may be known as North, Mono, Chinook, East, and Santa Ana winds. Foehn winds are typically warm and dry and have been known to reach speeds of 100 mph. Fires influenced by strong Foehn winds are difficult to contain due to extreme rates of spread, dramatic flame lengths, and long-range spotting.

In coastal regions, Foehn winds are influenced by the daily onshore and offshore cycle of the marine layer. As the marine layer or inversion recedes, Foehn winds may surface and accelerate raising havoc on the fire ground. When Foehn winds interact and compete with opposing local winds the condition is referred to as a *battling wind* and usually heralds a reversal of wind patterns. During the period of battling, the wind direction may fluctuate 180 degrees interrupted by brief periods of calm. A visible indication of battling winds is a wavering or fractured smoke column.



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Topic 3-1: Fire Behavior in California's Fire Environment

In mountainous ranges, Foehn winds typically will surface at night. During the day, local surface heating and corresponding convective lift will often keep Foehn winds above the surface until solar heating subsides. Once again, smoke column characteristics and direction will provide a good indicator of impending nighttime surfacing of Foehn winds.

Santa Ana Winds

Santa Ana winds occur in the southern portions of California. They are created when there is a strong high-pressure area in the Great Basin and a low-pressure area located above the Pacific Ocean along the southern California coast. This condition would normally produce a strong general wind. However, this wind is heated and dried as it crosses mountain ranges and drives toward the ocean. The results are predictable and potentially disastrous. As the Santa Ana winds begin to subside, they give way to the normal onshore winds. During this battle for supremacy, the winds can abruptly change 180 degrees in direction.

North Winds

North winds in northern California are produced in the same way as the other Foehn winds, and can sometimes be an indication (or warning) of developing Santa Ana winds in southern California.

Sundowner Winds

Sundowner winds are a significant warming event and a phenomenon common to the Santa Barbara area. Sundowners frequently occur in the late afternoon or evening hours – hence the name. Light sundowners create irregular rises in temperature in the downtown area of Santa Barbara with gentle offshore breezes. Stronger sundowners, occurring two or three times a year, can create sharp temperature rises, local gale force winds, and significant weather-related problems. Rarely, probably about a half dozen times in a century, an “explosive” sundowner occurs. These extremely strong, hot winds present a dangerous weather situation. In these events, super-heated air from the Santa Ynez Valley bursts across the Santa Ynez Mountains onto the coastal plain, reaching gale force or higher speeds within the city. Dust storms frequently occur and fires can race down the mountain slopes into populated areas. Outlying remote automated weather stations located in the Santa Ynez Mountains can give the earliest indications of an impending sundowner wind event. Dissipation of the coastal marine layer can give a later visual indication of an impending sundowner.

Thunderstorm Winds and Downdrafts

Thunderstorm winds are the result of updrafts predominating in and beneath growing cumulus clouds. Downdrafts occur in the later stages of full thunderstorm development and cold air outflow from dissipating thunderstorms. Thunderstorm downdraft winds may be very gusty, will also follow the path of least resistance, and have been clocked up to 140 mph. Although appearing suddenly and violently, thunderstorm downdraft winds are generally of short duration and should be expected in the presence of any thunderstorm activity. Their effects may be felt as much as 35 miles away from the parent storm.

Firefighters must remain vigilant if thunderstorms are forecast in the fire area. A building cumulus cloud over a fire may pull the convection column into the updrafts of the cloud, accelerating the inflow of surface oxygenated air into the fire area. Conversely, as the thunderstorm decays, the downdrafts from the cloud may push the fire outward in a 360-degree pattern turning flank fires into



Thunderstorm

head fires in all directions. In either case, the resulting erratic winds may have a profound effect on rate and direction of spread and firefighters must anticipate control problems and safety issues because of thunderstorm activity near an incident. Competent lookouts should be posted under these conditions.

Thunderstorms have a life expectancy of less than 12 hours. Thunderstorms created by convection generally do not form until afternoon, when there is sufficient solar heating to lift the moisture-laden air to great heights. They begin to break down before midnight.

There are several indicators that a thunderstorm is mature and that downdrafts may become a serious concern:

- The base of the cloud begins to roll on the downwind side
- Virga begins to hang under a darkened, ragged cloud base
- A dust cloud can be seen on the ground as the first gusts of wind reach the surface

Thunderstorms may either remain stationary or move with the prevailing winds. Indrafts can continue moving into the base of the cloud even as downdrafts are pouring from the center of the storm. The downdraft winds will normally be stronger on the downwind side of the storm as they can **combine** with the force of the prevailing wind. In 1990, six firefighters lost their lives on the Dude Fire in Arizona from a burnover that resulted from a thunderstorm downdraft.

Fuel Characteristics that Affect Wildland Fire Behavior

The following principle characteristics of fuel components can give an indication of potential fire behavior within a fuel complex.

- ① Fuel loading
- ② Live-to-dead ratio
- ③ Continuity
- ④ Arrangement
- ⑤ Moisture content
- ⑥ Chemical content

These characteristics are generally divided into two main categories: **physical and chemical characteristics**, which remain constant during a given fire situation and **moisture content**, which changes continually.

Fuel Loading

Fuel loading is the amount (volume) of fuel available for a fire to burn. It is usually measured in tons per acre. The volume or quantity of the fuel in an area is a factor that must be considered. The more fuel, the more heat output, and longer burn duration. Normally, the greater the volume of fuel, the more intensely the fire will burn. Grassy fuels can range from <1 to 5 tons per acre; shrub ranges from 2 to 80 tons per acre; slash can range from 10 to 200 tons per acre; and timber can range from 4-12 tons per acre. Heavy fuel loading increases resistance to control.

Your main concern when developing strategy and tactics is the fuel loading that is subject to burning under the current and forecasted weather conditions. These are primarily the dead surface fuels 3 inches and less in diameter, and live fuels under one fourth inch in diameter.

Fuel loading can be separated into four size classifications. The size of the fuel affects how it will respond to various forms of moisture (rain, dew, and relative humidity). Size also affects how quickly a dead fuel will lose and take on moisture. The four size classifications are listed by diameter and corresponding moisture time lag:

- Grasses and litter
 - Up to ¼" in diameter
 - 1 hour
- Twigs and small stems
 - ¼"-1" in diameter
 - 10 hour
- Branches
 - 1"-3" in diameter
 - 100 hour
- Large stems and branches
 - 3"-8" in diameter
 - 1,000 hour

Live-to-dead Fuel Ratios

Live-to-dead fuel ratios are also an important factor when forecasting fire behavior. Company Officers must visualize the percentage of dead fuel present in a fuel bed and determine how that percentage will affect fire behavior. A preponderance of dead fuel in the fuel bed will increase fire intensity and compound suppression difficulties.

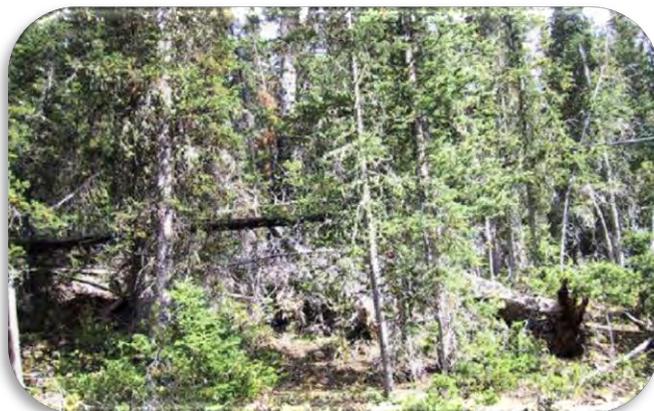
Continuity

Continuity or distribution of fuels has an impact on how a fire spreads; the rate of spread; and whether the fire will move along the surface or through the crowns; or both. A fuel bed may be either continuous or patchy. If the fuels are widespread or patchy, a fire will have some difficulty moving from one "island of fuel" to another. For a fire to move rapidly through patchy fuels, it will take a strong wind moving up a steep slope. Continuous fuel beds provide available fuels at the surface and in the crowns. You should be most concerned when the surface fuels are continuous. As discussed previously, if the aerial fuels are continuous, it will affect how the surface fuels burn. A fully closed canopy may block all solar radiation from reaching the surface, hold moisture longer, and drastically reduce the amount of wind that can influence surface fires. The greater the crown closure, the greater the reduction in wind. However, once a surface fire begins to "torch" individual trees or move into the aerial fuels, you have a changing situation.

Arrangement

The arrangement of the fuels is a very important characteristic. It will determine whether a fire will be able to move into the aerial fuels with ease or not. When there are fuels available for combustion throughout the vertical fuel bed, it is said that there are ladder fuels. There are several strata of fuel in a mature forest stand or even in a brush field. There is decomposing organic matter in the top layer of soil. There are surface litter and grasses. There are the low-level twigs and branches of the brush, understory shrubs, and young trees.

Then there is the subcanopy. The subcanopy can be the crowns of the brush, young trees, and/or the lower branches of mature trees. The top stratum is the canopy of the dominant trees. Fire may burn through one or more of these strata. If one or more layers are not burned initially, it leaves fuel available to burn later if conditions change. In most cases when lower fuel levels burn, the upper fuel levels are dried out and perhaps scorched. The upper-level fuels are still able to carry fire if there is sufficient heat to ignite them.



Fuel Arrangement

Having an environment where the fire has moved through an area and left one or more of the fuel layers available to burn can be a potentially dangerous situation. For example, if a low intensity fire moved through an area consuming the ground litter, it would dry out the fuels above it. If conditions changed later in the day, and an ignition source became available, a fire of much greater intensity could move through the area again in the higher fuel strata. This is called a **reburn**. You must concern yourself with the potential for reburns. When cutting line in an area that has not completely burned, you may think that you are making a direct attack (fighting fire right on the fire's edge), which is one

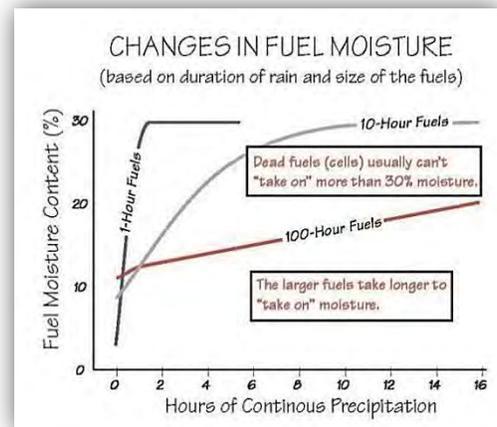
of the safer strategies. However, you are in fact making an indirect attack (fighting fire some distance from the fire's edge), because you have unburned fuel on both sides of the fireline you are constructing. This is a very dangerous scenario. Maintain situational awareness at all times.

Moisture Content

Fuel moisture is the greatest driver of fire behavior and has an exponential effect on fire behavior. In other words, small changes in fuel moisture can have a dramatic effect on fire behavior.

There are two categories of *live fuel* moisture: herbaceous and woody. Herbaceous plants are those that do not have woody material, such as annual grasses or perennial plants. The woody plant material that you should be most concerned with are the twigs, needles, and small limbs that will be consumed by the flame front of a fire.

Plants that "shed" their leaves each fall are called deciduous. The shed leaves are dead and constitute fine *dead fuels* along with grasses and needle cast. Evergreen plants are those that do not annually shed all of their leaves or needles, but they do shed some of them, contributing to the fine dead fuel load. The new growth has high fuel moistures, whereas the older foliage will have lower moisture content. The fuel moisture content of woody vegetation foliage is found in new growth, shoots, and stems. The level of fuel moisture content in these fuels usually decreases as the growing season progresses and the vegetation moves into dormancy. The lowest amounts occur in late summer or early autumn. Moisture content can range from 2% to 30% in dead fuels, and 30% to over 300% in live fuels.



Dead Fuel Moisture - Time Lag Relationship to Fuel Size		
Time Lag	Diameter of Fuel	Examples
1 hour	less than ¼"	Annual grass
10 hours	¼" – 1"	Coastal sage, juniper, and chaparral
100 hours	1" – 3"	Logging slash
1,000 hours	3" – 8"	Logs and mature standing timber

Fine dead fuel moisture is the moisture content of the most volatile fuel and is represented by the size class of >0 to ¼ inches in diameter. Hour-to-hour changes in relative humidity can be detected in this size class and provide the most variability of burning conditions. You should maintain their situational awareness with respect to RH, fine dead fuel moisture, and potential fire behavior.

Fire behavior potential when related to relative humidity; 1-hour fuel moisture and 10-hour fuel moisture			
Relative humidity %	1 hour fuel moisture %	10-hour fuel moisture %	Fire behavior potential
over 60	over 20	over 15	Very little chance of ignition; some spotting may occur from burn piles with winds above 9 mph.
46 to 60	15 to 19	13 to 15	Low ignition hazard; campfires become dangerous; glowing brands cause ignition when RH is less than 50%.
41 to 45	11 to 14	10 to 12	Medium ignition hazard; matches will readily start fire; mild burning conditions.
26 to 40	8 to 10	8 to 9	High ignition hazard, matches always dangerous; some crowning, spotting caused by gusty winds; moderate burning conditions.
15 to 25	5 to 7	5 to 7	Quick ignition, rapid buildup, high intensity and spread; an increase in wind causes increased spotting, crowning, loss of control; fire moves up bark of trees igniting aerial fuels; long-range spotting in pine stands; dangerous burning conditions.
less than 15	less than 5	less than 5	All sources of ignition dangerous; aggressive burning, spot fires occur often and spread rapidly, extreme fire behavior; critical burning conditions.

Chemical Content

Wildland fuel properties include the presence of substances such as oils, resins, wax, and pitch in the fuels. These substances can affect the rate of combustion. There are certain fuels that have rather high amounts of volatile substances that can contribute to rapid rates of spread and high fire intensities. On the other hand, certain fuels may be high in mineral content, which can reduce fire spread and intensity.

Topography

Simply put, topography is the lay of the land, the slope, aspect, and undulations that give terrain its character. It is the most constant fire behavior variable. Computer mapping programs, topographic maps, and on-site observations allow you to anticipate problem areas such as steep slopes and drainages, utilize favorable topographic features for specific strategies, tactics, and plan for incident strategy and resource needs. When developing incident strategy and tactics, you should recognize and anticipate that topographic features will affect direction of spread by "steering" the fire and/or accelerating rates of spread. Fire spreads significantly faster up a slope than on level ground and even faster up canyons and drainages where wind direction is aligned with, and funneled into, these terrain features. Flame lengths extend up slopes allowing more preheating of fuels and direct flame impingement ignition ahead of the fire front. When wind aligns with drainages, chimneys and steep slopes, the resulting extreme rates of spread may become death traps for any resource caught in the path of the fire front. Incident Commanders should include this knowledge in any planning and briefing process.



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Slope

Slope is important in the study of fire behavior and is a factor that affects fire ignition and spread by preheating the fuels upslope. Slope also enables spotting to occur from rolling and aerial firebrands. Slope has a direct effect on flame length and rate of spread. If fuels and wind are constant, the flame length and rate of spread will increase as the slope becomes steeper. In general, a 20% increase in slope will double the rate of spread. The steeper the slope, the more likely a fire will run in a wedge shape with a narrower head. Spotting ahead of the front is more likely. Slopes may be estimated from the ground or determined with reasonable accuracy from a topographic map. A clinometer may be used to determine slope but a clinometer requires the user to be fairly close to the base of the slope. The formula for determining slope is: rise, the change in elevation between two points, divided by run, the horizontal distance between the two points, multiplied by 100 equals the percentage of slope, or "rise over run times 100 = percent slope". For example, an elevation change of 400 feet over 2000 feet is a 20% slope. For a basic 7.5 minute USGS Quad Map, 1 inch will equal 2000 feet and the typical contour interval, the elevation change between contour lines, will be 40 feet.

Slope Reversals

Slope reversals occur when the fire crosses onto a slope of opposite direction. Two common examples of slope reversal are 1) a fire running to the top of a ridge begins to back down on the opposite slope and 2) a fire backing down a slope crosses a drainage and begins to run up the next ridge. The direction and rate of fire spread can respond quickly to slope reversals.

Slope reversal is a common occurrence on wild fires. Slope reversal occurs when either backing fire or running fire **burns downhill** into an adjoining drainage and then **runs uphill** in a different direction. This is a fire behavior situation that should be continually monitored. Unless the downhill spread terminates at an anchored control line, there is a high probability that the fire will reverse direction once it establishes itself on an opposing slope. Failure to recognize a potential slope reversal has been implicated as a major contributing issue in some fatal fires.

Ridges

Commonly, as a fire runs to the ridgetop, it encounters opposing upslope airflow from the other side of the ridge. This effect can slow the fire spread and limit the spotting problem on the opposite side. Often, a ridge provides firefighters with a safe and effective fire location.

The effect of erratic winds caused by various winds converging at the ridgetop can contribute to spotting. This is especially likely if the windward side of the ridge has stronger winds than the leeward upslope airflow.

A wildland fire burning near the top of the windward slope can spot across the ridgetop and onto the other slope. For this reason, firefighter safety could be easily compromised and the ridge no longer is an effective fireline location. Operational planning and effective Risk Management is the key to capitalizing on a slope reversal to slow, contain, and stop a fire's spread.



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Narrow Canyons

Increased fire intensity often produces crowning and spotting, which may cause the fire to cross to the opposite slope that has been preheated by radiation. This crossing can happen in a matter of a few minutes in narrow canyons, giving little warning to firefighters. Such crossings can occur progressively, at multiple points, creating a hazardous situation for crews. Firefighters may need to recognize when these situations before they occur.

Narrow canyons easily allow for stable air mass, such as an inversion to form. This is especially dangerous to firefighters since the smoldering fire continues to slowly consume surface fuels and dry out the aerial fuels present. When an inversion breaks, winds will increase into the canyon and fire activity will increase. The dried aerial fuels can easily ignite as well.

Intersecting Drainages

Where drainages intersect, fire might follow one or both drainages depending on

- The direction of canyon winds as determined by aspect and time of day
- The dominant winds in the canyon
- Wind eddies at the fork of the canyon
- The availability of fuels in the forked area

At the point of intersecting drainages, the intersection or combination of these variable factors often makes forecasts on fire spread very difficult and can produce eddies and erratic fire behavior.

Forked or Bent Drainages

Surface wind patterns associated with bent or forked river drainages possess the most complicated characteristics. Upslope and up-valley winds located in forked drainages share the same wind and stability properties as those in elongated valleys but with added complications.

Multiple river drainage arms create a complex terrain texture that ensures many different terrain aspects face the sun at different times of the day. This results in a complex and changing mosaic of local upslope winds at any given hour. Up-valley winds responding to the local upslope breezes could be drawn up sunny drainage forks while shaded forks are left alone.

The addition of general winds over the landscape complicate the picture since they are likely to surface only in those drainages aligned with the prevailing general wind direction. In bent drainages, general winds may surface in several exposed spots while leaving sheltered locations untouched. This has the effect of creating a mosaic of stronger and weaker 20-foot winds, eddies and erratic fire behavior.

The situation is simplified somewhat after dark. On clear nights, all the drainage arms are equally shaded resulting in similar, regular local downslope breezes that combine to produce a down-valley wind. The pooling of cold air in the drainage results in a temperature inversion and decoupling. However, the presence of a strong general wind after dark can complicate the situation as described previously.

Microclimates

Fire danger can change due to the microclimate conditions at all elevations. Factors affecting microclimates include:

- Type and availability of fuels
- Localized weather patterns
- Bodies of water
- Local terrain factors

General shape of the country and various aspects contribute greatly to the resulting climates of small areas and result in distinct fire behavior characteristics. A combination of topographic factors is usually present to influence fuel availability and the manner in which fire spreads.

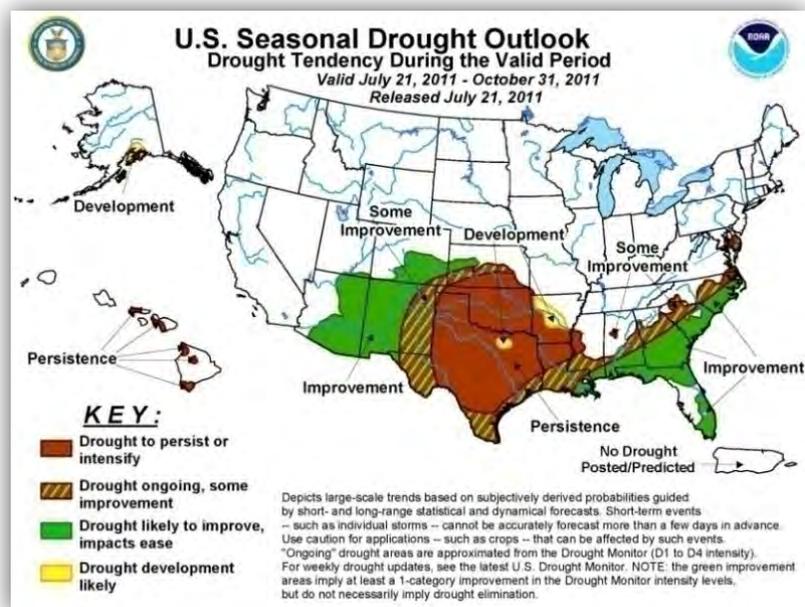
Slope percent, aspect, and position on the slope are all important factors; however, there are more factors involved than just topographic factors. Some California microclimates known for erratic and sometimes extreme fire behavior are the north coast, mountain ranges, Elsinore basin, Santa Inez hills, Santa Barbara hills, and the Diablo range just to name a few.

Seasonal Variability

Since live fuels generally respond to seasonal changes, it can be useful to estimate the live fuel moisture based on the time of the year. Appendix B of the *Fireline Handbook* has a table that correlates the stages of growth, time of year, and average live fuel moisture. These are approximate for the average year. You need to be observant of your local conditions to be aware of how the actual live fuel moistures may deviate from what is suggested in this table. These stages and their average moisture contents are contributing factors to determining fire potential.

The following can contribute to abnormal fire seasons or burning conditions by decreasing moisture contents in live fuels and/or producing additional dead fuels within a fuel's complex.

- Long drought periods
- Natural disease
- Insects
- Annuals curing-out early in the season
- Harvesting of timber and other vegetation
- Blowdown
- Ice storms



Special Considerations

Inversions

Night inversions are extremely important and must be considered in any discussion of fire behavior. Night inversions are common during periods of clear, calm, settled weather. Topography plays an important role in the formation and intensity of night inversions. Inversions are more common and more intense in poorly drained valleys or basins. Thermal belts are areas of trapped warm air sandwiched between two layers of cold air associated with an inversion. Generally, a thermal belt is found in the middle third of a slope. This area may experience active fire behavior throughout the night and should be monitored by incident personnel. Structures located in the thermal belt must continue to be monitored even though other parts of the fire are inactive.

Inversions are a phenomenon of atmospheric stability as well, and as such, will have a tendency to dampen fire activity sometime holding tremendous amounts of incipient heat at lower levels. Firefighters should expect to see subdued fire behavior under an inversion except within the thermal belt zone; however, fire behavior may increase rapidly as the inversion dissipates. Inversion dissipation generally occurs in the morning hours as the sun heats and mixes the air. As the inversion lifts, humidity's decrease, fuels dry out and winds increase. This action may cause extreme fire behavior compromising control efforts and creating serious safety concerns.

Atmospheric Stability

Atmospheric stability is the resistance of air to vertical motion. Wild fires are greatly influenced by atmospheric motion and the properties of the atmosphere that affect its motion. Convective circulation established by surface heat created by a fire is directly affected by the stability of the air. Winds are more turbulent and gusty under unstable atmospheric conditions leading to erratic fire behavior. Due to solar heating, most locations will experience a period of instability later in the day as the inversion is broken up allowing local winds mix with general winds. Cumulus formation may be the first visual indicator of this. During unstable conditions, smoke columns, also known as convection columns, may rise to considerable heights forming cumulus clouds. Under unstable atmospheric conditions, the atmosphere is usually quite clear, dust devils and fire whirls are more prevalent, winds are stronger and gustier, and inversions are very weak or nonexistent. Conversely, when stable atmospheric conditions prevail, the sky is generally hazy with light, steady winds. Smoke columns may be light and wispy and inversions are more prevalent.

The Haines Index is a severity index for wildland fires based upon the stability and moisture content of the lower atmosphere and is a valuable indicator of large fire growth potential. The Haines Index is a numerical value ranging from 2-6 with six being the most unstable atmosphere. Key elements that must be present for a Haines Index of six are instability and dry air. Instability affects fire behavior by enhancing the vertical rise of the smoke column, resulting in strong surface winds as air rushes into the fire area to replace air evacuated by the convection column. Fires create their own wind by this mechanism. A Haines Index of four or below will usually indicate low fire behavior. A Haines Index of 5 or 6 is an indicator of potential extreme fire behavior. In California during the summer months, the Haines index is almost always in the 5-6 range and is seldom discussed as a fire behavior factor but

rather taken as a given. In other areas of the western U.S. where atmospheric stability is subject to dramatic daily changes, the Haines index is given during the fire weather discussion at briefings

Clouds

Clouds are visible evidence of atmospheric moisture and motion. The appearance of clouds during the fire season may be a welcome sight or an indicator of an imminent weather event that may adversely affect fire behavior and suppression efforts. Although cloud activity is normally not a common sight during the fire season, fronts and troughs with associated clouds do occasionally pass over fire areas. In addition, moisture pulses that spawn thunderstorm clouds are a common occurrence in the summer months. An overcast sky provides shade and a cooling effect, tempering forest fuels. Rain may also be present with troughs or frontal passage increasing dead fuel moistures in 1, 10, and 100-hour fuels, advantageously affecting fire behavior. In order for clouds to develop, the atmosphere must be saturated with moisture by the addition of moisture to the air or by the lowering of the temperature. Lifting of air, either by orographic, thermal or frontal action, is the most important cooling method.

Local heating will result in thermal lifting and if the air contains adequate moisture and rises high enough, saturation will be reached and cumulus clouds will form. Moisture laden air may be forced up the windward side of slopes by orographic lifting and cooling forming clouds. As one air mass replaces another, air is forced upward by the passage of the front resulting in cloud formation and rain.

Understanding how clouds form and recognizing how cloud types signal weather changes is critical to making intelligent fire behavior forecasts. Clouds formed by localized vertical currents that carry air upward beyond the condensation level are known as **cumuliform clouds** distinguished by their billowy or heaped-up appearance. Cumuliform clouds tend to form in air that is initially unstable or becomes unstable as it is lifted. Clouds formed when an entire layer of air is lifted until condensation is reached are called **stratiform clouds** and have a layered appearance. Stratiform cloud formation is associated with stable air. The addition of the prefix or suffix nimbus denotes clouds that produce

precipitation. Fractus, when added to a cloud name, indicates that the cloud has been broken into fragments by strong winds.

Alto cumulus and altostratus clouds are "middle" clouds most generally formed by frontal or orographic lifting. Alto cumulus clouds appear as rounded cloudlets or in definite patterns such as bands or rows parallel or at right angles to the wind. Lenticular clouds are a middle cloud and are of particular importance to firefighters. **Lenticular clouds** indicate waves in the airflow caused by strong winds that typically blow across mountain



Lenticular Cloud



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ranges. They are also known as mountain waves. The appearance of lenticular clouds should give warning that the strong winds that are creating them may surface at some point during the day.

Castallanus clouds consist of cumuliform masses that appear as turrets or small castles. They indicate significant instability at high atmospheric levels and their appearance in the early hours of the day are a warning of possible thunderstorms later in the day.

Cirrus clouds appear as thin veils covering the entire sky often forming halos around the sun. They may be wispy and feathery and are also known as “mares tails” and may indicate an approaching front signaling changes in the wind patterns and overall weather outlook.

Clouds with vertical development include cumulus and cumulonimbus clouds. They may appear as groups displaying large, irregular, cauliflower shaped domes. The individual cloud bases are generally at the same altitude. **Cumulus clouds** are formed at the top of rising convection columns and their presence should be of particular concern to firefighters. The formation of cumulus clouds signifies possible surface instability that may increase fire activity and compromise suppression efforts. A cumulus cloud, if it continues to form, will become a cumulonimbus cloud or thunderhead. The appearance of a cumulonimbus cloud near or over the fire area should be of significant concern because of the strong erratic updrafts and downdrafts associated with these clouds and their influence on fire behavior.

Extreme Fire Behavior

Area Ignition

Area ignition is the ignition of several individual fires throughout an area, either simultaneously or in rapid succession, and so spaced that they add to and influence the main body of the fire to produce fast-spreading fire condition. Area ignition is a phenomenon associated with topography, fuel type, and heat. Most area ignition events occur in “bowls” or depressions in the topography. In addition, certain box canyon configurations are prone to area ignition. Area ignition is commonly the result of the concentrated heating and volatilization of chaparral type fuels. These volatile vapors tend not to be dispersed by the wind or slope, but rather accumulate in bowls, depressions, or box canyons mixing with the surrounding air. The ignition source for area ignitions could be ember cast resulting in multiple spot fires that ignite the area, or by vapors reaching an established section of the main fire and igniting. Area ignition is not dependent on the size of the area of involvement.

Crown Fire

Typically, fires start at ground level in surface fuels as the result of a fairly concentrated ignition source such as a spark, cigarette, or match. Depending on the fuel type, the current weather, and the topography, the fire may remain confined to the surface fuels either as a backing, flanking or head fire without interacting with the overstory. With favorable conditions such as a steep slope or high wind speed, the intensity of a surface fire may increase to the point that flames will either extend into the crowns of nearby trees or climb available ladder fuels to reach the crowns resulting in foliage ignition or torching of individual trees or small groups of trees. Torching is characterized by a tree being suddenly and completely enveloped by fire in a very short time, usually seconds. If conditions



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do not favor the sustained ignition of adjacent crowns, the affected trees will burn out with no further crown-to-crown spread. Embers are lofted and spread with the wind and may result in spot fires contributing to the overall fire spread. Torching is common on most fires where trees, especially conifer trees, are part of the fuel load. Torching is generally more prevalent during the hotter, drier periods of the day but may be observed during the night as well. Should favorable conditions prevail, the intensity and duration of torching events could lead to the development of a sustained crown fire.

The two most common crown fire behavior patterns are *independent* and *dependent*. When wind increases to >18 mph, or the slope is such that flames are driven into adjacent tree crowns, the most probable result is an independent crown fire where spread rates may range from 1-7 miles per hour, outpacing any surface fire. Steep slopes will accelerate the fire's spread especially when high surface winds are present.

Wind driven crown fires may run uphill for long distances but may slow or even stop at predominate ridgelines where fuel conditions change. However, during drought conditions or late in the fire season when forest fuels are at minimum moisture content, crown fires may run for several hours and into the evening.

Running crown fires most often produce large, boiling convection columns that may show signs of the winds influence by bending or hugging the ground. Ember showers and fire whirls should be expected. Dependent crown fire will only run as long as the understory provides a continuous source of preheating and ignition for the crowns. A fuel treatment ahead of a dependent crown fire can cause the fire to drop down to the surface and disrupt the crown run.

Plume Dominated

Plume dominated fires are associated with low wind speeds, usually less than 20 mph at the 20-foot level. They are distinguished by their towering convection columns that tend to remain stable over the fire rather than bend in the direction of the prevailing wind. The wind speeds at the surface are faster than the winds aloft. In essence, a plume-dominated fire has overpowered local surface winds and winds aloft allowing the column to develop directly over the fire reaching tremendous heights without being sheared by upper level winds. The vertical velocity of the convection column creates significant turbulence at the surface with increased indrafts resulting in increased fire intensity and accelerated fire spread. This process is self-perpetuating as the convection column grows.

A plume dominated fire develops a convection cell over the smoke column producing down drafts of wind that accelerate outward in all directions when they hit the surface, similar to down drafts from a thunderstorm cell. Firefighters should watch for indicators heralding this dangerous condition. A particularly important indicator is the appearance of virga or actual precipitation in any amount that reaches the ground. The mere presence of a large, towering convection column should alert firefighters to the possibility of convection down drafts. Another indicator may be a very short period of no wind at all around the fire as the updrafts begin the transition to downdrafts, however, this condition could be imperceptible and go unnoticed by fireline personnel.

As with thunderstorms, downdrafts from convection columns are also influenced by topography and will have a tendency to follow paths of less resistance. Another source of downdrafts is a collapsing convection column that may occur when a running crown fire runs out of fuel or encounters lighter fuels. The resulting column collapse may spawn severe down drafts and ember showers.

Visual Indicators of Extreme Fire Behavior

It is important to be able to identify visual indicators of extreme fire behavior. Orders to engage under extreme conditions need to be carefully considered before engagement. Listed below are several terms used to describe extreme fire behavior.

- Sheeting
 - Large areas of surface fire fanned by high winds
- Sustained crown runs
 - A crown run that produces sustained burning fire front for great distances
- Area ignition
 - The ignition of several individual fires throughout an area
- Long-range spotting
 - ¼ mile or more
- Multiple large spot fires
 - Fires outside the main fire that may burn together or cause entrapment
- Horizontal vortices associated with smoke columns under the influence of high surface winds
 - Vortices that may roll downward from the sky typically located on the lee side of the column
- Flame lengths in excess of 20 feet or flame lengths that exceed the suppression capabilities of ground equipment
- Significant fire whirls
 - Fire whirls that break off from the main plume and consume large amounts of acreage
- Spread rates >3 mph or exceeding 240 chains/hour

Color and Column of Smoke

A critical observation while en route to the incident is the condition of the smoke column.

Is the column thick, towering, and well defined or is it thin, wispy, and hard to see?

Does the condition of the column match the fire's initial description?

Translate the condition of the column and its relationship to the weather conditions in the fire area.

Is there an inversion over the fire?

Is the column sheared by strong winds?

Could this be a "plume dominated" incident where the power of the convection column is greater than that of the wind?

- Leaning column
 - Fast/critical rates of spread
 - Short-range spotting
 - Typical of wind driven fires
- Sheared column
 - A column of smoke that rises up and abruptly changes direction with a 90-degree bend; means winds aloft
 - May cause long-range spotting
 - The winds may have the potential to surface
 - Avoid working under a sheared column
- Undeveloped column
 - Lazy, thin smoke spreading in all directions may indicate that an inversion may be affecting the fire's spread and intensity
 - An incipient stage fire
- Changing column
 - If the smoke color darkens, this may indicate the fire is moving into structures or a heavier/different fuel model
 - If it begins to build rapidly, this may indicate increasing fire behavior
 - If it splits, this may indicate the fire is moving in different directions or has been affected by the topography
- Well-developed column
 - Intense burning
 - Unpredictable fire spread in any direction
 - Plume dominated fire
 - Power of the fire becomes stronger than the power of the local winds
 - The danger is the potential for down bursts that are similar to, but stronger than, downdrafts from a thunderstorm
 - If a light rain or sudden calm occurs, expect downbursts



Leaning Column



Sheared Column



Well-developed Column

WUI Specific Fire Behavior

Fire spreads through various heat transfer processes, including radiant heat, convective heat, and conductive heat transfer. In the WUI, direct flame impingement and ember cast must also be considered as potential heat transfer sources. During a WUI incident, structure ignitions and fire spread result from three possible sources: from direct flame impingement, radiant heat, and convective heat transfer which includes ember cast. Conduction, as a structure-to-structure fire spread factor, is of minimal significance in the WUI. A more likely scenario for the structure-to-structure fire spread is through ember cast.



The effects of weather and topography have a profound effect on structure-to-structure ignitions. Weather, in particular wind, relative humidity, and atmospheric stability, encourages the development of large, towering convection columns which can carry embers to great heights aided by an unstable atmosphere. High winds bend the convection column in the direction of fire spread, depositing embers in front of the main fire in the spotting zone. Certain topographic features such as drainages, chimneys, and canyons funnel heat, and wind especially when these features are aligned with the prevailing surface wind. Structures located in or near these topographic features are at greater risk of direct flame impingement and ember cast ignition. The convective heat transfer process is critical for the dispersal of firebrands and is considered an important heat transfer process for that reason. When these embers land in or on a receptive fuel bed such as furniture cushions, leaf



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and needle collections, and flammable roofs, a spot fire is the likely result and fire spread continues. The effects of ember cast are evident in areas of dense and sparse structure placement alike. Susceptible structures may ignite even without active fire spread in the immediate area. Embers may be transported over considerable distances by wind and convection columns while retaining adequate heat to ignite homes or vegetation, however, the probability of ignition is influenced by the condition of the vegetation or the construction materials used on a structure. In the WUI, this method of fire spread is dramatically illustrated in areas of highly flammable roofing material. Structures with flammable roofing may burn with no vegetation burning in the immediate area when embers land on the roof. Wood frame structures with flammable exterior siding and flammable roofs promote ignitions from almost every ignition source.

In areas of dense structure arrangement, radiant heat plays a significant role in fire spread. As a structure burns, heat radiates in all directions and if it is of significant duration and the adjacent structure is close enough and has flammable exterior construction components, there is a high probability that the adjacent structure will ignite.

In areas of sparse structure arrangement, direct flame impingement is generally not a critical factor. The fire front's burning time coupled with the structure's exposure time to the heat, and the time required to bring construction components to ignition temperature are factors to consider when forecasting fire behavior in the WUI. The fire front may be hot enough to ignite flammable construction components but if the structure is not exposed to the heat for an adequate period, the structure may not ignite.

Obviously, in areas of sparse structure density, the probability of structure-to-structure fire spread is minimal, however, as isolated structures burn they generate embers that could travel long distances potentially igniting structures down wind. Conversely, in areas of dense structure arrangement, radiant heat along with direct flame impingement contributes to structure-to-structure fire spread.

Wind eddies around structures and drives embers into traps such as gable end vents, open windows and into other sheltered areas receptive to ignition. Structures with high rooflines or convoluted rooflines generally affect eddying more than structures with flatter roofs. Structures with numerous exterior wall angles promote wind eddies. Every structure should be assessed for wind eddy effects and the potential for eddies to deposit embers in ember traps and receptive fuel collections. A primary consideration for structure defense is to assess and remove ember receptive fuels collected around the structure. Prior to being used as a temporary refuge area, every defended structure should be evaluated for the possibility of eddies and how the wind will direct heat and embers into the temporary refuge area (TRA).

Tactical Considerations

Every tactical action in the WUI must be based on current and forecasted fire behavior in conjunction with a risk management plan. Fireline supervisors should consider not just the effects of the fire front on threatened structures but should also consider the heat and embers produced by burning structures when forecasting fire spread. Fuel, weather, and topography, along with structure density



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and defensible space, should be considered when forecasting fire behavior and determining tactical options in the WUI.

Accurate fire behavior forecasting is crucial when developing objectives, determining strategy and tactics, and when placing resource orders. You should consider all the fire environment factors when forecasting fire behavior and should anticipate changes in the fire environment that will affect fire behavior and drive command decisions. There are several useful tools to aid Company Officers when making fire behavior forecasts and assigning or ordering resources in the following chapter.

When working in the WUI, you must consider how a fire spreads and affects values at risk. You will need to design tactics that will not only safely deploy assigned personnel, but also be operationally efficient in controlling the spread and impact of these fires.

Topic 3-2: Collecting and Using Wildland Fire Weather, Fuels, and Topographic Information

In an effort to forecast better the behavior of wildfires, the fire service has developed, through trial and error, a number of tools. While each of these tools is important, they are a very small sample of the instruments used today for forecasting fire behavior. No single tool should be considered the ultimate force, thereby eliminating the use of other tools. As the science of fire research progresses, there will be more and more tools available for this never-ending task of putting out fires. In order for you to make a fire behavior forecast, you need to not only be familiar with a forecasting system, but also where to collect the information for that system. The following are some of the more common forecasting tools used in the Western United States, along with sources of intelligence needed to make that forecast.

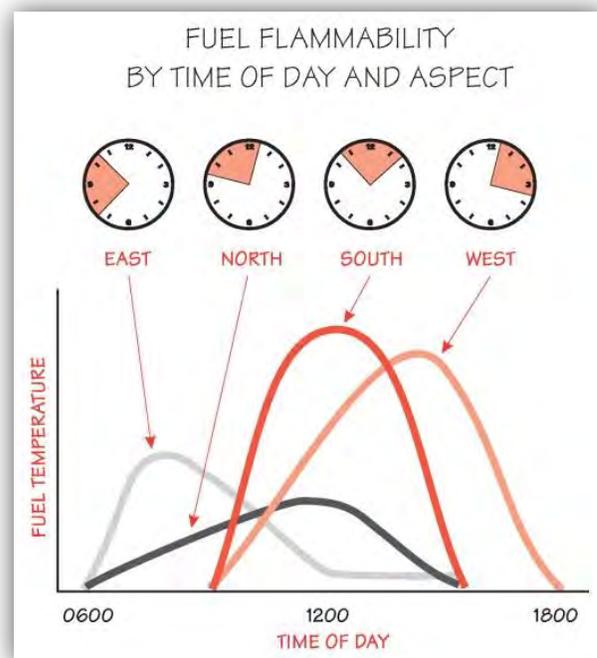
Campbell Prediction System

The Campbell Prediction System (CPS) is a quick and practical way to forecast, verify, and communicate when and where wildland fire behavior changes can occur. Common among burnover accidents is a failure to anticipate a change in fire behavior. Those firefighters that act on accurate fire behavior forecasts are safer and better firefighters. The focus of the CPS is to forecast fire behavior changes and potential for dangerous fire intensities.

In firefighting situations, the observed fire behavior (“the fire signature”) becomes the baseline for fire behavior forecasts. These observations include the forces of wind, slope and time of day, and their relation to one another.

The change in the strength and alignment of wind, slope, and preheating (based on aspect and time of day), cause variations of fire intensity. As long as the fire danger conditions are stable, the behavior that a fire exhibits will be repeated. Determining the conditions of past behavior and identifying similar conditions on the fireground determines when and where the fire will repeat itself. Firefighters who recognize these forecasted elements can implement proper fire behavior tactics. They can prevail more often when the forces are weak or out of alignment.

The Campbell Prediction System teaches firefighters how to use logic rather than intuition to make decisions on the fireline. It teaches a language to communicate the observed and forecasted fire





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behavior. CPS teaches firefighters how to discuss a fire's potential, assuring a safe and effective firefighting operation.

Appendix B, Fireline Handbook

Appendix B of the *Fireline Handbook* is used to estimate fire characteristics. Using inputs from the appendix, based off your current and forecasted conditions, you are able to get information such as rate of spread and flame length. Tactical decisions should be made only after a fire behavior forecast is made based on objective data, such as Appendix B.

Computer Applications

In order to assist in the preincident planning and control of WUI fires, several computer software products have been developed. Be familiar with these products' capabilities and situations where they may be useful, but also realize that a fair amount of training is needed before they can be used effectively. Fire Behavior Analysts and Land Managers are most familiar with these programs and can aid you by providing the most accurate and objective fire behavior forecasts for a given scenario. Fire Behavior Analysts can use the information from these models to determine where the fire is going and how long it may take to get there. This information can help determine where to build containment lines, when to order evacuations, and for the placement of hand crews.

BehavePlus

BehavePlus is a Windows® application used to forecast wildland fire behavior for fire management purposes. It is designed for use by fire and land managers who are familiar with fuels, weather, topography, wildfire situations, and associated terminology. BehavePlus uses a minimum amount of site-specific data to forecast fire behavior for a point in time and is as useful as a preplanning tool for trained fire personnel.

FARSITE Fire Area Simulator

FARSITE is a fire growth simulation modeling system. It uses spatial information based on topography and fuels along with weather and wind profiles. It incorporates existing models for surface fire, crown fire, spotting, post-frontal combustion, and fire acceleration into a two-dimensional fire growth model.

FARSITE is widely used by the U.S. Forest Service, National Park Service, and other federal and state land management agencies to simulate the spread of wildfires and fire use for resource benefit across the landscape. It is designed for users familiar with fuels, weather, topography, wildfire situations, and the associated terminology. Because of the complexity of FARSITE, only personnel with proper fire behavior training and experience should use it for making fire and land management decisions.

Collecting Internet and Radio Broadcast Intelligence

National Fire Danger Rating System

Each day during fire season, midafternoon fire weather observations are taken from a network of fire weather stations located throughout the United States. The fire weather network is comprised of

over 1,000 weather stations across the United States. Fire weather observations are reported to the Weather Information Management System (WIMS). These observations are combined with the station's fuel conditions and topography information, then processed by the National Fire Danger Rating System (NFDRS) and generated into various indices and components that describe fire danger in a particular rating area. NFDRS observed indices and components are used on a daily basis as a forecasting system by wildland fire managers to determine the strength and placement of fire suppression resources, establish fire suppression actions, and ensure firefighter safety. These forecasts also allow fire agencies to post the appropriate fire danger display to the public.

The weather input generated daily is processed into particular outputs giving fire personnel a way of forecasting a fire's potential and characteristics. Some of these outputs include the ignition component, spread component, and burning index.

The fire danger rating information is used by fire managers to determine staffing levels in a particular area and the appropriate tactics. These same ratings are used for prevention programs and communicating the fire danger to the public. Other decisions made from the fire danger ratings are declaration of red flag warnings, prohibiting industrial forest activities, extending fire season, and public forest use.

Fire managers can alter their staffing levels based on the NFDRS information, resource values, agency policy, etc. These staffing levels can range from minimal response to prestaging apparatus and crews in vital areas.

The public system is an adjective class that uses "Low," "Moderate," "High," and "Extreme" fire danger classifications. The current fire danger class is usually displayed along roadways, often using Smokey Bear signs, and is updated as the fire danger rating changes.

Remote Automated Weather Stations

There are nearly 2,200 interagency remote automated weather stations (RAWS) strategically located throughout the United States. These stations monitor the weather and provide weather data that assists land management agencies with a variety of projects such as monitoring air quality, rating fire danger, and providing information for research applications.

Most of the stations owned by the wildland fire agencies are placed in locations where they can monitor fire danger. RAWS units collect, store, and forward data to a computer system at the National Interagency Fire Center in Boise, Idaho, via the Geostationary Operational Environmental Satellite operated by the National Oceanic and Atmospheric Administration. The data is automatically forwarded to several other computer systems including the



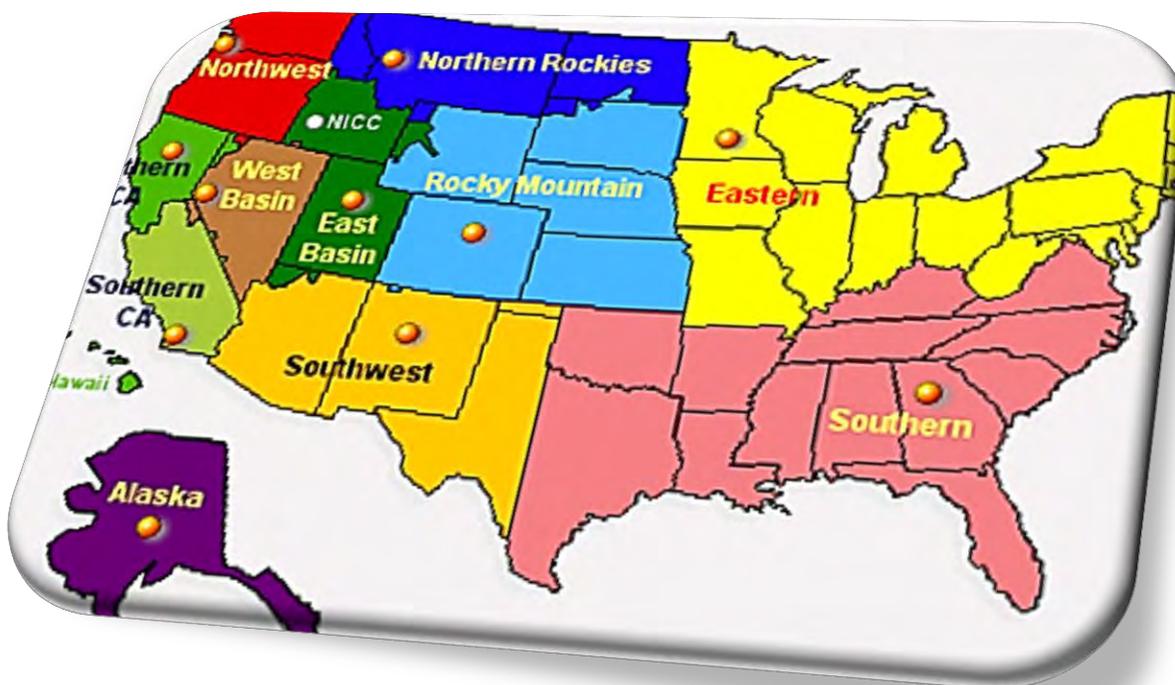
RAWS

Weather Information Management System (WIMS) and the Western Regional Climate Center in Reno, Nevada.

Fire managers use this data to forecast fire behavior and monitor fuels; resource managers use the data to monitor environmental conditions. Locations of RAWS stations can be searched online courtesy of the Western Regional Climate Center.

Geographic Area Coordination Center

The United States and Alaska are divided into 11 geographic areas for the purpose of incident management and mobilization of resources (people, aircraft, and ground equipment). Within each geographic area, an interagency Geographic Area Coordinating Group is established and includes directors from each of the federal and state land management agencies involved. Working collaboratively, the Geographic Area Coordinating Group's mission is to provide leadership and support not only for wildland fire emergencies, but to other emergency incidents (i.e. earthquakes, floods, hurricanes, tornadoes, etc.), as necessary. Authority for establishment of the Geographic Area Coordinating Group is through departmental policy and interagency agreements. Additional agreements are established with cooperators and other organizations in order to facilitate efficient fire management activities within and adjacent to the Area. A cost-effective sharing of resources among public agencies is a key component of the Geographic Area Coordinating Group mission and is expected by the public, Congress, and States. All agencies and geographic areas work together under the auspices and direction of the National Interagency Fire Center (NIFC).





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The Geographic Area Coordination Center (GACC) is a result of an interagency agreement established by the respective Geographic Area Coordinating Group. The primary mission of the GACC is to **serve Federal and State wildland fire agencies** through logistical coordination and mobilization of resources (people, aircraft, ground equipment) throughout the geographical area, and with other geographic areas, as necessary. This is generally done through coordinating the movement of resources between the many Dispatch Centers within the geographic area and, as necessary, with the National Interagency Coordination Center (NICC) when resources are unavailable within the area or when mobilization support is needed in other geographic areas.

Although the primary mission of the GACC is logistical coordination, the center also has support programs in predictive services, intelligence, and in several Center's fire information. **Predictive Services** consists primarily of professional meteorologists who monitor weather and fuel conditions, conduct briefings, produce fire weather related products, liaison with the National Weather Service, and oversee all aspects of the RAWs. The Intelligence Section is primarily responsible for collecting and disseminating wildland fire and prescribed fire activity information, monitoring the status of national firefighting resources, maintaining year-to-date and historical fire occurrence data, and managing the Sit Report and ICS-209 programs. In some GACCs, the predictive services and intelligence sections work as one unit called the Predictive Services. The Predictive Services and Intelligence sections, whether separated or combined, work collaboratively producing weekly, monthly, and seasonal fire weather/fire danger outlooks.

Each coordination center provides additional support to their respective geographic area's wildland fire community through training, workshops, special projects, and other tasks. Except for dispatch of air tankers and lead planes based outside the dispatch center responsibility the fire is located in, the GACC does not have initial attack dispatch responsibilities.

Collecting Field Tool Intelligence

Belt Weather Kit

Belt weather kits contain small, easy to use instruments that provide accurate fire weather observations when used correctly. The instruments measure temperature and wind speeds at eye level. In addition, relative humidity can be calculated from measured values of dry and wet bulb temperatures. The kit, when used correctly, is the standard and generally most accurate set of basic weather observing tools used by fire personnel on wildland fires, prescribed burns, and fire use.

Most wildland firefighters are very familiar with an item called a belt weather kit, which is a pouch that contains a variety of items for weather measurement. The kit is designed to attach to a belt around the waist and contains the following items:

- Wind meter (anemometer) measures wind speed
- Sling psychrometer measures temperature and relative humidity
- Water bottle used with the sling psychrometer (wet bulb readings)
- Compass provides wind direction readings
- Slide rule computes the relative humidity based on the readings from the sling psychrometer
- Pencil and paper used to record measurements, make calculations, and take notes

You also need to be knowledgeable in the cleaning and maintenance of the kit's components using the following guidelines.

Wind Meter (Anemometer)

Cleaning – Clean the outer shell with a damp cloth and the inner tube with a pipe cleaner. Clean the pinhole in the top stem with the small nylon bristle provided with the meter. This small hole must remain open to maintain correct wind speed measurement.

Drying – If moisture enters the inner tube, the white plastic ball may not move freely in the tube. To remove moisture in the tube, unscrew the metal plug and carefully remove the white ball. Clean the tube with a pipe cleaner. After all moisture has been removed, reinsert the ball and fasten the plug.]

Removing static – A static electricity charge may also cause the ball to stick in the tube. This can be corrected by moving a pipe cleaner up and down the tube. Follow the procedure given for cleaning or drying the tube.

Sling Psychrometer

Changing the wick – The wick on the wet-bulb thermometer should be changed once every four weeks if the instrument is used daily. If it is used irregularly, change the wick at the first sign of dirt, discoloration, or difficulty in wetting. New wicking should be cut in a 1½" length so it extends well above and below the thermometer bulb. To obtain a snug fit on the bulb, use extra-strength white sewing thread to tie the wick above and below the bulb.

Cleaning – Clean the thermometers with vinegar to remove any dirt or any stubborn mineral deposits.

Electronic Pocket Weather Station

The electronic pocket weather station is battery operated, compact, and easily operated in the field. There are several brands of electronic weather stations to choose. For example, the Kestrel™ brand has several models that monitor relative humidity, temperature, wind speed, dew point, altitude, barometric pressure, and heat index conversions. Most units require annual calibration.

Global Positioning System

A global positioning system (GPS) is a radio-navigation system consisting of 24 satellites and ground support. GPS provides users with accurate information about their position and velocity, as well as the time and elevation, anywhere in the world and in all weather conditions. Several manufacturers produce GPS units, from small handheld models to larger mobile-mounted units.

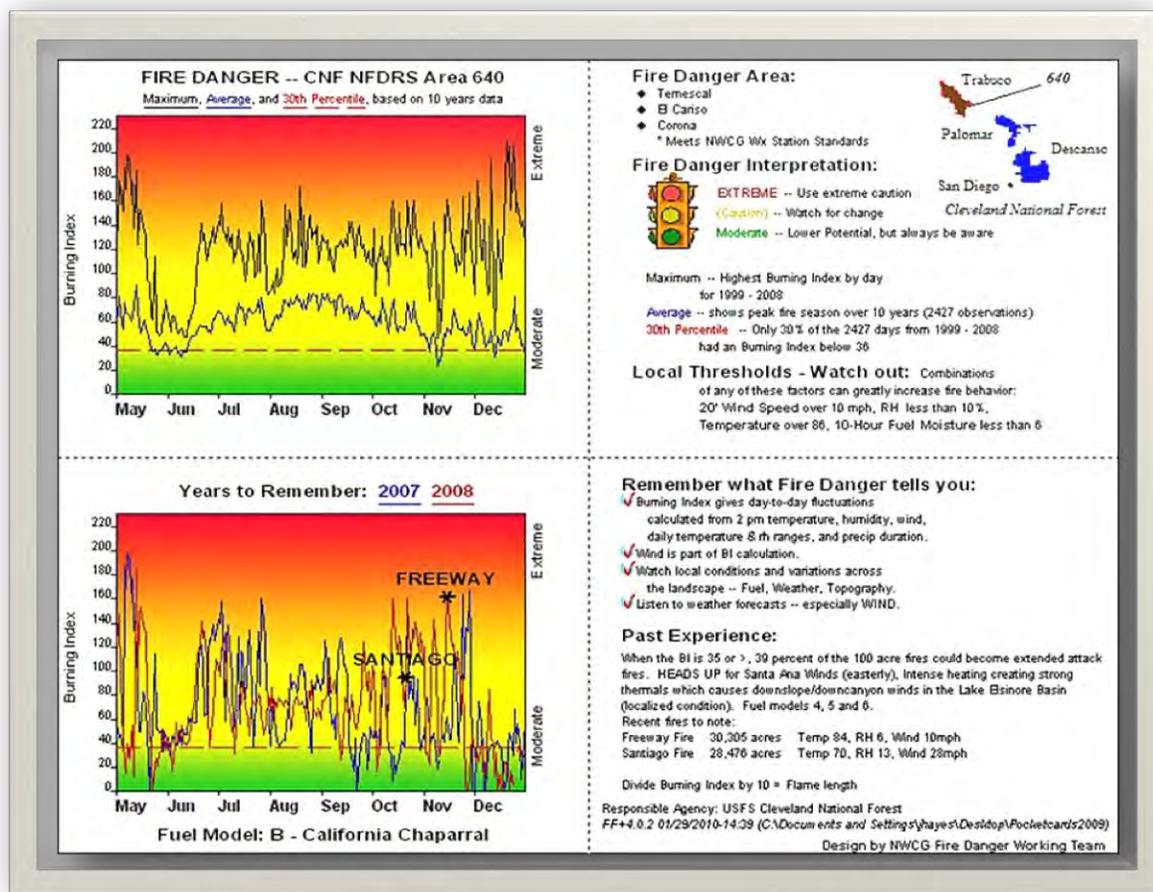
GPS gives fire service personnel the ability to accurately pinpoint a specific location. A fire perimeter can be mapped accurately or a helispot location can be easily marked with a latitude/longitude. In the WUI, structure location, water sources, and hazards can be marked using GPS. This information



should be passed on to the Situation Unit Leader (SITL) who transfers it onto the incident maps for the next operational period.

Pocket Cards

The Pocket Card provides a format for interpreting and communicating key index values provided by the National Fire Danger Rating System. The objective is to provide greater awareness of fire danger and subsequently increased firefighter safety. The Pocket Card provides a description of seasonal changes in fire danger in a local area. It is useful to both local and out-of-area firefighters.



The Pocket Card has very important day-to-day "presuppression" uses. When the morning and afternoon weather is read each day, the actual and predicted indices are announced. Firefighters can reference their card and assess where today falls in the range of historical values for danger rating. This important information should be discussed at morning crew meetings, tailgate safety meetings, incident briefings, etc.

The Pocket Card is a visual aid for fireline personnel and command and general staff members. Other program areas within the fire service, such as dispatchers and upper management personnel, have



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access to the same information through their computer or smart device. The Pocket Card is a synopsis of fire danger information for a specific area.

The Pocket Card is used to make a general assessment of fire potential based on local weather conditions, historical fire occurrence, and interpreting fire danger ratings for a local area.

Another goal of the Pocket Card is to enhance a firefighter's understanding of local conditions affecting fire behavior in a specific area and to enhance situational awareness. The Pocket Card is not a replacement for fireline experience plus adherence to the *10 Standard Firefighting Orders* and the *18 Situations That Shout Watch Out*.

Each Pocket Card contains historical and interpretive information. The information on the card should be representative of a wide area, such as the North or South portion of a fire zone, a section of a state or a National Forest.

In the upper left quadrant of the card, a color graph shows the historical worst and average seasonal trends for the fire danger rating output that best illustrates local fire activity. A dashed line drawn horizontally indicates a significant threshold for the energy release component (ERC). This line reminds firefighters that only 3% of the days with recorded weather during the fire season reached an ERC above 69.

In the lower left quadrant are two more trends that are seasonal for the ERC. One is for a year with relatively low fire activity and the other is for a relatively active fire season. Significant fires are labeled on the seasonal curve for either year, not to dramatize a past event, but to heighten situational awareness. The fuel model most representative of the area covered by the card and used in calculating the trends.

On the left half of the card is a red-to-yellow-to-green graph. Each color band is adjusted to reflect local conditions. The colored graph serves as a tactical guide to suppression options based on the fire danger rating. The suppression options are spelled out next to the stop light icon. The red light means "stop," or "direct control by any means is not likely"; the yellow light means "caution," or "this is the upper limit of manual control effectiveness"; the green light means "go," or "generally controllable fire behavior."

The geographical area covered by the card is shown in the upper right quadrant. This information is specific to that area and is not be used for any other area. Sources of weather data used to make the card are identified and local weather factors of critical safety concern are located in the right upper quadrant. A checklist in the lower right quadrant is a reminder to firefighters about ERC calculations and shows data on significant past fire activity.

Maps

Maps have long been an integral element in incident support. Company Officers responding to a WUI fire must have a basic understanding of the different types of maps that are used at these incidents. This tool is invaluable for getting to and from your assignment, finding water sources, and navigating the terrain. They can also be used to locate landing zones for helicopters, direct crews to spot fires,



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and locate safety zones and escape routes. The types of maps normally used at a WUI fire incident are planimetric, topographic, and orthophoto.

Planimetric literally means "in one plane" or flat. They are the most common maps and the ones we are most accustomed to seeing. Planimetric maps present only the horizontal positions of an area's geographic features, identifying locations without displaying the contours of the land. Features usually shown on a planimetric map include boundaries, rivers, roads, railways, and populated places (cities and towns). These maps are the typical road maps, area maps, and schematic maps that most fire departments carry in their vehicles and apparatus.

Topographic maps, often called "topo" maps, were developed from aerial and ground surveys, and are very extensive as to information and scaling. They represent the land as it appears in three dimensions, as if the observer was looking at eye-level across the landscape. The United States Geological Survey (USGS) over many years has produced the topographic maps that are the most widely used. Some of the natural features depicted on a topo map include mountains, valleys, plains, lakes, rivers, and vegetation. Topo maps also identify selected artificial features such as roads, boundaries, transmission lines, and major buildings.

An orthophoto map depicts terrain and other features by color-enhanced aerial photographs of the land. Some orthophoto maps are overlaid with contour lines and other features commonly associated with topographic maps. These maps are corrected to scale and are the same size as USGS maps.

Electronic Maps

Whether they are on a hard drive, CD-ROM, or SD card, electronic maps can provide both portability and strategic advantages for companies on the fireline. These electronic maps can give personnel in the field accurate information regarding current location, surrounding values at risk, as well as topographical data that can assist in forecasting fire behavior and tactical planning. Many electronic map products are available that can be used with notebook computers, smart phones, and handheld GPS units. The most popular electronic maps and mapping software are made by National Geographic, Thomas Brothers, and Garmin.

Some degree of mapping software is always used on large incidents to create incident maps. Field personnel using compatible electronic mapping systems may be tasked to assist incident overhead resources in intelligence gathering and processing. This kind of intelligence gathering can be extremely useful in the early stages of incident management. Having an accurate map is very important for resource management and real-time intelligence gathering by field personnel is vital to the process. It is important that you stay up-to-date with your map reading skills and consider investing in and becoming competent in the use of an electronic map system.

Topic 4-1: Managing Risk at a WUI Fire

WUI fires are dynamic, high-risk environments with many challenges facing suppression resources. To manage the numerous potential risks, you must follow a methodical process of evaluating and managing risk or exposure in a consistent and repeatable manner. The considerations that affect risk management are situational awareness, rules of engagement, safety and survival, and the process for managing risk.

Situational Awareness

Situational awareness (SA) is the perception of environmental elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future - **LOOK, THINK, ACT**. To maintain situational awareness you need to utilize a continual process of collecting, analyzing, and disseminating intelligence, information, and knowledge of a particular situation to allow organizations and individuals to anticipate requirements and to react effectively and safely. The situational awareness process includes:

- Relevant information
- Objective
- Communications
- Who is in charge?
- Previous and current fire behavior
- Weather
- Local factors
- Evacuation needs
- Resources deployed and available

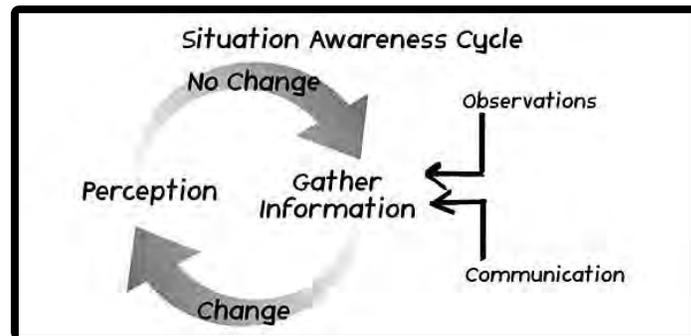
The following barriers can hinder your attempts at situational awareness. These barriers will be discussed in detail later.

- Inexperience
- False sense of security
- Distraction from primary duty
- Misplaced motivations and hazardous attitudes
- Groupthink, social influence, and peer pressure
- Stress reaction
- Physical impairment

Situational awareness is depicted as a cycle because the situation and people's perceptions of the situation are constantly changing. This internal cycle continues as long as people are awake.

Everyone starts with an initial perception of any given situation and then continuously updates it with new information. People gather information through both observation, which includes input from the

senses, and communication, which includes face-to-face conversations, written communication, and radio or telephone exchanges. Simply paying attention is an important part of maintaining good situational awareness, but even more important is determining what to pay attention to.



All perceptions are subject to filtering and focusing: people constantly filter information and shift focus. People also produce numerous internal inputs such as thoughts about what to do next, stress, memories of similar experiences, fear. Those with more experience in an environment often can more easily filter out distractions and unimportant details and focus on the most important information.

Rules of Engagement

The fire service has created many rules of engagement for different firefighting conditions in order to reduce the risk to firefighters. The *10 Standard Firefighting Orders* is the one rule that should always be followed and never compromised. The other rules are guidelines that require action to mitigate risk. Depending on the conditions encountered, you will need to consider one or more of the following rules of engagement.

- 10 standard firefighting orders
- 18 situations that shout watch out
- Fire suppression interpretations based on flame length
- Safety zone guidelines
- Lookouts, communications, escape routes, safety zones
- Last resort survival
- Common denominators
- Urban wildland watch outs
- PACE
- DRAW-D
- Downhill line construction
- Thunderstorm safety
- Power line safety
- Hazard tree safety
- Unexploded ordinance

Information on PACE, DRAW-D, and LCES is provided because they are the most commonly used rules of engagement for fighting a wildland urban interface fire.

Tactical Engagement Process (PACE)

Structure defense firefighting in the wildland urban interface is inherently dangerous because it is primarily associated with indirect firefighting. An approaching fire is a dynamic event and subject to sudden changes that can be very difficult to anticipate. Structure defense should start with a determination of the exit strategy.

Indirect firefighting safety mitigations depend on fire behavior forecasts made in advance of the fires arrival. Accurate fire behavior forecasts are difficult to make with absolute certainty and at the same time, these forecasts are the crux for determining effective safety mitigations (tactical refuge areas, escape routes, and safety zones).

With firefighter safety depending upon accurate fire behavior estimates that cannot be assured, it is imperative that a multistep safety plan be established to compensate for the uncertainties.

Firefighters must anticipate the unexpected and build agility (tactical maneuver) into their plan with contingency planning. The lexicon for contingency planning is PACE. Implement PACE prior to engaging in any structure defense action.

P – Primary Plan [Offense]

The primary plan is the preferred plan that yields the best results and is focused on mission objectives and firefighter safety. The primary plan is the tactical action selected to address the current task or challenge. During structure defense, you will develop a fire behavior forecast then decide on the best tactical action that will have the least impact on property, such as tactical firing, hose lays, or pretreatment with foam or gel.

A – Alternate Plan [Offense]

An alternate plan is a fall back plan that supports the primary plan. The results of an alternate plan may be less desirable than the primary plan and the risk to firefighters may increase. An alternate plan should be identified prior to fire front impact at a threatened structure in case the fire behavior exceeds the forecast and prevents the primary plan from being implemented. An alternate or backup plan allows resources to quickly and effectively refocus their efforts while continuing to work toward the incident objective. This substitute action may mean the loss of some assets at risk but may save the bulk of those assets in the end. While perhaps not as successful as the primary plan, which was to successfully defend all the assets at risk, the alternate plan saves the majority of at risk assets. An alternate plan may require the use of a temporary refuge area if fire behavior dictates such action.

C – Contingency Plan [Defense]

A contingency plan is totally focused on firefighter safety. The plan may include withdrawal from active firefighting or a total change in the incident plan. The contingency plan is activated when fire behavior or other conditions exceed what was forecasted and resources must withdraw from their position in order to avoid injury or entrapment. At this point, the tactical objective to save property is abandoned and the focus shifts to firefighter safety, which is accomplished by moving firefighting

personnel into a temporary refuge area or a safety zone. Escape routes to a safety zone or a temporary refuge area are good examples of a contingency plan and is already a fire ground practice. Contingency plans are developed for numerous “What if?” situations such as spot fires, incidents within the incident, threats to subdivisions or communities, and evacuations. A contingency plan may include the following actions:

- Employ tactical maneuvers to avoid the fire front
- Move to a temporary refuge area
- Withdraw along an escape route
- Move into a safety zone

E – Emergency Plan [Defense]

An emergency plan means firefighter survival is the immediate priority. When immediately threatened by fire, firefighters should move to their shelter deployment zone and deploy shelters. It is the responsibility of every firefighter to always have an identified shelter deployment zone and to deploy fire shelters in an appropriate location as a last resort.

The need for all personnel to take responsibility for knowing how and when to execute the emergency plan cannot be overstated. It is common during entrapments for the crew to become separated; communications are severed and personnel find themselves having to provide for their own individual safety. There should be a tailgate safety briefing between you and the crew about where the TRAs are, where the safety zones are and what the decision points are for implementing the plan. If situational awareness has been maintained, firefighters should not be surprised by an approaching fire front. However, there are unexpected situations that may trigger the decision to disengage and evacuate the area, take temporary shelter in an engine of structure, or deploy fire shelters in a deployment zone. Obviously, time and distance from the threat, or following escape routes to a safety zone are the preferred actions. If the decision is made to deploy fire shelters, do not hesitate until it is too late; if in doubt, deploy fire shelters quickly in a suitable deployment zone maintaining close contact among the crew and providing for personnel accountability.

P	<p>Primary Plan [Offense]</p> <ul style="list-style-type: none"> ★ Focused on firefighter safety and mission objectives ★ Yields the most desirable results <p style="text-align: right;"><i>Staffing hoselines to suppress the fire around a structure</i></p>
A	<p>Alternate Plan [Offense]</p> <ul style="list-style-type: none"> ★ A fall back plan that closely supports the Primary Plan ★ The results may be less desirable but still supports the Primary Plan <p style="text-align: right;"><i>Retreating into or behind the structure until fire intensity diminishes</i></p>
C	<p>Contingency Plan [Defense]</p> <ul style="list-style-type: none"> ★ Entirely focused on the firefighter’s safety <p style="text-align: right;"><i>Move to a tactical refuge area (an area that provides short-term relief) or withdraw along the escape route. Move into a safety zone.</i></p>
E	<p>Emergency Plan [Defense]</p> <ul style="list-style-type: none"> ★ Entirely focused on individual firefighter survival <p style="text-align: right;"><i>When threatened by fire, firefighters should get into their fire shelter Always Have A Deployment Zone Identified!</i></p>

Levels of Engagement (DRAW-D)

As with military operations, there are five levels of engagement in firefighting – DRAW-D. These actions apply to all aspects of wildland firefighting from the incident strategy to the individual line assignments and structure defense. They identify a thoughtful and mindful approach to choosing the appropriate tactical action. Use of DRAW-D as levels of engagement incorporates a “can-do” attitude in every level of engagement and every level of engagement is equal in value to the overall effort as the other.

D	Defend – Holding actions, protecting priority areas ★ Protect the structures ★ Hold and improve the line
R	Reinforce – Bring more resources to bear ★ Add resources necessary to advance or defend
A	Advance – Anchor and flank ★ Direct or indirect attack ★ Active burnout operations
W	Withdraw – Cease current activities until conditions modify ★ Abandon an established position or constructed line in response to an increase in fire intensity ★ Not a stigma, but a decision to move away from a threat
D	Delay – Wait until the situation has modified sufficiently to allow a different level of engagement ★ Conditions meet preidentified triggers necessary to advance or defend ★ Not a lack of effort, but a conscious decision to maximize long term effectiveness

LCES

The LCES system approach to fireline safety is an outgrowth of analyzing fireline fatalities and near misses over a 20-year period. LCES simply focuses on the essential elements of the standard firefighting orders. Its use should be automatic in fireline operations, and all firefighters should know the LCES interconnection. LCES is the *minimum* level of risk mitigation that must be employed on all wildland fires.

Lookouts ⌘ Communications ⌘ Escape Routes ⌘ Safety Zones

Establish LCES before fighting the fire; select lookouts, set up communications, choose escape routes, and select safety zones. LCES functions sequentially, as a self-triggering mechanism. Lookouts assess and reassess the fire environment and communicate threats to safety; firefighters use escape routes to safety zones. All firefighters should be alert to changes in the fire environment and have the authority to initiate communication.

There are two guidelines for LCES: 1) Before safety is threatened, each firefighter must know the LCES system will be used, and 2) LCES must be continuously reevaluated as fire conditions change.

Lookouts

Lookouts are often better situated to notice the cumulative changes of fire behavior. Firefighting Order #5 says, "Post lookouts when there is possible danger."

Should you utilize lookouts at all times? What are you looking for when you are selecting a lookout location?

- Choose a good vantage point
 - Preferably with a good overview of the entire area where firefighters are located
 - Include escape routes and safety zones
- Utilize aircraft, but have an alternative on the ground

What are the desired qualities, capabilities, knowledge, and responsibilities of a lookout person?

- Experienced firefighter
- Solid knowledge of fire behavior and ability to recognize and monitor other environmental hazards
- Good communicator
 - Keeps the crew advised of fire behavior changes
 - Tracks weather trends and relays the information
 - Informs crew of work progress and updates from the latest strategy and tactical briefings
- Monitors and accounts for all individuals within his or her assigned area at all times and will notify others if breaks are needed

What is the necessary equipment for a lookout?

- Appropriate protective ensemble
- Radio with extra batteries
- Compass
- Binoculars
- Belt weather kit
- Incident action plan (IAP)
- Map
- Food
- Water

Communications

Effective communication is a critical backbone of safe and successful operations. Know the factors that affect radio communication at the incident.

- Type of radio issued
- Net control, frequencies
- Line-of-sight restrictions

- Antenna polarization effect (direction of the antenna)
- Minimizing noise interference

How can you mitigate potential problems?

- Implement effective communication procedures
 - Be brief, clear, concise, and to-the-point
- Give a good comprehensive briefing
 - Refer to the Briefing Checklist inside the back cover of the Incident Response Pocket Guide
- Confirm that relayed information is received, acknowledged, and understood
- Keep a continuous information flow
 - Updates on weather
 - Fire behavior
 - Work progress
 - Changes in strategy/tactics
 - Arrival of additional resources
 - Solicit feedback
- Establish emergency check-in procedures
- Provide a minimum of four radios per 20-person crew

Five Communication Responsibilities for All Firefighters

1. Brief others
2. Debrief your actions
3. Communicate hazards to others
4. Acknowledge messages
5. Ask if you do not know

Escape Routes

An escape route is a preplanned and understood route to reach a safety zone.

What are the primary concerns in choosing an escape route?

- Select the closest, least obstructed route
- Plan for more than one escape route
- Avoid an uphill escape
- Scout and clearly mark the route for visibility
 - Aids during smoky situations or night operational periods
- Determine escape time
 - Consider slowest person, fatigue, and temperature factors
- Continuously reassess the situation with regard to work progress and additional resource arrivals
- Ensure all line personnel are familiar with escape routes

Safety Zones

A safety zone is a location where the threatened firefighter can find adequate refuge from an approaching fire.

What is the difference between a safety zone and a deployment zone?

The safety zone is the area where a firefighter can survive without using a fire shelter. Use the deployment zone when fire conditions have comprised your escape routes and safety zones.

How do you identify a good safety zone?

- Consider the distance from the escaped fire as well as topography, winds, fire behavior, and fuels in the area
- The best locations are usually "in the black"
 - Those with a minimum of, or devoid of, ground/aerial vegetation or large bodies of water
- Size is sufficient for all present resources with a minimum distance from fire of at least four times the maximum flame height
- Location is scouted and marked well for visibility at all times
- Location has been reassessed in relation to line work progress, fatigue, changes in fire behavior, and arrival of additional resources

Safety and Survival

Entrapment Avoidance

Entrapment avoidance is a decision process for not only engagement/disengagement on the fireground, but to examine the factors that will determine the effectiveness of escape routes and safety zones as well as the viability of temporary refuge areas. Entrapment avoidance does not address fire shelter deployment actions after firefighters become trapped.

The first objective is to identify trigger/decision points when given a set of fireline conditions to engage or disengage in firefighting activities. The second objective is to define a procedure for recognizing and identifying escape routes, safety zones, and temporary refuge areas prior to engaging a fire. Human factors such as qualifications, training, physical fitness, attitudes, leadership ability, and experience levels can contribute to fireline decision errors when determining the appropriate level of engagement as conditions change.

Skills to Avoid Entrapment

What skills are needed to avoid entrapment? The following is an "ability guide" to help you understand the skills needed to avoid entrapment.

- Ability to gain good situational awareness
- Ability to anticipate fire behavior
- Ability to select effective strategy and tactics
- Ability to make decisions about when to engage a fire
- Ability to recognize good safety zones and escape route opportunities

Entrapment Avoidance Decision-making

There are two key steps in the decision-making process you must make to avoid entrapment. The first step is to develop an accurate analysis of the fire problem or the assignment. The second step is to develop a comprehensive plan that incorporates an expectation of a changing situation.

In order for you to engage in this two-step decision-making process, you must possess critical skills and situational intelligence so that an appropriate decision can be made. These skills must include the ability to:

- Acquire and maintain good situational awareness
- Forecast fire behavior
- Determine appropriate strategy and tactics
- Evaluate effectiveness of actions taken
- Recognize good safety zones and escape routes
- Identify targets of opportunity, that when engaged, maintain the leader's intent
- Employ risk management techniques
- Communicate hazards to your subordinates
- Disengage at appropriate times and/or fire conditions
- Maintain a profound level of awareness in regards to yourself and your subordinate's personal strengths, weaknesses, and emotional triggers

Safety Zone

A safety zone is “a preplanned area of sufficient size and suitable location that is expected to protect fire personnel from known hazards without using fire shelters.”

- Avoid locations that are downwind from the fire
- Avoid locations that are in chimneys, saddles, or narrow canyons
- Avoid locations that require a steep uphill escape route
- Take advantage of heat barriers such as lee side of ridges, large rocks, or solid structures
- Burn out safety zones prior to flame front approach

Safety Zone Size

The size of the safety zone is determined by the observed maximum flame height. The *Fireline Handbook* and *Incident Response Pocket Guide* (IRPG) require the separation distance between firefighter and the flames to be four times the maximum continuous flame height.

The calculation to determine safety zone radius is four times the maximum flame height plus 50 square feet per firefighter, or an additional four feet of radius per firefighter. This calculation provides the radius of the safety zone, meaning the safety zone diameter should be twice the value of the above formula. If potential for the fire to burn completely around the safety zone exists, the diameter should be twice the values indicated above and the distance must be maintained on all sides.

Factors that will reduce safety zone size include reduction in flame height by thinning or burnout operations, shielding the safety zone from direct exposure to the flame by locating it on the lee side of ridges or other geographic structures, or reducing flame temperatures by applying fire retardant to the area around the safety zone. Keep in mind that these guidelines address radiant heat only and do not address convective energy. Convective heat from wind and/or terrain influences will increase this distance requirement. The calculations in the following table assume no slope and no wind.

Flame Height	Distance Separation Firefighter to Flame	Area in Acres
10 feet	40 feet	1/10 acre
20 feet	80 feet	1/2 acre
50 feet	200 feet	3 acres
75 feet	300 feet	7 acres
100 feet	400 feet	12 acres
200 feet	800 feet	50 acres

Area in acres is calculated to allow for distance separation on all sides for a three-person engine crew. One acre is approximately the size of a football field or exactly 208 feet x 208 feet. Distance separation is the radius from the center of the safety zone to the nearest fuels.

If the fire has the ability to burn completely around the safety zone, this distance must be maintained on all sides of the safety zone, meaning the diameter should be twice the value indicated above. In addition, convective heat from wind and/or terrain influences will increase this distance requirement. Firefighters should remember that safety zones should be large enough to accommodate fire apparatus in addition to personnel.

Safety zones that meet the *Fireline Handbook* and *IRPG* criteria are rarely present in the WUI, where housing density and small parcel sizes preclude the existence of large open areas. It is also difficult to construct adequate safety zones in the WUI without destroying residential improvements, however there are many existing areas that can function as a safety zone:

- Large parking lots
- School/athletic fields
- Parks with open grass areas
- Recreation areas with beaches, lakes, launch ramps
- Cleared open space and green belts



Safety Zone

- ❑ May be created by burning an area of light vegetation that meets *IRPG* size criteria
 - Consider in any burned out area of the fire with adequate space for personnel and apparatus where there is no canopy

If a firefighter miscalculates the fire spread and intensity of the fire and is unable to use an escape route to get to a safety zone, they should still attempt to move to a safety zone when safe to do so. As they move to the safety zone, predetermined temporary refuge areas (TRAs) may be utilized for protection.

Temporary Refuge Areas

A temporary refuge area (TRA) is a preplanned area where firefighters can immediately take refuge for temporary shelter and short-term relief without using a fire shelter in the event that emergency egress to an established safety zone is compromised. However, anything that protects firefighters from radiant or convective heat should be considered a temporary refuge area. Taking shelter behind a suitable barrier may provide adequate temporary relief as the fire front passes. When confronted with intense, significant flare-ups on open fireline, firefighters may find temporary refuge by retreating down the fireline, moving further into the black, or by moving to the lee side of a ridgeline or large boulders. Depending on the fire environment, many objects in the WUI can become a TRA. Firefighters should constantly evaluate their surroundings for TRAs while they complete their assignments.

Firefighters in the WUI and on wildland fires in general should always establish lookouts, communications, escape routes, and safety zones (LCES) prior to any tactical engagement. However, a review of near miss and fatality fires reveals that many wildland firefighters have abandoned or ignored temporary refuge areas offering suitable protection from radiant and convective heat while en route to a safety zone. Many of these wildland firefighters have been killed or injured in chutes, saddles or areas of thick vegetation while en route to a safety zone when they could have waited a minute or two in a temporary refuge area prior to moving through a more dangerous area to access the safety zone.

A TRA is a location that provides temporary shelter and short-term relief from an approaching fire front without having to use a fire shelter and without injury to suppression personnel. A TRA does not meet the requirements for a safety zone, but will provide an acceptable margin of safety for short periods.

Unlike a safety zone that may be some distance away from the engagement area, a TRA should always be near the area of operation so firefighters may quickly secure short-term relief from an unexpected flare-ups or adverse changes in fire behavior. The major difference between a TRA and a safety zone is that a TRA requires another planned tactical action as a contingency in the event the primary TRA environment becomes hostile. For example, firefighters taking refuge inside a structure must plan their next move in the event the structure begins to burn and they cannot remain inside. This may mean moving to a vehicle or engine, sheltering behind a wall or rock outcropping, or as a last resort, deploying shelters.

Identifying a TRA must be based on current and forecasted fire behavior; it is vital for suppression personnel to remember that temporary refuge areas are indeed *temporary* and they should anticipate moving to another temporary refuge area or safety zone when the environment becomes immediately hazardous. Temporary refuge areas are intended to provide firefighters ready access to escape routes during a sudden increase in fire intensity and give them time to assess their situation. If a temporary refuge area cannot provide sufficient thermal protection from the fire, firefighters should immediately withdraw using an escape route to a safety zone.

Examples of TRAs

- Large turnouts or cul-de-sacs
- Green belts, meadows, pastures
- Large areas of lawn or nonflammable vegetation
- Swimming pools
- Rock covered areas that are outside of chutes/chimneys
- Leaside of structures
- Inside of structures
- Inside apparatus

Deployment Zone

Deployment zones are areas where fire shelters must be deployed to ensure firefighter survival due to the available space and/or fire behavior conditions at the deployment zone location. It is used when fire conditions are such that escape routes and safety zones have been compromised. During deployment, you as the Company Officer are responsible for declaring an emergency and notifying your supervisor of your entrapment, maintaining accountability of your crew, ensuring your crew stay together and are under shelters.

While in Your Fire Shelter

Keep in contact with your supervisor and crew. The length of your fire shelter deployment will vary based on the fuel and fire conditions. You can expect it to last as long as 90 minutes. It is your responsibility to check outside conditions and determine when it is safe for the crew to exit their shelters. Some of the indicators that it will be safe will be a drop in noise, reduction in wind, less heat, and a change in the interior brightness and color. If you are in doubt, stay in your fire shelter.

Safe Refuge Areas

A safe refuge area is a temporary, safe location to shelter evacuees until a safe evacuation route is opened, the fire threat is mitigated, or evacuees return to their homes. A safe refuge area differs from sheltering-in-place in that it removes people from their homes or current location and relocates them to a safe area where they may remain unaffected by the fire threat. Typically, a safe refuge area is a local setting where neighborhood citizens may congregate not far from their homes such as a school, park, or mall. As with sheltering-in-place, strong command presence is required to maintain calm, minimize confusion, and provide clear direction to evacuees.

Moving the public to a safe refuge area is a protective action that you can use during initial attack incidents. This action is usually verbal and short-term in nature. Safe refuge areas may be formalized for specific areas on written plans produced by a team assigned to the incident, the local agencies, or emergency operating plans.

Survival Facts (S-FACTS)

Firefighters must perform a rapid assessment and decide whether a structure may be safely defended. In the WUI setting, it may be difficult to remember all the factors that must be considered in the safety assessment process. The mnemonic, “S-FACTS” may assist with the safety assessment process. Survival FACTS, or S-FACTS, is used to remind firefighters of the safety concerns that must be addressed during structure defense operations: Survival, Fire environment, Access, Construction/Clearance, Time, Stay, or go.

Using the S-FACTS memory aid, firefighters may make a rapid assessment of the relative safety of their assignment by determining the presence of safety zones or TRAs near the residence, assessing the fire environment, evaluating ingress or egress to the structure, evaluating building construction and defensible space clearance, forecasting the time available before fire front impact on the structure, all culminating in a decision to stay or go.

S – Survival

The primary consideration prior to engaging in structure defense operations is firefighter SURVIVAL. Firefighters must have viable escape routes to adequate safety zones and a pre-identified TRA at the structure. If an escape route to a safety zone does not exist, and there is no TRA at the structure, the structure is nondefensible and the firefighters must leave. Firefighters should never use a TRA as a safety zone. If an escape route to a safety zone exists and there is an identified TRA at the structure, firefighters may then consider the FACTS.

F – Fire Environment

Firefighters must observe current fire behavior and forecast expected fire behavior prior to the fire front impacting a threatened structure. The goal is to accurately forecast *when* the fire front will arrive at a target structure and with what intensity. A thorough evaluation of the fire environment will determine if a given location is survivable. The fire environment is the fuel burning and expected to burn, the current and forecasted weather influencing the rate and direction of spread, and the topography surrounding the structure. A situation that appears safe now may become unsafe if the fire behavior changes adversely.

Attention should be given to the flame length, rate of spread, flanking, backing or head fire, crowning, long range spotting, sheeting, and the presence of sustained runs. Persistence forecasting is the theory that, given the same environmental conditions, a fire will behave in the future as it is behaving currently, allowing firefighters to more accurately forecast fire behavior.

The relative position of a structure on a slope is also important. A structure located at the top of a ridge is inherently more dangerous than one at the base of a slope. A structure located mid slope, or in a drainage, may present the most hazardous situation to firefighters.

The alignment of wind with topographical features such as chimneys or drainages, coupled with light flashy fuels may lead to rapid rates of spread and extreme fire behavior. Extreme fire behavior may make otherwise defensible structures nondefensible compromising firefighter safety.

A – Access

The condition of the access road to a structure may be a determining factor on whether or not to commit to a structure defense assignment. Narrow roads or driveways may easily become bottlenecks if an engine or other apparatus is unable to negotiate a turn and is stuck, blocking traffic in both directions. Narrow and winding roads may make it impossible for resources to safely access the target structure. Road grade and surface condition may adversely affect ingress and egress compromising an orderly retreat and access to a safety zone. Heavy fuels adjacent to a driveway or roadway may compromise escape routes, especially if the fuels form a canopy over the road.

A narrow or locked gate may prevent access to a structure and possibly cause a bottleneck. Inspect bridges and culverts to assure heavy equipment can safely pass and follow all posted vehicle weight limitations. Insure that bridges will not be compromised by the fire by applying foam or gel or posting an engine at the bridge.

Insure that ingress and egress times are compatible with time and distance factors to an identified safety zone to maintain an adequate safety margin. A safety margin is the estimated time it will take the fire to reach the target structure location, minus the known escape time. Remember, as rates of spread increase, the safety margin will decrease.



Access over a Bridge

If there is any doubt that the ingress or egress to a structure may be unsafe, a scout, field observer or strike team/task force leader driving a light vehicle should first check the road before any larger equipment uses the roadway or driveway.

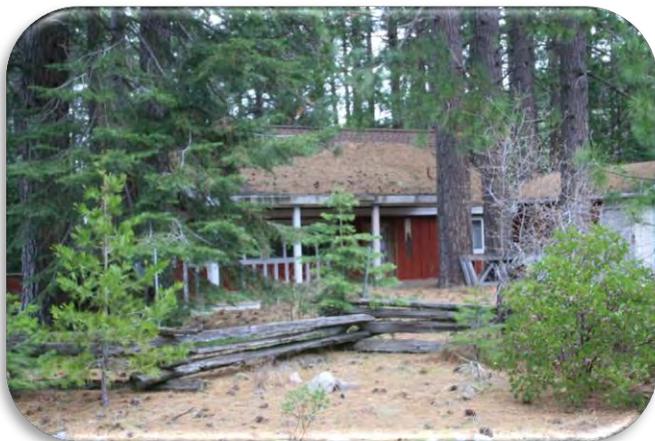
C – Construction/Clearance

Identify and evaluate the construction materials used on the exterior of any threatened structure to determine if the structure can withstand the forecasted fire behavior while providing an adequate TRA for the firefighters defending it. Wood siding, flammable roofing, and numerous firebrand traps, such as decks and gable end vents, encourage spot fires and structure ignition, compromising firefighter safety.

Determine if there is adequate clearance or defensible space around the structure for firefighter safety and successful structure defense. Base the defensible space evaluation on the current weather, predominant fuel carrying the fire, and the topography influencing the rate and direction of

the fire's spread. Ensure there is a preidentified TRA that will withstand the fire front impact or any adverse change in fire behavior.

Identify the location of propane tanks and fuel tanks and remember, they may be hidden within a structure or buried. Ensure that propane tanks are not located in a position that could compromise safety if they vent or fail. Be prepared to remove any fuel surrounding them if necessary.



Lack of Clearance

Be aware of hazardous materials around or inside the structure. Identify them during size up and ensure everyone at the site is aware of their location. Should a structure containing hazardous materials ignite, take suppression action on the structure only if the percentage of involvement is such that the structure may be extinguished with the resources and water at scene.

Fire apparatus are the primary means of evacuation to safety zones in the WUI. It is unacceptable to locate fire apparatus in areas where they may be damaged and/or

destroyed. Loss of fire apparatus is unacceptable and must never be considered as the "cost of doing business" when defending structures. The "blistered paint" and "melted light bar" mentality is no longer an option.

If the construction materials and defensible space around the structure are highly flammable or inadequate and there is not enough time to prepare the structure for fire front impact, then firefighters should leave the structure.

T – Time Constraints

Monitor current fire behavior and forecast expected fire behavior to gauge when the fire front will impact the target structure. Continuously observe the fire's rate of spread to avoid surprises when the fire front arrives. If sufficient time does not exist to complete any structure preparation safely, or if there is not enough time to reach a safety zone prior to the fire reaching the structure, firefighters should leave the area.

S – Stay or Go

After considering the FACTS, *stay if it is safe; leave if it is not safe to stay.*

Survival Facts Decision Tree

- Determine if there a safety zone or TRA
- If there is no safety zone or TRA present, the structure is **not defensible**, leave the area
- If a safety zone or TRA exists, then consider the FACTS
- If any of the FACTS point to an unsafe situation that cannot be mitigated, leave the area

Decision Point

Decision points help you identify or anticipate an event before it occurs and then initiate a preplanned response. They also help you evaluate the situation and make decisions based on the risk management process.

When there is a change or impending change in fire activity such as weather, fuel type, or terrain, as well as human factors such as tactical progress and logistical support, a decision point is triggered to compel you to take action in accordance to those changes. The following decision points are critical and quick action on your part is necessary.

Environmental

- Changes in wind direction
- Rapidly dropping relative humidity
- Wind and slope come into alignment
- Combined RH and wind speed threshold exceeded
- Fire transitions from surface to torching

Operational Concerns

- Loss of lookout
- Loss of communication
- Escape route time increases
- Failure to meet performance standards
- Air support diverted
- Resources diverted
- Excessive fatigue

Decision points will vary by geographic area and fuel type. You should determine them when potential exists for the fire situation to degrade. Ensure your situation awareness includes monitoring factors that relate to the decision points you have set and have a planned response in place.

Remember, as a Company Officer, you have the responsibility to communicate a clear change in orders to your firefighters, account for all your firefighters, ensure your firefighters change engagement as planned, and communicate the information to adjacent resources and up the chain of command.

Responder Rehabilitation

Extended periods of maximum effort may reduce a fire suppression force's capability to a level that would adversely affect both safety and productivity. This situation may be offset through the assignment of rest and relaxation (R&R) periods or through assignment relief.

Rest and relaxation is assigned by an IC to ensure a safe and productive incident-free workforce. Personnel on R&R are temporarily assigned to a short-term situation, which will allow them to rest and regain their previous productivity level. R&R is used when the normal off-shift period does not



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provide sufficient recuperation of an individual's ability to perform at the optimum level. Personnel on R&R assignments remain assigned to the incident and are not subject to reassignment. Personnel on R&R assignment may be relocated to an off-incident site but remain assigned to the incident.

Risk Management Process

The risk management process was developed to provide firefighters with a brief and accurate method to recognize and then reduce the risk to firefighters on the fireline. Each firefighter has a comfort level that they will risk depending on training, experience, education, and background. The steps in the risk management process will help you make decisions when you are at risk.

Step 1 – Situation Awareness

In this step, you will gather information to help you decide when, where, and how to deploy personnel. Before a decision can be made, you must obtain the following information:

- Objectives
 - What are the primary objectives and expected action plan?
 - Is there a clear obtainable objective?
 - Are the objectives known to everyone?
 - Are there enough resources to handle the objective?
- Communications
 - Are communications established and known to everyone?
 - Can all forces communicate with each other?
 - Are radio frequencies confirmed?
- Command
 - Is one person in charge of the incident?
 - Is the span of control accurate?
- Previous fire behavior
 - Is the fire history known?
 - What has the fire been doing?
- Weather forecast
 - What will the weather conditions be when the forces are deployed?
 - What will the weather conditions be in the future?
- Local factors
 - How will local conditions affect fire behavior?

Step 2 – Hazard Assessment

In this step, you will identify hazards on the fireline that would affect your decision to engage or not engage. These hazard considerations should include fuel characteristics, fuel moisture, fuel temperature, terrain, wind, stability, and fire behavior.

- Estimate potential fire behavior hazards
 - Look up/down/around indicators that include the conditions, influences, and modifying forces that control fire behavior
- Identify tactical hazards
 - Watch out situations that develop
 - What other safety hazards exist?
 - Consider severity versus probability

Step 3 – Hazard Control

In this step, you can make changes to certain hazards that have been identified.

- Standard Firefighting Orders and LCES checklist are mandatory
- Downhill checklist
 - Downhill fireline construction is hazardous in steep terrain, fast-burning fuels, or rapidly changing weather
 - Downhill fireline construction should not be attempted unless there is no tactical alternative
 - When building downhill fireline, the following is required
 - Crew supervisors and fireline overhead will discuss assignments prior to committing crews
 - ◆ Responsible overhead individual will stay with job until completed
 - Decision will be made after proposed fireline has been scouted by supervisor(s) of involved crew(s)
 - LCES will be coordinated for all personnel involved
 - ◆ Crew supervisor(s) is in direct contact with lookout who can see the fire
 - ◆ Communication is established between all crews
 - ◆ Rapid access to safety zone(s) in case fire crosses below crew(s)
 - Direct attack will be used whenever possible; if not possible, the fireline should be completed between anchor points before being fired out
 - Fireline will not lie in or adjacent to a chute or chimney
 - Starting point will be anchored for crew(s) building fireline down from the top
 - Bottom of the fire will be monitored; if the potential exists for the fire to spread, action will be taken to secure the fire edge

Step 4 – Decision Point

In this step, your answers to the following questions take you to the appropriate action.

- Are controls in place for identifying hazards?
 - No: Reassess situations
 - Yes: Next question



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- Are selected tactics based on expected fire behavior?
 - No: Reassess situation
 - Yes: Next question
- Have instructions been given and understood?
 - No: Reassess situation
 - Yes: Initiate action

Step 5 – Evaluate

In this step, you will evaluate the personnel and the situation.

- Personnel
 - Low experience level with local factors?
 - Distracted from primary tasks?
 - Fatigue or stress reaction?
 - Hazardous attitude?
- The situation
 - What is changing?
 - Are strategy and tactics working?

Risk Refusal

Refer to the Incident Response Pocket Guide (IRPG) for further information.

Every individual has the right and obligation to report safety issues and express any concerns regarding their safety. Supervisors are expected to give these issues and concerns serious consideration. When an individual thinks an assignment is unsafe, he or she is obligated to identify, to the degree possible, safe alternatives for completing that assignment. Turning down the assignment is one possible outcome of managing risk.

Turndown

A "turndown" is a situation where an individual has determined he or she cannot undertake an assignment as given and is unable to agree on an alternate solution. Every effort must be made to negotiate a safe alternative by all parties involved. Turning down an assignment must be based on an assessment of risks and the ability of the individual or organization to control those risks. Individuals may turn down an assignment as unsafe under the following circumstances:

Violation of Safe Working Practices

- If you are fighting a WUI fire, you should have a lookout that can see the operation and report any changes that may be a risk to the firefighters. If you are given an assignment and you do not have a lookout, you would be in an unsafe situation and have the right to turn down the assignment.
- If you are fighting a WUI fire without established escape routes before engagement then you have the right to turn down the assignment until you have a safe alternative or an escape route has been established.

- If you are assigned to defend structures in an area without turnarounds or wide enough roads to navigate or you are in an area where you may be overrun by fire before getting to that structure, then you have a right to turndown that assignment until you have an alternative solution.
- If you are assigned to defend structures near live power lines that are down and you think that you cannot protect those structures without the risk of injury, then you have a right to turn down the assignment.

Environmental Conditions Make the Work Unsafe

- If you are assigned to defend structures in an area where extreme fire behavior exists, a large flame front is approaching your location at a rapid rate, and long-range spotting is occurring, you may believe that the fire behavior is too extreme to safely operate. You have the right to turndown that assignment until fire conditions change or you have negotiated an alternate solution.
- If you are assigned to an area where smoke conditions would make it unsafe to drive to your assignment, then you may turn down the assignment until the conditions change or an alternate route is established.
- If you are assigned to an area where lightning is still active and you believe it is unsafe to operate, you have the right to turn down the assignment until the storm passes or an alternate solution is established.
- If are operating in an area with strong winds and you think the wind conditions could make it unsafe to operate then you may turn down the assignment.

Lack of the Necessary Qualifications or Experience

- If you are assigned to burnout around a structure or use fire to fight fire and have not been trained or you believe that you do not have the experience to conduct the firing operation, then you have the right to turndown that assignment.
- If you are assigned as a Structure Group Supervisor without the experience or training for that position, you have a right to turndown that assignment
- If you are assigned to fall a tree without receiving the proper training or you do not think that it is safe to fall that tree, you have the right to turndown that assignment.
- If you are assigned to cut fireline downhill below a structure and you have never cut line before without supervision, you have the right to turndown that assignment if you believe it to be unsafe.

Defective Equipment is Being Used

- You have a right to turn down an assignment if you are assigned to mobile attack and your pump is not working correctly.
- You have the right to turn down an assignment if you are told to go into a burning building and your SCBA is out of air.
- You have a right to turn down an assignment if you are assigned to a four-wheel drive route and you cannot engage the front axle.

- If you are assigned to an active portion of the fire and your fire shelter has been damaged and you believe it to be unsafe to use, then you have the right to turn down the assignment.

The individual will directly inform the supervisor that he or she is turning down the assignment as given. The most appropriate means to document the turndown is using the criteria outlined in the risk management process.

The supervisor will notify the Safety Officer immediately upon being informed of the turndown. If there is no Safety Officer, notification shall go to the appropriate Section Chief or to the Incident Commander. This provides accountability for decisions and initiates communication of safety concerns within the incident organization.

If the supervisor asks another resource to perform the assignment, the supervisor is responsible for informing the new resource that the assignment has been turned down and the reason(s).

These actions do not stop an operation from being carried out. This protocol is integral to the effective management of risk as it provides timely identification of hazards to the chain of command, raises risk awareness for both leaders and subordinates, and promotes accountability.

Decision Making

Good leaders are required to make sound, timely, sometimes unpopular decisions often under stressful circumstances. Good decisions may sometimes have negative ramifications. For example, when extreme fire behavior poses undue risk to firefighters, fireline supervisors must order resources out of harm's way and because of this decisive action, structures and other assets at risk may be destroyed. The correct decision was made for all the right reasons but the decision had consequences that the public and firefighters might find unacceptable. This dilemma is hard for fireline supervisors to accept and decisions of this nature must not be taken personally. A good leader must be confident in their abilities and must make decisions based on as much current intelligence as is available, and must not become mired in collateral consequences of the decision.

Numerous case studies have shown that sound decision making while under stress is influenced by training, experience and an understanding of department policies. Seasoned leaders use the "slide tray" concept. Over the course of a career, past experiences are filed away in an individual's slide tray to be recalled automatically when faced with a current similar situation. This means that a leader, when faced with a decision, recalls an experience and applies past successful actions to the current similar situation to make the decision. Typically, younger leaders rely on their training more than on their limited experience while seasoned leaders rely on numerous similar past experiences, while applying training and knowledge of policy and procedure to enhance the decision making process. This process is generally subconscious and is comprised on five critical points:

1. Situational awareness
2. Situational recognition
3. Analyze and select a course of action
4. Decision point
5. Action

Subconsciously Incident Commanders and tactical commanders make quick decisions through a process known as Recognition-Primed Decision (RPD). RPD is a model of how people make quick, effective decisions when faced with complex and dynamic situations. In this model, the decision maker is assumed to generate the best possible course of action, compare it to the constraints imposed by the situation, life experiences, and then select the first course of action that is not rejected. RPD has been described in diverse groups including nurses and doctors, fireground commanders and military leaders. It functions well in conditions of time pressure, and in which information is partial and goals poorly defined. The limitations of RPD include the need for extensive experience among decision-makers (in order to recognize correctly the totality of the problem and ideal solutions) and the problem of the failure of recognition and modeling in unusual or misidentified circumstances. It appears to be a valid model for how human decision-makers make decisions while under stress.

TWO KEY DECISION-MAKING ERRORS THAT LEAD TO TRAGEDIES ON WILDFIRES
1 - Underestimating hazards and using inadequate safety measures (inadequate LCES)
2 - Failing to notice changing conditions and adjust tactics accordingly

RPD reveals a critical difference between experts and novices when presented with recurring situations. Experienced leaders will generally be able to come up with quicker decisions because the situation may match past situations they have encountered. Novices, lacking this experience, must cycle through different possibilities, and tend to use the first course of action that they believe will work. The inexperienced also have the tendencies of using trial and error through their imagination. Leaders lacking experience will also tend to lean towards training, policy, and/or procedure. While experienced leaders will use training, policy, and procedure, they also have past incidents to help make quick and appropriate decisions.

Decision-making Errors

Each of these errors arises from human nature. With **optimism**, we assume that nothing bad will happen and everything will work out. With **inertia**, once we form an interpretation of our situation and choose a course of action, we tend to stick with it. Usually, optimism and inertia are appropriate, even beneficial, but sometimes they get in the way of sound decision-making.

How do we make decisions? Early theories held that we weigh options, analyze relevant factors, and then choose the most appropriate course of action. Recognition-primed decision-making is a more current model (RPD). When we look at a situation, our minds search for a similar situation from the past, and we react to the current situation based on our experience—we go through “slides” in our head, pick out the one that most closely matches current conditions, and act on that.

Tragedies occur when you pick the wrong slide or conditions change, but your slide stays the same. Why does this happen? Nearly every fatality came with numerous clear early warnings. So why did not people notice? Human optimism and inertia do not explain it all. In hindsight, the warnings *seem*



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so loud that they should have been enough for any seeing, thinking person. People must have missed the warnings because they were not seeing and thinking clearly; something must have gotten in the way.

The Seven Barriers to Situational Awareness and Decision Making

There are seven key kinds of barriers to situational awareness and decision-making.

1 – Inexperience

- Do not have the “slide”
- Do not know what to focus attention on and what to filter out
 - What is top priority
- Do not recognize the severity of warning signs
 - Have not developed the emotional triggers or “gut reactions”

2 – False Sense of Security (or Getting Too Comfortable)

- Get so used to things working out that you think nothing bad will happen
- Get comfortable taking risks because they have worked out so far, and nothing bad has happened yet
- Get so used to an activity that your brain goes on autopilot and you pay less attention
- Key terms
 - Letting your guard down
 - Complacency
 - Automaticity
 - A sense of invulnerability, normalization of risk, inattention, mindlessness

3 – Distraction from Primary Duty

You can only focus fully on about one thing at a time, and you can only juggle about five things in your brain. When you try to track too many things, vigilance suffers.

4 – Misplaced Motivations and Hazardous Attitudes

Our decisions are based on a variety of motivations and they are constantly moving up and down on our mental priority list throughout the day. While this is going on in our heads, we are usually not aware of it. It is easy for our motivations to be jumbled, especially when the pressure is on. Misplaced motivations are just normal motivations that get ahead of staying safe. Saving structures, accomplishing the mission, and not letting others down are good motivations, but they can become misplaced. Motivations when they get ahead of safety and effectiveness. Motivations and desires also affect how we see the world—we see what we want and we block out what we do not. We filter information based on our priorities. This can lead to wishful thinking and avoidance.

5 – Groupthink, Social Influence, and Peer Pressure

Social influences affect how we view the world. As our brains try to figure out what is going on, they notice clues and hints about what other people are thinking. As our brains read the people around us, we trust most of what we get from them. Therefore, we pick our “slides” based on what others seem to be thinking. In addition, we do most of this without realizing it. Usually this works well, because usually what other people seem to be thinking really *is* correct. This, however, may not always be true because social influences may in the way.

One familiar form of social influence is peer pressure. Peer pressure can be powerful even when it is unspoken.

A social influence applied to the fire service after the South Canyon fatalities was the term “Abilene Paradox.” Dr. Jerry B Harvey originated the term to describe the social influence of people who decided to do things even though individually none of them wanted to do it. Each person involved assumed the others felt that it is good. Each one fails to speak up wanting to meet the others needs and in the end none of them felt good about doing it. This was the beginning of the term Groupthink.

Groupthink is another example of how social patterns can get in the way. In groupthink situations, the group mind locks onto a slide, and group members stop thinking as individuals, members of the group do not question the group opinion.

Here are some of the characteristics of groupthink that Irving Janis identified; these sound strikingly similar to what we find in fatality reports.

- Group members stop thinking for themselves
- Group cohesion takes priority over other objectives
- Group members do not notice warnings that contradict the group’s slide
- Members explain away warnings they do notice
- Members do not speak up; if they do, they are ignored or silenced by other members
- Groups have an illusion of invulnerability, and take irrational risks

This is not to say that all group decision-making is dangerous. Groupthink is just a way that group decision-making can go wrong.

6 – Stress Reaction

Stress triggers our fight-or-flight survival mechanism. This is a physical, chemical change in the body and brain. Heart rate and breathing speed up, as you get ready to respond immediately to threats and challenges. As the stress reaction builds, the rational “thinking” part of the brain shuts down, and the emotional “reacting” part takes over. When this happens:

- Your mind locks into a course of action and you fixate on a goal
- You lock into trained behaviors
- When you “lock in” and block out new information
- Communication breaks down

This extreme stress reaction is powerful if you have to react quickly and fight hard or run fast. However, it is not helpful for thinking clearly or seeing the big picture. Moreover, it can cause you to do things that “don’t make sense.” Key terms include hot cognition, tunnel vision, action tunneling, and mission fixation.

7 – Physical Impairment

Physical factors such as fatigue, carbon monoxide, heat stress, alcohol, or drugs bog down and interfere with your ability to perceive, think, and respond.

Fatigue

Proper management of fatigue has been a major problem in industries using extended work periods. Many regulatory organizations have been formed because of industries trying to manage fatigue as a way to create safer work environments. The Federal Aviation Administration (FAA), Department of Transportation (DOT), U.S. Chemical Safety Board, and Occupational Safety and Health Administration (OSHA) are just a few regulatory industries that have created laws to manage work periods and reduce fatigue as a way to reduce the number and severity of accidents.

Many studies have been created that show causal effects of fatigue and accidents; however, few have focused on specific behaviors frequently exhibited by fatigued workers, often leading to accidents. The most recent studies conducted on pilots highlight many of the same behaviors seen in fatigued firefighters and Company Officers responding to and performing operations at an extended attack fire. The only difference may be a lack of legal regulation limiting the engagement of firefighting forces. It is important to remember that certain operations can compound the effects of fatigue with the Company Officer serving as the only advocate for the fatigued firefighters. Accepting high-risk assignments during periods of fatigue will only increase the risk and reduce the potential for success. This occurs because fatigued workers routinely display the following behaviors:

- Slowed reaction time, both physically and mentally
- Increased errors despite increased effort
- Individual's underestimation of their performance degradation
- Performance variability and unpredictability
- Preoccupation with a single task
- Fixation on a single source of information
- Perseverance of an ineffective solution
- Short-term memory loss
- Impaired judgment and decision making
- Easily distracted by unimportant items
- Sloppy driving
- Loss of initiative
- Depressed, apathetic, lethargic or moody
- Willingness to accept below standard performance



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WUI Command Operations for the Company Officer



Topic 4-1: Managing Risk at a WUI Fire

- Limited situational awareness
- Poor communication skills

Anyone of these behaviors can and often do lead to accidents. It is essential that the Company Officer remains vigilant to these behaviors and more importantly length or intensity of work assignments that can have a negative effect on their company's safety.

To reduce occurrences of fatigue, work/rest guidelines should be met on all incidents. Plan for and ensure that all personnel are provided a minimum 2:1 work to rest ratio (for every 2 hours of work or travel, provide 1 hour of sleep and/or rest).

Intervention with Assertive Statement Process

Crew Resource Management expert Todd Bishop developed a five-step assertive statement process that encompasses inquiry and advocacy steps for intervening when a leader has lost situational awareness and barriers have affected their decision making. Much like the Refusal of Risk concept, personnel must intervene in a spirit of inquiry or advocacy to correct the course of action:

- ❖ ***Opening or attention getter:*** Address the individual. "Hey Chief," or "Captain Smith," or "Bob," or whatever name or title will get the person's attention.
- ❖ ***State your concern:*** Express your analysis of the situation in a direct manner while owning your emotions about it. "I'm concerned that we may not have enough fuel to fly around this storm system," or "I'm worried that the roof might collapse."
- ❖ ***State the problem as you see it:*** "We're only showing 40 minutes of fuel left," or "This building has a lightweight steel truss roof, and we may have fire extension into the roof structure."
- ❖ ***State a solution:*** "Let's divert to another airport and refuel," or "I think we should pull some tiles and take a look with the thermal imaging camera before we commit crews inside."
- ❖ ***Obtain agreement (or buy-in):*** "Does that sound good to you, Captain?"

These are often difficult skills to master, as they may require significant changes in personal habits, interpersonal dynamics, and organizational culture.



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WUI Command Operations for the Company Officer



Topic 5-1: Preincident Considerations

Topic 5-1: Preincident Considerations

Preparedness is the result of activities that are planned and implemented prior to wildland fire ignitions. The preparedness process involves routine preseason actions as well as incremental in-season actions conducted in response to increasing fire danger. It is a continuous process and includes:

- Developing and maintaining unit, regional, state, and national level suppression resources
- Forecasting fire activity
- Hiring, training, equipping, and deploying firefighters
- Evaluating performance
- Correcting deficiencies
- Improving overall operations

Evaluating Potential Risks

- ❖ **Risks** are those human-related activities that cause fires to start. They can include such things as debris burning, arson, smoking, mishandling hot ashes, logging operations, sparks from a chimney or machine use, and railroad operations.
- ❖ **Hazards** are the flammable materials in which the fire starts. They include such things as grass, leaves, forest fuels, logging slash, and trash.
- ❖ **Fire danger** is the chance of a fire starting given the current/expected risks and hazards. Categories of fire danger are low, moderate, high, very high, and extreme.
- ❖ **Exposures** are the resources, properties, or lives that would be threatened by a fire.
- ❖ **Damage potential** is the net economic change as the result of a fire.

Fuel Modification to Provide Defensible Space

Another term that you should know is **defensible space**. This is the cleared area between the structure and wildland vegetation that may “save” the home if there are no firefighting personnel available to protect it, or the area where you will set up a defense of the home. Adequate defensible space and proper design elements are the key factors in protecting a home from an advancing fire. You must have both to have maximum advantage.

The development of defensible space is critical to the survivability of the home. Creating the space does not mean the removal of all the vegetation for 100 feet around the house. The key is the modification of the fuels so that the fire cannot easily move through them to the home and ignite it. Brush and dense undergrowth are primary hazards to buildings. They ignite easily, burn with intense heat, and spread fire rapidly. Vegetation clearance requirements are necessary to reduce flame exposure and radiant heat, AND to give residents and firefighters a reasonable chance of protecting structures. Remember, the Firewise zone recommendations are:

- ❖ **Zone 1:** 30 feet adjacent to the home and its attachments
- ❖ **Zone 2:** 30 to 100 feet from the home

❖ **Zone 3:** 100-200 feet from the home

- This includes the entire “home ignition zone” in high hazard areas such as at the top of a chute or chimney

Location of the Home on the Property

Placement of the home may also be critical to its survivability. Topographic features that can influence the home's survivability include being located midslope, in or adjoining drainages, and the tops of steep ridges. The steeper the terrain, the further back from the edge of the slope it should be set. If this is not possible, the fuel modification zone should be extended further down the slope. The Firewise recommendation is to place the home at least 30 feet back from a slope that is greater than 40 percent.



Location on the Property

Flammability of the Home

The most critical part of a home is its roof covering. If a home has an untreated wood roof, the chance of it catching fire from flying firebrands is dramatically increased. If there is an accumulation of leaves and needles, the likelihood of a fire starting is increased that much more. The fire does not have to be right up to the home to threaten it from burning brands. The Firewise recommendations to deal with these problems are:

- A 30-foot (minimum) “green area” cleared of flammable vegetation to reduce heat and spotting.
- Every spring, or as necessary, remove all debris (needles, leaves, twigs, and branches) from the roof and gutters.
- Encourage the homes in your area to be constructed with a fire-resistant roof covering. Steel roofs are considered better than tile because they are lighter in weight.

The flammability of the siding materials is also important. Discourage the use of wood siding, but if the homeowner insists, recommend plywood, or another less porous wood surface. The best exterior covering would be stucco or another nonflammable material. If wood is the material of choice, the clearance around the home should be increased.

There are several other ways a fire can enter a home. Heat can accumulate under eaves, cantilevered floors, and balconies. Firebrands can get into the attic through unprotected attic vents. Radiant heat can pass through windows, igniting curtains and nearby furnishings.

Access to the Home

A home has to be adequately marked so firefighters can find it. Streets have to be marked, and the home has to have a readily visible street number. The roadway has to be wide enough to allow fire



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Topic 5-1: Preincident Considerations

apparatus to move into an area at the same time the residents are evacuating. If a bridge is involved, it must have the load capacity to support heavy fire apparatus. There has to be adequate area to allow the fire apparatus to maneuver and turn around. The Firewise recommendations are:

- Streets are named and have signs
- Homes are marked with reflective numbers large enough to be read from the road (4" minimum)
- Driveways are at least 12 feet wide with a vertical clearance of 15 feet and a slope of less than 5 percent
- Access roads are a minimum of 20 feet wide and have a grade no steeper than 15%
- Bridges have a minimum load capacity of 40,000 pounds
- Cul-de-sacs, if present, should not be less than 1,000 feet in length with a radius of at least 45 feet

Other Hazards

Several other things may cause a problem in the event the property is threatened by a wildland fire:

- Log piles close to the structure
 - Log piles tend to be a great place for fire to take hold, and once on fire can hold heat for hours
- LPG tanks are very common in rural areas
 - Be sure they have proper clearance, and if threatened, are kept cool. If they do start to vent and burn, let them burn out, if possible
- Structures with unskirted foundations or storage areas located beneath the structure or a deck
- Hazardous chemical storage

Preincident Planning

Preincident planning may be one of the most important steps taken to help an Incident Commander make prompt, critical decisions at a WUI incident. A WUI preincident plan created prior to need and validated through realistic training exercises is the foundation for a safe, organized response.

A WUI preincident plan is a two-part document consisting of a written plan and a map. The planning process starts by defining a target area that has a significant fire history or where the **fire potential** is so great that the problem cannot be ignored. Fire history, structure density, ingress/egress, fuel loading, topography, and assets at risk are some of the driving forces influencing target site selection for WUI preincident plans.

A WUI preincident plan created with ample time and validated through interagency training exercises, prepares local suppression forces for the possibility of an incident in the planning area. To be successful, the plan must be completed by someone with in-depth knowledge of local fire history, fire environment variables, and potential fire behavior. The planner should have experience with mapping programs and have a solid operational and planning background.

Typically, several people may work as a team to complete the plan and should include input from all agencies potentially affected by a WUI incident including law enforcement, Red Cross and Salvation Army, highway departments and public works, and animal control. Homeowner buy-in and cooperation is essential for a successful WUI preincident plan. Town hall meetings stressing the



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Topic 5-1: Preincident Considerations

importance of fire awareness, defensible space and evacuations are one way to encourage homeowner cooperation in the planning process. Often, public enthusiasm for fire defense preparation is always high during the fire season when media interest is at its peak. However, after fire season, interest wanes and public focus shifts to other areas of concern.

Ideally, WUI preincident planning should start during the conception phase of a new subdivision or new home construction. Building codes should reinforce fire safe construction and firefighter safety. Defensible space laws should be part of the construction planning process and must be enforced. Green belts planted with fire-resistive vegetation and landscaping around structures should be encouraged whenever possible and practical. All of these preparation steps are intended to affect fire behavior.

Preincident Plan Map

Fire department planners should develop a planning area map showing structure locations, access routes and road systems, evacuation routes, critical infrastructure, hazards, and any other pertinent information. The map should identify areas of special concern such as hospitals and nursing homes, multiple family dwellings, commercial centers, and hazardous sites and should include specific strategic and tactical direction concerning their defense. ICs should anticipate that critical infrastructure might be damaged resulting in a loss of power, which will affect everything from hydrants to lighting and communication. During the planning process, this should be addressed and plans should be developed to override any system deemed critical to incident success.

Incident specific information should be included on the map showing potential locations for Incident Command Posts, staging areas, water sources, helicopter dip sites, pre-existing or potential control lines, and safety zones. Proper ICS symbology and common terminology must be used on all map notations. Locations for an ICP should take into consideration safety, communications, shelter, and room to assemble at the selected facility. Selection criteria for ICPs should also include the availability of hard line phone and data service, cellular service, sanitation facilities, and adequate parking for the anticipated number of resources that may use the facility. Staging areas are critical for effective resource utilization and should be identified based on their capability to safely contain numerous types of suppression resources and efficiently dispatch them to any area of the incident. As with ICP selection criteria, staging areas should be located in safe areas with adequate parking and easy ingress and egress.

GPS coordinates should be noted for helicopter dip sites to facilitate access. If the target area has pre-existing control lines from previous fires, or fuel breaks constructed in strategic locations, they should be noted on the map along with their access points. Areas suitable for potential control lines should be scouted and given a high priority designation on any preincident plan map.

The map should also designate high hazard areas such as narrow or midslope roads, chimneys and drainages (especially those that align with normal wind conditions in the target area), areas of dense or highly flammable vegetation, or areas with minimal clearance around structures. In addition, hazards specific to firefighting aircraft should be addressed such as power transmission lines, convoluted topographic features that may spawn unusual air turbulence.



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Topic 5-1: Preincident Considerations

CHENEY (SYLVIA PARK AREA) STRUCTURE DEFENSE PLAN

MAP GRID:
TB: 590 C3-C4
LAC Grid 346 D2-E2
WLPAP # 69-2-2
Jurisdiction: F.S. 069

STREETS (Access: Cheney Dr. @ ~ 1500 N. Topanga Canyon Blvd.)

- CALLON DR.
- CHENEY DR. = (ENTRANCE FROM TOPANGA CYN. BLVD.)
- KELLER RD.
- PARADISE LANE
- PENNY ROAD
- ROCHEMONT DR.
- OZARK TRAIL
- SYLVIA PARK
- SYLVANIA LANE

MANRIQUEZ CANYON (NOT A ROAD)

SAFETY ZONES: CHENEY DR AT CALLON DR.
CHENEY DR AT PARADISE LANE

RESOURCE NEEDS: 3-4 STRIKE TEAMS

S/T LEADER	S/T LEADER	S/T LEADER	S/T LEADER
_____	_____	_____	_____
E _____	E _____	E _____	E _____
E _____	E _____	E _____	E _____
E _____	E _____	E _____	E _____
E _____	E _____	E _____	E _____
E _____	E _____	E _____	E _____



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W/UI Command Operations for the Company Officer

Topic 5-1: Preincident Considerations



Fire Location: (Malibu Canyon Plan)

Map: **Grid:** **Follow-Up Report:**
Inc. Name:
CP Location:
Add'l. Resources:
Staging Location (Assign Mgr.):
Request Comm. Plan (w/ Blue3):
(Status Reports @ 30-45 Min.)

Helispot: 125-A (TB 558 F5)(Calabasas Landfill) **Helispot Engine: E-_____**
(H-67 A @ Malibu Creek State Park, 2nd parking lot on left, TB 588F5)
(H-88 A @ Pepperdine Univ., TB 628 G7)
(H-69-A @ Summit Motorway, TB 560 A6)

Communications Plan:

(Blue 3 = 470.6125)

LAC Keep Blue 3 Repeat: **(Must Use Blue-7 Repeat in Topanga Canyon Areas/Only Translates to Blue 3)**
(Initial Comm. Plan) (Extended Attack Comm. Plan)

Command	LAC Blue 3 Rpt	470.6125		
Tactical	LAC Tac 17	154.430		
Air-to-Ground	LAC Tac 19	154.400		
Crew Net (& Dozers)	LAC Blue 5 Dir	470.4625		
Other: LFD				

(Blue: Receive 470.****; Transmit on 473.****)

C.P. Location:

Map:

Staging Locations:

“Las Virgenes Staging” @ FS125, Las Virgenes Rd. & 101 Fwy. (558 H5) Mgr: _____
“Lost Hills Staging” @Lost Hills & Las Virgenes Rd.(De Anza Park) (588 G1) Mgr: _____
“Malibu Park Staging @1700 Las Virgenes Rd. & Mulholland Hwy. (588 G5) Mgr: _____
“Liberty Staging” @ Liberty Cyn. Rd. & Agoura Rd. (558 E7) Mgr: _____
“Grape Staging” @ Canwood St. & Parkville Rd. (Grape Arbor Park) (558 G6) Mgr: _____

Road Closures:

Sheriff - Mureau Rd. at Calabasas Rd. (559 C5)
Sheriff - Las Virgenes Rd. at Mulholland Hwy. (588 G4)
CHP - 101 Fwy. At Parkway Calabasas NB (559 D4)
CHP - 101 Fwy. at Chesebro Rd. SB (558 C6)

Base:

Small Fire: Fire Station 125, 5215 Las Virgenes Rd. (558 H5)
Malibu Creek State Park, 1700 Las Virgenes Rd. (588 G5)
Large Fire: FS 125, 5215 Las Virgenes Rd. (558 H5)
** House at Salvation Army; Tapia Park, Dorothy Dr. (588 G7)
Malibu Creek State Park, 1700 Las Virgenes Rd. (588 G5)
Malibu Civic Center, 23555 Civic Center Way, Malibu (629 A7)



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WUI Command Operations for the Company Officer



Topic 5-1: Preincident Considerations

Preincident Plan Training and Validation

Once completed, the preplan should be validated with realistic scenario training exercises attended by representatives and resources from all agencies who may respond to an incident in the planning area. Distribute preplan maps to all attendees. Review and discuss the preplan map and written plan to ensure a common understanding of the target area including evacuation plans, access, assets at risk, potential hazards, strategies and tactics, and the roles and responsibilities of each agency that may participate on a potential incident.

In some areas, agencies coordinate preseason fire training with a multi-agency drill. This is an excellent opportunity to train on and evaluate the preplan. Assign resources to interagency strike teams and task forces to foster cooperation and teamwork. Designate strike team and task force leaders to supervise and coordinate the movement of their resources throughout the training exercise. Establish training stations at key points within the target area and rotate the strike teams and task forces through the stations focusing on safety, perimeter control tactics, structure triage, structure defense tactics, communication, and basic firefighting techniques.

Non-fire cooperators such as law enforcement and road departments may be included in the training exercise as participants or observers. A training exercise not only exposes any flaws in the written plan or planning area map, it also fosters interagency respect and cooperation, reducing the risk of incident-related confusion and misunderstanding at a time when interagency cooperation is essential to suppression efforts.

Evaluating the Impact of Weather Events

In daily, as well as seasonal, preparation for fire events in or out of fire season, you must evaluate the potential impacts of weather patterns on fire potential. Weather is a critical driving force in the wildland environment and preplanning resource allotments must go hand in hand with forecasted weather.

As you learned in Intermediate Wildland Fire Behavior, weather is the most dynamic influencing factor in WUI firefighting. It not only changes by the season, but by the day and even the hour. You have wind, temperature, humidity, and precipitation all having direct influences on the fuels and firefighting tactics.

Fortunately, the astute Company Officer has a number of forecasting devices at hand to determine the weather that is about to impact him or her in not only immediate time frames but long-range. There are national and local forecasting sites online or on the news (radio and TV) that offer weather updates regularly. It is suggested that every Company Officer that has the slightest chance of responding to a WUI event pay close attention to the weather.

Weather Preparedness

The FIRESCOPE 410-3 document, *California Fire Weather Program Risk Preparedness Guide*, May 2010 provides information when the combination of fuels and weather conditions support extreme fire danger and/or fire behavior.



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WUI Command Operations for the Company Officer



Topic 5-1: Preincident Considerations

- ❖ **High Risk Day** – Notice issued by the Predictive Services Units located in Redding and Riverside when there is a minimum 20% chance of either of a new large fire occurring, or significant growth on existing fires. High Risk Days are displayed in the 7-Day Significant Fire Potential Product that incorporates fuel dryness and weather triggers to display Significant Fire Potential during the next seven days across the Geographic Area by Predictive Service Areas.
- ❖ **Fire Weather Watch** – Notice issued by the National Weather Service usually 24 to 72 hours in advance of a Red Flag Event (i.e., critical weather conditions that may result in extreme fire danger/behavior). Fire Weather Watches, however, can be issued for the first twelve hours of a forecast period for dry lightning.
- ❖ **Red Flag Warning** – Notice issued by the National Weather Service usually 24 hours in advance of a Red Flag Event.
- ❖ **Cancellation** – When the National Weather Service terminates a Fire Weather Watch or a Red Flag Warning, or it expires.

Staffing Augmentation Plans

Although potential fire weather is one of the most influential factors when determining fire season activities, you need to realize that resource availability can fluctuate during significant weather events. This fluctuation can result in more resources for initial attack or a resource reduction because they have been prepositioned elsewhere for increased fire potential. Many factors influence the decision to augment staffing and you must be familiar with the staffing plans of your particular agency and geographic area.



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WUI Command Operations for the Company Officer



Topic 5-2: Readiness of Assigned Personnel and Equipment

Topic 5-2: Readiness of Assigned Personnel and Equipment

Tactical operations in the WUI require the knowledge and skills used in both wildland firefighting and structure firefighting. It takes a careful blend of both disciplines so that safe and efficient structure defense can be employed while still being effective in the suppression of the wildland fire. The knowledge of WUI tactical operations is important for the protection of the structures and for the safety of suppression crews. Although you will be involved in both structure defense and wildland fire perimeter control as a Company Officer with a local agency, structure defense is generally your priority. However, you will be responsible to handle any slopovers, spot fires, or other incident objectives that come your way. Always remember you are still in a wildland fire environment.

Personnel Preparation

Preincident Training

Preincident team building, joint training, and networking are critical factors when working with assisting and cooperating agencies on a WUI incident. Pre-established relationships provide a level of trust, an understanding of common goals and expectations, and a simplified expansion of incident organization, roles, and responsibilities. The time to establish interagency relationships is prior to the start of an incident, not when the flame front threatens a housing development.

Doubt and confusion are reduced when cooperating and assisting agency personnel know one another and know what is expected of their participation in the incident. Familiarity instills calm in a chaotic situation. Preincident training is important to check system effectiveness and increase efficiency. Develop WUI drills for your engine company and work with other agencies to resolve problems before the call.

County fire chief association meetings, training officer meetings, joint tabletop exercises, drills, and planning efforts are just a few of the opportunities available to begin the preincident team building process. Informal meetings such as lunch or coffee can go a long way towards developing and maintaining strong jurisdictional and personal relationships. Consider the following objectives when meeting with cooperating and assisting agency leaders:

- Make the expectations of all agencies known before an incident
 - If all agencies make their needs and expectations known to each other before an incident, it minimizes the potential for confusion, surprise, and disappointment
- All cooperators should be on a first name basis
 - Meet informally before an incident occurs
 - Chief Officers and Company Officers should build strong communications networks with cooperating and assisting agencies
 - Consider a monthly breakfast meeting or weekly coffee get together for critiques of past incidents
 - Discuss the potential for future incidents and possible actions for incidents in at risk areas



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Topic 5-2: Readiness of Assigned Personnel and Equipment

- All cooperators should know each agency's capabilities and limitations
 - Each person and agency has strengths, and weaknesses and knowing these well in advance of an incident will foster the effective use of resources for the given situation
 - Conduct open and frank discussions regarding agency and management expectations when mitigating incidents of any magnitude
- Agencies must train together before an incident occurs
 - Encourage daily, weekly, monthly, or annual interagency training exercises utilizing realistic scenarios
 - Interagency training should be considered a prerequisite for successful command of multiagency incidents
- Consider organizing after action reviews of recent multiagency incidents
 - These reviews give AREPs a chance to share each other's philosophies and experiences as well as develop an understanding of each agencies strengths and weaknesses

Physical Fitness and Health Maintenance

Firefighting is physically demanding and punishing work. Besides being a very hazardous occupation, it will demand your highest physical and mental efficiency, and a sustained expenditure of energy. You must be prepared, and take every precaution to prevent injury to yourself and others.

Physical fitness goes hand-in-hand with productivity and safety. You will be fighting fire when it is hot, dry, dirty, and windy. If you cannot keep up, you will slow down the firefight. Do not think that all of your fire assignments will be of short duration. This is not a nine-to-five day job. You may be on the fireline for a couple of weeks, asking your body and mind to work hard and long. You will be as tired as you have ever been. The best way to combat fatigue and achieve high performance is to follow a physical fitness program.

Fitness has two aspects – aerobic and muscular. **Aerobic fitness** is a measure of the maximum amount of oxygen that you can take into your body and transport to the muscles. Oxygen intake is the primary factor that regulates work capacity, because working muscles need a continuous supply of oxygen to perform vigorous work for lengthy periods. The more efficient your oxygen delivery system, the better you can do the tough job of firefighting. **Muscular fitness** includes both strength and muscular endurance. Aerobic fitness and muscular fitness together are essential parts of your work capacity. Fit firefighters are more tolerant of heat. They acclimate faster, and work with lower heart rates and body temperatures.

The best physical fitness program is one that balances aerobic conditioning and muscular training, and that starts well before the beginning of fire season.

Recommended Equipment for Type 3 Engines

The items below should be standard inventories on Type 3 engines prior to any deployment. There is a significant difference between the Type 1, 2, and 3 inventories on any given day. Type 3 engines



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WUI Command Operations for the Company Officer



Topic 5-2: Readiness of Assigned Personnel and Equipment

need the items listed below, whereas Type 1 and 2 engines need to augment their inventories if time allows prior to responding to a WUI incident:

- Structural firefighting protective ensemble (SFPE), including SCBA
- Wildland firefighting protective ensemble (WFPE), including a fire shelter
- Out-of-county bag with a minimum of seven days of personal supplies
- Food and drinking water
- Additional handheld radios with spare batteries
- First aid and burn kits
- Shovel, McCloud, Pulaski , and other wildland hand tools
 - Various combination with minimum of 6 tools
- Chainsaw with a 20" bar
- Firing tools, including drip torches, extra fuel, and fusees
- Weather instrument/belt weather kit
- Hard suction hose for drafting
- 25-foot or less of 2½" hose for hydrant connection
- Appropriate nozzles
 - High GPM is not for extended hose lays
 - Low GPM may not be appropriate for structure defense
- Hose adapters, including clamps, reducers, tees, etc.
- Foam and gels, including applicators
- Portable pump with spare fuel

Personal Protective Equipment

When engaged in a WUI incident, you must wear the appropriate agency-approved personal protective equipment (PPE). One of the complex aspects of utilizing PPE in the wildland urban interface is the back and forth between wildland firefighting and structural firefighting during structural defense operations. All PPE must meet NFPA 1851: Standard on Selection, Care, and Maintenance of Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting.

Wildland Fire PPE

- A wildland firefighting protective ensemble (WFPE)
- Web gear with fire shelter
 - Keep web gear in the apparatus, not in an outside compartment that may be inaccessible during extreme fire behavior
- Hydration system (separate or removable from other web gear)
- Leather gloves
- Lug soled leather boots

- Hard hat with a face and neck shroud
- Approved eye protection



Wildland Firefighting Protective Ensemble

Structure defense tactics can be undertaken using wildland fire PPE. If the structure becomes involved in fire and a decision is made to extinguish the fire, use the appropriate structure fire PPE including SCBAs as required.

Structure Fire PPE

- A structural firefighting protective ensemble (SFPE)
- Insulated structure firefighting gloves
- Helmet with shroud
- Nomex hood
- Eye protection
- Self-contained breathing apparatus (SCBA)

Structure fire PPE should be available any time a supervisor believes that suppression operations will shift from wildland firefighting to exterior structure attack or from exterior to interior structure attack.

SCBAs are required for interior structural firefighting operations beyond the incipient stage. SCBAs may be necessary when conducting exterior firefighting operations if firefighters are exposed to combustion products from a burning structure.

Do not rely on SCBAs during normal WUI operations. However, SCBAs may be used in extreme life and death situations or if permitted by departmental policy. Structure fire PPE and SCBA should never be used to remain at the structure longer than it is safe. If you are confronted with extreme fire behavior, excessive radiant and convective heat, or smoky conditions that exceed the protection provided by wildland fire PPE, change your tactics or leave the area.



**Structural Firefighting
Protective Ensemble**

Do not base your decision to remain at a structure or the safety of your personnel on the use of SCBAs

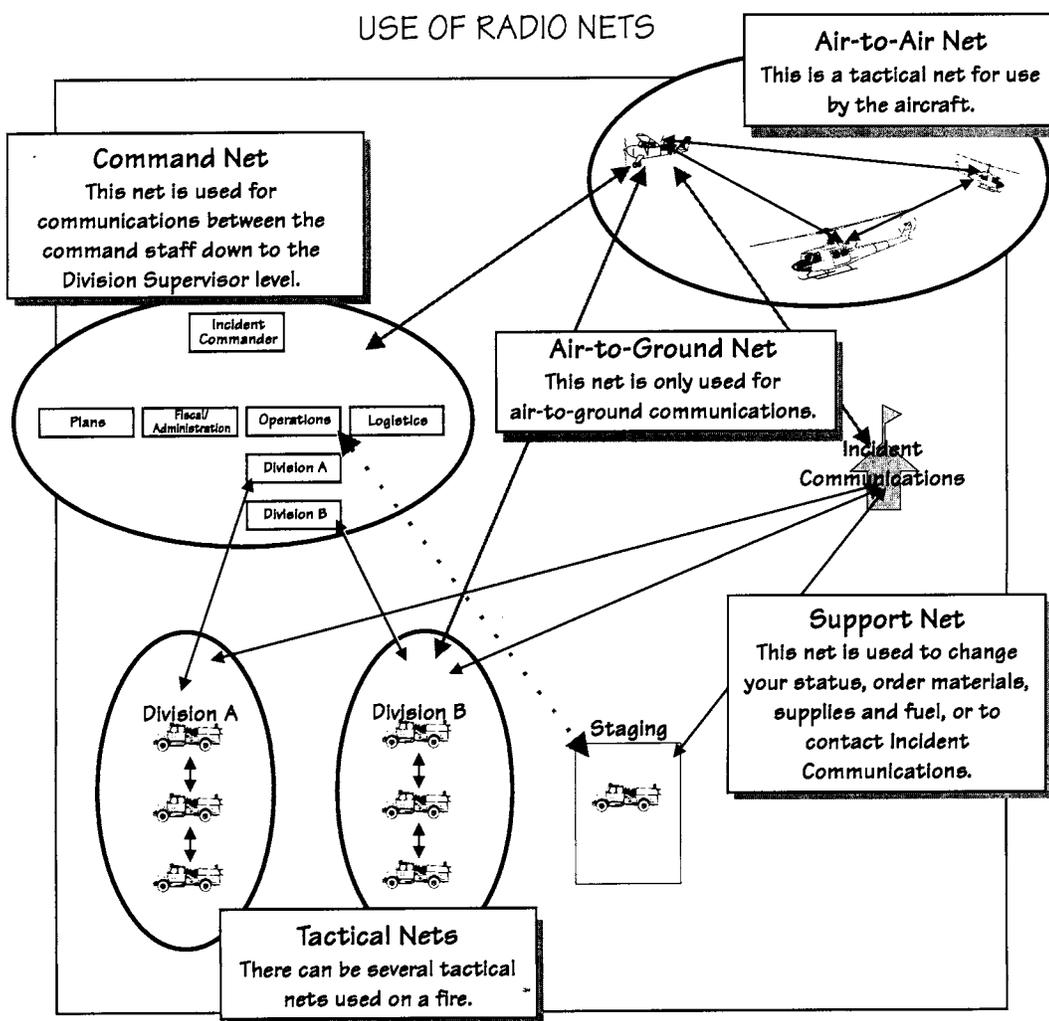
Topic 5-3: Radio Communications

Radio Networks

On larger fires or other disasters, many radio frequencies are utilized. It is imperative that you know not only the frequency you are assigned, but also the other frequencies that are going to be used. Knowing how to use your equipment and the frequencies for your incident can mean the difference between a successful operation and a confusing, dangerous operation. On an incident, you will find five radio nets.

Command

The Command Net is used to communicate between the various Command and General Staff positions down to the Division/Group Supervisor level. This is an exclusive channel for command and control communications. It is not for general tactical operations.



On larger fires or other disasters, many frequencies are used. It is imperative that you know what



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Topic 5-3: Radio Communications



Tactical

The ability for Division resources to communicate with each other and the supervisory staff is critical to the success and safety of the operation. Tactical Nets are used for tactical communications at the division or branch level. Tac Net may be established around agencies, geographical areas, or specific functions. On large operations, there will be several tactical nets assigned. Their specific radio frequencies will be listed in the Incident Action Plan on the bottom of each Division Assignment List.

Support

The Support Net is established for handling status changes, requests for support needs, and communications that are not tactical or command functions. Use the Support Net to communicate to Incident Communications about changes in status, such as "out-of-service mechanical" or "in incident base, off shift." If you need fuel, water, or food, you would use the Support Net.

Air-to-air

The Air-to-air Net is the net used for tactical air operations. It is the net used by the air tanker and helicopter pilots to communicate among themselves and with the Air Tactical Group Supervisor (ATGS), commonly called "Air Attack." This net should never be used by ground forces. The only exception may be the communications between a helitack crew and its helicopter.

Air-to-ground

The Air-to-ground Net is used by ground resources to communicate with the incident's assigned aircraft. It is an exclusive net for air-to-ground communications only. This net is critical during major fire operations where several tactical nets are in use. It is impossible for the Air Tactical Group Supervisor to monitor every Tac Net. If ground forces need air support, they can switch to a specific air-to-ground frequency and request assistance.

ICS Communications Plan

The following is an example of an ICS Form 205: Incident Radio Communications Plan form showing the different assigned functions and associated frequencies for the incident. This form becomes part of the Incident Action Plan for the time period covered. It is used as the basis for each unit's specific frequency assignment. This information is also found on the ICS Form 204: Division Assignment List.

INCIDENT RADIO COMMUNICATIONS PLAN		Incident Name OAKGROVE, CA- LAU- 11- 223987				Date/Time Prepared 8/24/2011, 2000 Hours			Operational Period Date/Time Day Shift, 0600- 1800 Hours	
Ch #	Function	Channel Name/Trunked Radio System Talkgroup	Assignment	RX Freq N or W	RX Tone/NAC	TX Freq N or W	TX Tone/NAC	Mode A, D or M	Remarks	
1	Air to Ground	V- Fire- 4	Air Operations	170.000N		170.000N	2	A	USFS Air/Ground - Channel 14	
2	Command	V- Fire- 8	Command	170.450N		170.450N	3	D	USFS CMD 2 RPT - Channel 8	
3	Command	V- Fire- 1	Command	168.100N		168.100N	3	D	USFS Command 2 - Channel 47	
4	Tactical	V- TAC- 1	Division A and B	168.050N		168.050N	2	D	USFS TAC 1- Channel 1	
5	Tactical	V- TAC- 2	Division Y and Z	168.200N		168.200N	4	D	USFA TAC 2 - Channel 2	
6	Tactical	V- TAC- 5	Oak SPG	173.9625N		173.9625N		M	USFS TAC 5 - Channel 5	
7	Tactical	V- Fire- 6	Staging	164.280N		164.280N	1	M	USFS White 1- Channel 6	
8	Support	CALCORD	Plans/ Finance	166.075N		166.075N	3	D	CALCORD - Channel 18	
9	Support	V- TAC- 3	Logistics	168.600N		168.600N	4	D	USFS TAC 3 - Channel 3	
10	Administrative	V- Fire- 7	Dispatch	164.295N		164.295N		D	USFA CMD RPT - Channel 7	
11										
12										
13										
14										
15										
16										

Radio Capabilities

Radio Bands

There are three radio bands used by the fire service – low band, very high frequency, and ultra-high frequency.

Low Band (LB) - Equipment that used low-band frequencies were used years ago. The longer waves tended to bend a little over hills and up canyons, but lost favor because they also skipped off the atmosphere, and interference from great distances was common.

Very High Frequency (VHF) - Systems that use very high frequencies (VHF) are still very common. Most of the state and federal forestry agencies still use this type of equipment in the 150 to 170 MHz frequency range. Radio frequencies in this range do not travel as far as low frequencies, so radio relay stations are used.

Ultra-high Frequency (UHF) - Municipal fire departments use ultra-high frequency (UHF) radio systems. They are much shorter range, but this is compatible with the area they usually protect. Radio waves in this range are absorbed by vegetative cover, trees, etc.

Narrow Banding

Because of the increase in radio use, the Federal Communications Commission (FCC) has made available additional frequencies within the radio spectrum for use through licensing agreements. Historically, there were 15 kHz between channels. Technology now allows this gap to be cut to 7.5 kHz. The only problem is that with so many different kinds of radios used in the fire service, most of the time the systems are not compatible with each other.

Repeaters

Repeaters are just what the name implies; they relay transmissions from mobile radios. Their sole purpose is to extend the range of the mobile radio over mountains and for greater distances. Most repeaters are positioned on a high point - in mountainous country they are located on a high peaks, on flatter terrain they are placed atop a tall building or tower.

To use a repeater, you must set your mobile radio to transmit on a specific frequency. You may also have to select a specific tone. A tone is a security frequency sent out ahead of the transmission in order to activate the repeater. The frequency may be used by more than one repeater, but the tone would select a specific repeater. If a tone is used to activate a repeater, you may have to activate the transmitter a second or so before you speak. This will allow the tone time to “turn on the relay” before your voice is transmitted.

Tone Protection

Radio System Interference

Interference to Local Net communications has become increasingly common because of planned reuse of assigned radio frequencies, FCC authorized frequency assignment, and because of antenna improvements made at various remote radio sites.

- Local Net radio frequencies have been reutilized to create additional Command Nets. This was accomplished to increase radio system efficiency and relieve Command Net congestion. Reuse of radio frequencies however, can cause interference to existing Local Net assignments.
- Radio frequencies are not assigned exclusively to any one department. FCC rules also authorize use of these radio channels to many other local government and forestry-conservation agencies. These users can also create interference to fire department radio nets.
- Improved antenna towers and associated radio and antenna systems at remove radio sites have improved local area radio coverage. However, coverage may be extended unintentionally to other co-channel units with resultant interference.

Continuous Tone Coded Squelch System

An accepted, standard method for elimination of co-channel public safety radio system interference is the activation of continuous tone coded squelch system (CTCSS) protection. CTCSS protection is commonly used worldwide for control and protection of commercial and public safety radio systems. CTCSS protection is built into modern radio equipment. References are occasionally made to PL as a tone protection system. "PL" refers to private line, which is the trade name reference to the CTCSS feature provided in radio equipment manufactured by Motorola Corporation. Recent purchases of replacement radio equipment statewide have provided the opportunity to enable CTCSS protection throughout many radio systems. Basic elements of CTCSS implementation will include protection of all radio equipment.

- Each Local Net has been assigned a discrete CTCSS tone. Mobile relays within the Local Net continuously transmit the specified CTCSS tone.
- Radio receivers within each Local Net are CTCSS protected so that the receiver will not open unless it detects the assigned CTCSS tone. All receivers, including mobile radios, aircraft radios, and helicopter radios, are protected.
- An example of CTCSS protection is illustrated by examination of the CA-BTU Local Net and the co-channel (151.400/159.375 MHz) CAL FIRE Command-4 Net, which is operating in central California.
 - CA-BTU ECC radio receivers will be protected by CTCSS Tone-1.
 - CA-BTU mobile relays will always transmit CTCSS Tone-1.
 - CA-BTU ECC Local Net will only hear radio traffic from their mobile relays (see CTCSS Limitations).
 - CA-BTU ECC Local Net will not hear the interfering radio traffic from Command-4 because that radio system transmits CTCSS Tone-8.

Similar CTCSS tone assignments are planned and activated to eliminate other co-channel interference situations. System planning and engineering will be completed to ensure that existing and future co-channel radio systems are assigned different CTCSS tones.



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Topic 5-3: Radio Communications

CTCSS Limitations - Direct Communications

CTCSS protection for a specific Local Net includes activation of CTCSS tone decoding for all mobile radios. Direct communications (car-to-car or talk around) requires that the assigned CTCSS tone be transmitted to open the mobile receiver. Some mobile radios are programmed to automatically select the proper CTCSS tone in the talk around transmit mode.

If you are unable to obtain and program a CTCSS for your radio, you may be unable to transmit or receive radio transmissions with other CTCSS-protected radios. You still may be able to monitor CTCSS traffic by following your radio manufacturer's recommended steps to turn off your squelch. Remember, engaging the fire while lacking two-way communication with your supervisor and your adjoining forces is a direct violation of Fire Order #7.

Radio Antennas

The antenna radiates power (signal) into the air; without this signal, your radio will be unable to properly transmit or receive and your message will not be heard. Radio signals, like visible light, can be polarized. Since mobile communications use vertical polarization, the radio antenna needs to be in a near vertical position for best communications.

Antennas have a specified length that correlates to the wavelength used for communications. Antenna lengths should only be altered by qualified radio technicians. Telescopic antennas should be used in extended mode (length is critical). Care must also be given to avoid damage to the antenna connector.

Some radios have a Hi-Lo Power switch or button that changes the output power of the unit. The 'Lo' position should be used when communicating in close proximity to another receiver. The 'Hi' position should be used to extend the transmission range. Using the 'Hi' position will greatly reduce battery life.

- Never hold your radio by its antenna
- Do not transmit if the radio's antenna is missing or broken
 - A faulty antenna (rubber coating) will usually show visible damage
- Make sure the antenna is securely connected
 - Do not over tighten
- Keep the antenna vertical and as high as possible to maximize the radio's range
- If you carry the radio on your belt or in a chest harness, your body will absorb some of the signal and limit the radio's effectiveness
 - Hold the radio up and away from your body
- Once you have established contact, maintain the antenna's location and position until you have finished transmitting
- Hearing a voice transmission does not guarantee you can talk with the other person
- Vehicle mounted radios have a higher transmit power than handheld radios



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Topic 5-3: Radio Communications

Care and Handling

Proper care and handling can extend the life of your portable radio, and help ensure that it is in good working order:

- Protect the radio from dust, moisture, fire retardant, excessive vibration, dropping, extreme heat, etc.
- Keep radios in a protective cover
- Do not modify or attempt repairs on any radio; notify your supervisor if your radio is not functioning properly
- Do not use the antenna to pull the portable from its case, or put unnecessary bending pressure on the antenna

Communication Interoperability

Interoperability is the ability of emergency responders to work seamlessly with other systems or products without any special effort. Wireless communications interoperability specifically refers to the ability of emergency response officials to share information via voice and data signals on demand, in real-time, when needed, and as authorized. Some interoperability is achieved by coordination at the dispatch level. A high level of interoperability would be a shared radio system and dispatch center that could dispatch multidiscipline responses on a single channel. Interoperability can be intradiscipline or interdisciplinary:

- Intradiscipline
 - Similar disciplines
 - Common tactical objectives
 - Same language and terminology
 - Usually easiest to achieve
- Interdiscipline
 - Different disciplines
 - Different tactical objectives
 - Different terminology

Many technologies are available to achieve interoperability. Often the simplest solutions are overlooked in favor of complex technical ones. The simplest solutions, such as face-to-face communications and swapping radios, are easy to understand and the quickest to implement.

Radio Procedures

Radio Discipline

Radio discipline is vital for effective communication among firefighters, dispatchers, and other emergency personnel. As mentioned previously, a lack of radio discipline can overwhelm even robust communication systems, which still have finite capacities. Systems with inadequate capacities can become quickly overwhelmed even during routine incidents, seriously compromising firefighter

safety. Allowing unlimited transmissions may create a situation where vital messages cannot be heard due to the number of less important transmissions being broadcast. By contrast, restricting radio traffic to only "vital" messages may prevent important information from being broadcast. The challenge, therefore, is achieving a balance to ensure that all potentially important information is broadcast, but not at the expense of emergency transmissions.

The radio communications system will often be overloaded.

Use cell phones to communicate or, better yet, talk face-to-face.

There are several things firefighters can do to help improve radio discipline. An obvious way is **not** to use radios for communicating when face-to-face dialogue is a better and available choice. Some examples of this would be 1) when the sender and receiver are located a short distance from one another, 2) when conferring about strategic or tactical options, or 3) when a complex, vital message such as a change in strategy from offensive to defensive must be conveyed. Face-to-face communication is generally more effective than radio communication anyway, since both sender and receiver have the added benefit of using nonverbal cues to help convey ideas or understanding (e.g., eye contact, physical contact, body language). Distractions are also reduced and people can ask questions or identify problems more readily during one-on-one dialogue. Command officers can use runners to deliver and obtain information from remote units. Using a runner has the potential added benefit of providing another view of the situation to the Incident Commander.

Radio communication skills are critical for effectively conveying information at the incident scene. One of the most critical of these skills is being a good listener. Although it is often difficult to listen to radio traffic while performing fireground tasks, it is an important skill to develop. By doing so, firefighters can avoid rebroadcasting nonurgent messages that have already been transmitted and maintain awareness of the overall situation. Listening skills also help firefighters recognize when potentially urgent information has **not** been broadcast and ensure that urgent messages are effectively communicated to the Company Officer or Incident Commander.

Good speaking skills are also vitally important for effective communication. Messages need to be transmitted using a logical format, at the appropriate volume, with good enunciation, and at a moderate pace. Most firefighters are familiar with the frustration of trying to understand someone either screaming or whispering into the radio, or an individual who speaks very fast or too slowly. Before transmitting a message, firefighters should collect their thoughts and format the message in their head. Messages should be clearly stated without distracters such as "um" or "uh." Messages that are clear, direct, and to the point minimize unnecessary radio traffic and help prevent urgent messages from being delayed or unintentionally overridden. When transmitting a lengthy radio message, you may need to suspend the transmission by using short "breaks," allowing other radio traffic to transmit before resuming your message.

The best way to develop good listening and speaking skills is through training and continued practice during multicompany operational drills or simulations. It may also be helpful for command or training officers to use tapes of actual incidents or drills to analyze procedures and reinforce the importance



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Topic 5-3: Radio Communications

of these skills. This can be done privately, allowing radio users to hear themselves and providing vital feedback for improvement.

Another significant way to improve radio discipline is for the fire department to create SOPs describing standard message formats and distinguishing routine messages, urgent messages, and Emergency Traffic messages. In addition, standard terms should be defined for use during radio communication to help eliminate potential confusion and promote brevity during message transmission.

Traditionally, fire department communications have been predominantly one way. Emphasis is placed on "giving orders," "following orders," and "sending" messages. This is perhaps related to the traditional emphasis on unity of command and span of control as the primary means of maintaining order on the fireground. Although there is little room for extensive conversation on the emergency scene, the emphasis on maintaining the chain of command has created a potential communications problem. Firefighters may be reluctant to circumvent the chain of command and risk being considered insubordinate.

However, firefighters seem to have minimal reluctance to communicate directly with Chief Officers when obvious safety issues or unsafe conditions are involved. A more common problem, expressed by some command officers, is that firefighters report information to the wrong person because they are unaware of changes that were made to tactical assignments. When such misrouting occurs, it is important that the message recipient first relays the message to the appropriate person, and then advises the sender of the proper reporting pattern.

Proper Use of Radios

- Wait until the person using the radio is finished before you transmit your message
- When initiating a call, say the station name or unit number of the person you are calling, followed by your station name or unit number (Some agencies use personal names)
- Hold the microphone from 2 to 4 inches away from your mouth; avoid blowing into the microphone when you speak
- Wait a full second after you press the key before you speak
- Have a note pad and pencil ready to record information
- Answer your radio when your station or unit is called
 - There may be times when more than one unit is attempting to use the net at the same time
 - Wait until they are done, and make your call again
- The person who initiates the call closes with the proper FCC station identification or some other form of acknowledgment

Communication Problems

Firefighters commonly encounter communication problems on an incident. Most problems are technical in nature that can and do appear on the fireground. Some of the most dominant ones are unsuitable equipment, equipment failure, inadequate system capacity, and interference.



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Topic 5-3: Radio Communications

Fire Shelters Weaken Radio Transmissions

Firefighters who have deployed fire shelters during training have had difficulty communicating using mobile radios. In 2003, the Missoula Technology and Development Center (MTDC) conducted a brief study to determine how well radios worked inside fire shelters.

The study showed that when firefighters were inside fire shelters within 50 feet of each other, they could communicate using the VHF (Very High Frequency, 30 to 300 MHz) Bendix-King radios. They could not communicate using the newer UHF (Ultra High Frequency, 300 to 3,000 MHz) Motorola Astro XTS 3000 radios. In either case, the radio signals were significantly weaker when the radio was used inside the fire shelter, particularly when the radio was inside the New Generation Fire Shelter.

Unsuitable Equipment

The problems here lie most in ergonomics and durability. The trend toward miniaturization is a good thing while other qualities are sacrificed, which are not a good thing. A small radio in a gloved hand trying to set new frequencies during battle tends to be a problem. The small view screens are not easily seen in smoke or night conditions. In addition, not many radios in use today are water resistant, which causes problems on the fireground.

Equipment Failure

Modern public safety radio communications systems are complex and highly technical. They may require multiple fixed antenna sites or repeaters. When a unit leaves their own radio net system, they may be out of communication with units from other areas. Batteries are often unique to a particular radio. This can create a problem because, after a few days of use, a radio may be out-of-service if the Supply Unit did not stock its particular type of battery. Make sure you always carry spare batteries for your radio.

Inadequate System Capacity

Many times the sheer volume of radio traffic will bury the system, causing radio failure. Too much demand on a system not designed for heavy use is devastating. Many radio systems do not have numerous channels from which to choose, thereby limiting use. In these cases, dedicating channels to different parts of the operation becomes important.

Interference

Atmospheric, environmental, and electronic interference may hamper effective communication at the incident and can take the form of "skipping" created by solar disturbances and atmosphere fluctuations. Geographic features such as hills, tunnels, and valleys also will interfere with transmissions. Electronic interference from lighting, siren use, and other equipment will occur on occasion.

Firefighters can reduce interference factors by turning down the volume on portable radios, shielding microphones, turning off sirens before transmitting when possible, and maximizing face-to-face communications.



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Topic 5-3: Radio Communications

Radio Troubleshooting

If your radio does not work, check these simple things:

Location – You may be in an area closed-in by terrain and your radio is working perfectly, but the signal is not getting to the right person. If you are on a car-to-car frequency, you may be able to change to a frequency that uses a mobile relay. You may have to change locations.

Batteries – If you are using a portable radio, your batteries may simply be spent. Replace them if needed. The more “features” you are using on the radio, the shorter the battery life.

Net – You may be on the wrong net or frequency; check and change if needed.

Antenna – You may have the wrong type of antenna or it may be loose; change if needed or tighten.

Firefighter Emergency Traffic

It should be understood that fire department radios are "For Official Use Only," and even if you have official business, Emergency Traffic has priority. When firefighters or incident personnel are faced with life-threatening emergencies, they may call "Emergency Traffic" to clear radio traffic. Clear text shall be used to identify the type of emergency, i.e., "Firefighter Down," "Firefighter Missing," or "Firefighter Trapped."

While on the incident, refer to the incident action plan, ICS Form 206: Medical Plan for specific firefighter emergency procedures and protocols.



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Topic 5-4: Resource Needs, Availability, and Capability

Topic 5-4: Resource Needs, Availability, and Capability

Before the Company Officer can assign any resources, the capabilities of those resources must be understood. Potential resources for a wildland urban interface incident could include hand crews, dozers, aircraft, and engines of various types, just to name a few. Understanding resource capabilities will assist you in the proper deployment of resources for incident operations.

Determining Resource Needs

In determining resource needs, you need to start with the incident objectives and formulate an incident strategy. Once the incident strategy has been established, follow with the proper tactics to successfully accomplish your strategy. Determine what resources are needed for each tactical task that must be accomplished, and then properly assign each resource according to their capability.

Resource Configurations

In determining the most appropriate resource configuration to order, **reflex time** is your driving factor. Reflex time is defined as the time lapse between placing the order and when the resource is deployed on the line. This time includes resource request, dispatch, response, check-in, briefing, and deployment. When time is critical, consider ordering single resources rather than ordering strike teams since you normally get the nearest single resource available. You can form single resources into strike teams or task forces at the incident reducing reflex time while maintaining span of control.

The three ICS resource configurations are single resource, strike team, and task force. Firefighters must understand the advantages and disadvantages of each configuration.

- ❖ **Single Resource:** An individual piece of equipment, its personnel and tool complement; an organized crew or team of individuals with an identified work supervisor. Example: an engine company, a crew, a dozer.
- ❖ **Task Force:** A group of unlike resources with common communications and a leader, that may be pre-established and sent to an incident, or formed at an incident, to perform a specific task. Example: three Type 1 or Type 2 engines, two Type 3 engines, one water tender, and a leader.
- ❖ **Strike Team:** Specified combination of the same kind and type of resources, with common communications and a leader. Example: a Type 1 engine strike team (five Type 1 engines and a leader), a Type 1 crew strike team (minimum 30 personnel including a leader), a Type 2 dozer strike team (two Type 2 dozers, one dozer tender, and a leader).

The task force is a good configuration for the WUI environment. It allows resources to complement each other using their different capabilities. A task force also allows for close supervision and accountability. For example, Type 1 engines can be used for structure defense while a Type 3 engine lays hose for perimeter control around the same structure. A water tender provides a water supply for both engines. A crew simultaneously cuts a control line around the house and assists with structure defense preparation.

Strike teams are a common resource configuration ordered for extended attack and major incidents. Strike team leaders may assist division supervisors with geographic line supervision when there is a



Engine Strike Team

critical need for supervision and intelligence gathering. Strike teams typically form in their home unit, department, or operational area and do not leave until the last resources arrives, increasing reflex time. Strike teams may be ordered to form at the incident. However, strike team components arriving at the incident at different times may increase span of control problems. A Strike Team Leader or Task Force Leader reports to a Division Supervisor or Group Supervisor

and is responsible for performing tactical assignments in a geographical or functional area. The Strike Team Leader or Task Force Leader reports work progress and resource status, maintains work records, relays important information and intelligence to the line supervisors, and coordinates activities with adjacent strike teams, task forces, and single increment resources.

ICS Resource Typing

When requesting resources for your incident, remember to be very specific on what kind and type of resource you need. Do you need engines, hand crews, or dozers? What type of engine or dozer will have the capabilities to meet your needs? The ability to determine the number, configuration, kind, capabilities, and proper deployment of resources is a critical component of effective incident command.

Engine Typing

An engine staffed with a well-trained crew is the most versatile resource on the fireground and may be the first resource to arrive at a WUI incident with the Company Officer assuming the role of initial attack IC. In wildland urban interface firefighting, fire engine crews may be used in the following ways:

- Life safety and rescue
- Fire suppression by mobile attack or extended hose lays
- Structure defense
- Defending manmade improvements, historical and archeological sites, and valuable natural resources
- Hot spotting critical areas of the fireline
- Hand line construction
- Supplying water via hose lays, portable tanks, back pumps, or other engines
- Providing emergency medical care to firefighters and civilians

The ICS typing of engines changed in 2012. Minor changes were made to Engine Types 1, 2, and 3. Significant changes were made to Engine Types 4, 5, 6, and 7.

MINIMUM ICS STANDARDS - ENGINES							
REQUIREMENTS	STRUCTURE			WILDLAND			
	1	2	3	4	5	6	7
Tank minimum capacity (gal)	300	300	500	750	400	150	50
Pump minimum flow (gpm)	1000	500	150	50	50	50	10
Pump @ rated pressure (psi)	150	150	250	100	100	100	100
Hose 2½" (feet)	1200	1000	-	-	-	-	-
Hose 1½" (feet)	500	500	1000	300	300	300	-
Hose 1" (feet)	-	-	500	300	300	300	200
Ladders (per NFPA 1901)	Yes	Yes	-	-	-	-	-
Master stream (500 gpm minimum)	Yes	-	-	-	-	-	-
Pump and roll	-	-	Yes	Yes	Yes	Yes	Yes
Maximum GVWR (lbs)	-	-	-	-	26,000	19,500	14,000

Type 1 and 2 Engines

Type 1 and 2 engines, while often requested and used during WUI incidents are not as well suited for WUI incidents as Type 3 engines. Their large size and lack of maneuverability and off-road capability are not ideal for rural areas. These engines may lack basic wildland firefighting tools, such as single jacket hose, hand tools, and basic firing devices. While Type 1 and 2 engines do have a role in WUI operations, firefighters need to have a good understanding of their capability and limitations.

Firefighters must consider the strategies and tactics for the mission and then assign the most appropriate resource for the tasks. In subdivisions where hydrants and paved roads are common, or in rural areas with well-maintained roads, Type 1 and 2 engines can be a valuable resource. They can be used to support Type 3 engines or combined with Type 3 engines in a task force for maximum impact.

Type 1 and 2 engines can be used as a holding force during firing operations and patrol around structures after the fire front has passed. This is a vital function as many structures surviving the fire front may be destroyed by residual burning after the fire front passes. Their personnel can also assist with hose lay and hand line construction. When ingress and egress are safe for Type 1 and 2 engine access, these engines can be an effective resource for structure triage, structure preparation, structure defense, and evacuations. Scout access routes prior to committing Type 1 and 2 engines.

Capabilities and Benefits

- ❖ **Wildland firefighting tools and hose:** Type 1 and 2 engines should maintain a basic complement of wildland firefighting equipment including 1½" single jacket and 1" hose, hose clamps, hose tees, nozzles, hand tools, and firing devices.

- ❖ **Hose lay and hand line construction:** Type 1 and 2 engines may be used for hose lays and hand line construction, if properly equipped and staffed with personnel trained for these tasks.
- ❖ **Structure triage and preparation:** May have the ability to pre-treat structures with foams and gels and provide defensible space on roadways and driveways.
- ❖ **Firing operations:** Type 1 and 2 engine crews can provide an effective holding force during firing operations, assisting in controlling spot fires and flare-ups.
- ❖ **Rescue and evacuations:** Type 1 and 2 engines are suited for rescue and evacuations if maneuverability is not an issue.
- ❖ **EMS:** Many are staffed and equipped for basic life support (BLS), but may also have advanced life support (ALS) capability.
- ❖ **Mop up and patrol:** Type 1 and 2 engines should be considered for mop up and patrol, especially Tactical Patrol, freeing up the more versatile Type 3 engines for other tasks.

Type 3 Engines

For years, the philosophy has been that Type 3 engines or wildland engines were only used for perimeter control, while Type 1 engines or structure engines were only used for structure defense. In reality, the primary suppression strategy on a WUI fire should combine structure defense and perimeter control operations.

The Type 3 engine is the preferred engine for WUI incidents because of its design, flexibility, and capabilities. Type 3 engines are capable of extended progressive hose lays, as well as mobile attack, due to their hose complements and pump capabilities. The pumps on Type 3 engines are designed for the high pressures often required for extended hose lays in steep terrain. They can also be used for mobile attack operations, allowing the engine to maintain a charged hoseline as it moves along the fire perimeter. Type 3 engines are generally more maneuverable than Type 1 and 2 engines, because of their shorter wheelbase and turning radius, higher ground clearance, and off-road capability.

Crew training and experience will vary between wildland agency and municipal agency personnel assigned to Type 3 engines. The personnel on wildland agency type 3 engines generally work and train together on wildland fire tactics and typically have more experience suppressing wildland fires, than municipal fire department personnel. Not all wildland agency firefighters are authorized, trained, and equipped to suppress interior structure fires. However, some are capable of performing exterior structure fire suppression. Structure

defense primarily utilizes wildland strategy and tactics until the structure ignites. Fireline supervisors should consider this difference when assigning resources to specific tasks.



Type III Engine

Capabilities and Benefits

- ❖ **Maneuverability:** Type 3 engines have a shorter wheelbase and many have 4-wheel drive capability. They are more effective in steeper terrain and where there are tight turnarounds.
- ❖ **Wildland firefighting tools and hose:** Most wildland agency Type 3 engines carry a minimum of 1200 feet of 1½" hose and 800 feet of 1" hose, as well as portable pumps, wildland firefighting hand tools, and chain saws.
- ❖ **Hose lay and hand line construction:** A strike team of Type 3 engines may extend a progressive hose lay with lateral lines over a mile, with tremendous efficiency. The same personnel may be assigned to construct hand line.
- ❖ **Versatility:** Many Type 3 engines carry structure firefighting equipment such as 3" supply line, SCBAs, ladders, and EMS/rescue tools, as well as their wildland hose/tool complements.
- ❖ **Firing operations:** Type 3 engines should carry firing tools, such as drip torches and fuses, and firefighters should be trained in their use. Type 3 engine crews may also function as an ignition team and/or holding force during firing operations.
- ❖ **Structure triage and preparation:** Type 3 engines, if equipped, may pre-treat structures with foams and gels in anticipation of fire front impact.
- ❖ **Rescue and evacuation:** Type 3 engines can be used to rescue victims and assist with evacuations in areas where fire front passage is imminent, the roads are narrow, or turnarounds are tight.
- ❖ **Mop up and patrol:** Type 3 engines are an excellent tool for mop up and patrol assignments due to their maneuverability, tools, and hose complements.

Considerations When Working with Type 3 Engines

- Assign three engines with 9-10 personnel to an extended hose lay.
 - Hose lays in excess of 600 feet should be considered an extended hose lay.
- An accepted standard used to estimate the time needed to place an extended hose lay in-service is 4-5 minutes per 100 feet of hoseline.
 - This takes into account for broken hose, returning to the engine for more hose, variations in slope and fuel, and crew fatigue.
- Allow for enough engines or water tenders with sufficient travel and refill time to maintain a constant water supply.
 - Studies have shown it takes an engine 3 minutes per mile to travel a good road, 6 minutes for a poor road, and approximately 15 minutes to refill.
- Type 3 engines can mobile pump at a rate of 100 feet per minute, depending on terrain.
- Select the pumping engine based on tank capacity and pressure capability.
 - Head pressure can be critical in wildland hose lays; relay pumping might be required.
- Type 3 engines are better suited for off-road driving.

Type 4, 5, 6, and 7 Engines

These engines are smaller and more maneuverable than Type 1, 2, and 3 engines. They do not carry as much water, equipment, and hose but are still a viable option for WUI firefighting. These engines have lower-volume, higher-pressure pumps and fewer personnel. They are relatively flexible in the WUI environment and can conduct both structure defense and perimeter control.

Both fire agencies and private contractors use these engine types. The engine crew's training, experience level, equipment, and policy constraints may dictate its assignments and limit its use.



Type IV Engine

Capabilities and Benefits

- ❖ **Maneuverability:** These engines have a shorter wheelbase and many have 4-wheel drive capability. They are more effective in steeper terrain and where there are tight turnarounds.
- ❖ **Wildland firefighting tools and hose:** These engines have limited hose and equipment capacity.
- ❖ **Hose lay and hand line construction:** These engines can do hose lay but may be limited by pump capability and the amount of hose they carry. The personnel are equipped and trained for hand line construction.
- ❖ **Firing operations:** These engines should carry firing tools, such as drip torches and fuses, and firefighters should be trained in their use.
- ❖ **Structure triage and preparation:** They have the ability to access narrow driveways and conduct limited structure defense preparation. However, their limited crew size and tool complements may limit their abilities.
- ❖ **Rescue and evacuations:** The crew may or may not be trained or equipped for EMS support. However, they are very maneuverable and can access and turn around in narrow or tight areas with little difficulty.
- ❖ **Mop up and patrol:** This is a good application for Type 4, 5, 6, and 7 engines, freeing up other resources for more critical assignments.

Hand Crew Typing

Hand crews are organized, trained, and equipped to work together and perform a variety of tasks on WUI incidents including perimeter control and structure defense. They contain their own supervision and radio communications. Crews vary in size and configuration. They are classified by their capabilities and restrictions.



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Crews can be organized in single increments (one crew), strike teams (multiple crews), or task forces (multiple resource kinds and types). Once a crew is committed, it may not be rapidly moved or reassigned. It takes time for hand crews to return to their vehicle for relocation.

When conducting perimeter control operations, crews may construct hand line, assist with hose lays, conduct firing operations, mop up, patrol, assist with fireline suppression repair, and be a general labor source.

During structure defense operations, crews usually prep around structures, construct control lines, conduct firing operations, assist in evacuations, conduct direct suppression activities (hot spotting, patrol and take action on spot fires), and assist engine companies.

When hand crews support engine companies, they may perform the full spectrum of wildland engine company activities, such as carrying and deploying hose in support of hose lays, working lateral hoselines during mop up/holding operations, and structure preparation to improve defensible space, such as:

- Removing fencing that may impede suppression action or escape routes
- Removing flammable material around structures, propane tanks, etc.
- Removing wood piles, lawn furniture, and any other flammable item
- Constructing hand line around structures
- Firing operations including ignition and holding actions

Type 1 Hand crews

- Have the highest level of training and experience
- Are fully mobile and equipped
- Have permanently assigned supervision
- May have specialty skills such as firing or timber felling
- May be split into squads or teams as supervision allows
- Are well equipped for most long duration assignments
- Typically have a higher production rate than Type 2 crews
- In California, Type 1 hand crews include
 - Federal Hot Shot crews
 - CAL FIRE/California Department of Corrections and Rehabilitation (CDCR) crews
 - Local government hand crews
 - Contract county hand crews

Type 2 Hand Crews

- May or may not be utilized on hot line assignments, structure defense, or for firing operations due to use restrictions
- Have less training and experience than Type 1 crews

- May be used for structure pretreatment and preparation and to construct control lines when safe to do so
- May not have fulltime crew transportation, issued radios, or the logistics required to support them in the WUI environment
- Have less supervision than a Type 1 crew and that supervision may not be permanently assigned
- May lack crew cohesion as they may not have worked together prior to the fire assignment

Hand Crew Strike Teams

According to FIRESCOPE's *Field Operations Guide 420-1*, a hand crew strike team consists of a group of like resources with minimum of 30 personnel (including crewmembers, supervisors, and a Strike Team Leader). Strike teams can be all Type 1 crewmembers or all Type 2 crewmembers, but not a combination of the two. The Strike Team Leader has a separate vehicle and is not part of an individual crew. Some Type 1 hand crew strike teams may have multiple support vehicles. This may increase efficiency by splitting up crew assignments, but it can also create additional traffic congestion in the tight confines of the WUI environment.

Dozers

Dozers should be coordinated with engines and hand crews to maximize their efficiency. In the WUI environment, dozers can

- Perform perimeter control
- Construct control or check times
- Develop or expand safety zones and temporary refuge areas
- Improve defensible space around structure or communities
- Improve access and egress to and from structures
- Support offensive and defensive firing operations

When there are multiple dozers assigned to an incident, it may be advantageous to utilize them in pairs, recognizing that there will be many situations where the dozers may be separated or working in two different directions from a common anchor point. This tactic may increase line production and may create opportunities to change from a defensive to an offensive strategy by taking advantage of terrain and natural barriers.

Dozers can be very destructive to property and infrastructure. Firefighters should weigh the consequences before assigning dozers. For example, in common neighborhoods, dozers may damage fences, roads, trees, water lines, and other infrastructure. When dozers are necessary, include suppression damage and repair in the overall incident plan.

When working with dozers, scout the area for dozer traps such as mines, bridges, septic tanks, propane tanks, aboveground fuel tanks, underground fuel pipelines, exposed water pipes or hydrants, utility poles, swimming pools, and any other item that could compromise a dozer. This is especially important when dozers are working in a fire area under impaired visibility or at night.

Dozers can be used as a single resource or configured into groups, strike teams, or as part of a task force. Dozers and fire crews work well together. Direct communication between fire crew supervisors and dozer operators is vital because of the added risks present when fire crews work in tandem with dozers.

Dozer Typing

Under most conditions, a Type 1 dozer (D7, D8) is capable of putting in more fireline faster through heavier fuel than a Type 2 dozer (D5, D6). There are a few things to consider before requesting a Type 1 dozer. Due to their size and weight, special transport permits may be required. The transports that carry a Type 1 dozer will be less maneuverable in tight terrain. These transports, when loaded, will be extremely heavy, and light roads, bridges, and railroad crossings must be taken into account when moving these machines.

Type 2 and Type 3 dozers (D4) are more typically used for rapid initial attack by fire service agencies. Fire service dozers are specifically equipped for fire duty with radios, roll cage, fire blankets, air systems, tools, and a blade type and angle that is suitable for fireline construction.

Since dozers are commonly more effective working in tandem, ICS provides for the use of a dozer strike team that includes two dozers of the same type, a Dozer Tender, and a Dozer Strike Team Leader.

Dozer Safety Considerations

As an IC, safety should always be a priority and there are several specific safety considerations when working with dozers. Be aware of adverse damage claims that can result from dozer access and operations.

- Any dozer used at night should have a swamper and must be equipped with lights.
- Slope limitations should always be considered.
- Over extended periods, operator fatigue becomes an important factor.
- Hand crews and engine companies should not be assigned to work in areas where rocks and debris dislodged by the dozers might roll their way.
- Dozer operators that are not fire service personnel should be thoroughly briefed on their assignment and supervised by qualified fire service personnel.
- The operator must have safety gear issued.



Dozer on the Line

Performance Standard Guidelines

Performance standards and production rates will change over the duration of the event and the type of topography. For specific production rates, refer to the *Fireline Handbook*. The following are general guidelines only.

- ❖ **Engines:** progressive hose lay @ 100 feet per 5 minutes; mobile pumping @ 100 feet per minute
- ❖ **Hand Crews:** 9-foot line width @ 225 feet per hour; 6-foot line width @ 450 feet per hour; 3-foot line width @ 900 feet per hour
- ❖ **Dozers:** 1,000 yards per hour

Strike Team Types

KIND	TYPE	NUMBER/TYPE
Engine	A	5 - Type 1
	B	5 - Type 2
	C	5 - Type 3
	D	5 - Type 4
Crews	G	Hand crew combinations consisting of a minimum of 29 persons. Do not mix Type 1 and Type 2 crews
	H	
Dozer	K	2 - Type 1 / 1 - Dozer Tender
	L	2 - Type 2 / 1 - Dozer Tender
	M	2 - Type 3 / 1 - Dozer Tender

Water Tenders

A water tender is a mobile water supply. Water tenders can provide water to engine companies assigned to remote fire areas that lack water supply systems (hydrants, tanks, etc.). Some can also provide dust abatement, directly suppress fires, and provide potable water supplies. Water tenders are classified by function (support or tactical) and size.

MINIMUM ICS STANDARDS – WATER TENDER					
REQUIREMENTS	SUPPORT			TACTICAL	
	S1	S2	S3	T1	T2
Tank capacity (gal)	4000	2500	1000	2000	1000
Pump minimum flow (gpm)	300	200	200	250	250
Pump @ rated pressure (psi)	50	50	50	150	150
Max. refill time (minutes)	30	20	15	-	-
Pump and roll	-	-	-	Yes	Yes
Personnel (min)	1	1	1	2	2



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- Support Water Tender
 - Used in supporting firefighting operations
 - Water transportation to tactical equipment
 - Personnel have minimum fire safety training
 - Used for watering roads and supporting camp operations
- Tactical Water Tender
 - Fully capable of wildland fire suppression operations
 - Fully trained personnel as per NWCG 310-1
 - Must have pump and roll capability
 - Must have a foam proportioner
 - May also be used for support functions (watering roads)

Aircraft

Aircraft are a valuable resource, significantly enhancing firefighting operations and improving safety in the WUI environment. The Company Officer should have a working knowledge of aircraft capabilities in order to properly deploy and utilize fixed and rotary wing aircraft.

A good analogy for aircraft utilization is to use helicopters like engines and use air tankers like bulldozers. Much like engine companies, helicopters are excellent for direct suppression of active fireline. Similar to bulldozers, air tankers are excellent for constructing indirect line just ahead of the fire, allowing the fire to burn into the retardant line.

Air Tactical Group Supervisor

The Air Tactical Group Supervisor (ATGS) is one of the most important resources the IC will interact with on a WUI incident. The radio call sign of the Air Tactical Group Supervisor will have the same identifier as your incident name, e.g., *[Incident Name] Air Attack*. The Air Tactical Group Supervisor flies in an observation plane staffed with a pilot. Air Attack's primary responsibility is the coordination and safety of all aircraft operations when fixed and/or rotary-wing aircraft are operating on an incident. Similar to an air traffic controller, they maintain air space separation between aircraft. Air Attack can be one of your best resources on a WUI fire and should hold a prominent place in your strategy and tactics.

Several critical communications must occur between the IC and Air Attack early in the incident. Air Attack has a tremendous view of the situation. Air Attack can see the "big picture" better than anyone else on the incident and will organize the aircraft in close coordination with ground forces.

Helicopter Coordinator

The Helicopter Coordinator (HLCO) and is primarily responsible for coordinating tactical or logistical helicopter mission(s) at the incident and reports to the Air Tactical Group Supervisor. Their radio call sign is "Helco." The activation of this position is contingent upon the complexity of the incident and the number of helicopters assigned. The HLCO can be airborne or on the ground, operating from a

high vantage point and assists with establishing locations and takeoff and landing patterns for helibase(s) and helispot(s).

HLCO determines what aircraft (air tankers and helicopters) are operating within the incident area of assignment. By surveying the assigned incident area, the HLCO can determine the situation, aircraft hazards, and other potential problems. Responsibilities include:

- Coordinates Air Traffic Control with pilots, Air Operations Branch Director, Air Tactical Group Supervisor, Air Tanker/Fixed Wing Coordinator, and Air Support Group as the situation dictates
- Coordinates the use of assigned ground-to-air and air-to-air communications frequencies with the Air Tactical Group Supervisor, Communications Unit, or local agency dispatch center
- Ensures that all assigned helicopters know appropriate operating frequencies
- Receives assignments, briefs pilots, and assigns missions
- Supervises helicopter activities

Helicopters

Helicopters can provide close-in tactical support. Helicopters are very versatile. They can move personnel to remote sections of line, transport supplies, and be used to start backfires. They can also be used to evacuate injured personnel and provide an excellent vantage point for reconnaissance and mapping. Helicopters are classified in the same manner as the air tankers.

Helicopters can be fitted with two types of drop tanks: buckets and fixed-tanks. Buckets are suspended by cables from the helicopter's cargo hook. Fixed-tanks are installed directly to the frame of the helicopter. Drop tanks can be filled by hoses on the ground or a snorkel system that allows for unaided filling from ponds, portable tanks, streams, or lakes. Most helicopters that are used to drop water are also fitted with a Class A foam injection system. Helicopters are categorized by their size and capabilities.

ICS MINIMUM STANDARDS - HELICOPTERS				
COMPONENTS	TYPES			
	1	2	3	4
Seats (including pilot)	16	10	5	3
Card weight capacity (lbs)	5000	2500	1200	600
Gallons	700	300	100	75
Examples	Sikorsky S70	Bell 204, 205, 212	Bell Jet Ranger	Hiller 12E3T

Type 1 Helicopters

Type 1 helicopters can deliver a minimum of 700 gallons of water, foam, or retardant in a single drop. This makes them an excellent resource for suppressing and cooling large sections of fireline. Most Type 1 helicopters utilize a bucket to deliver their drops. Helicopters with buckets cannot split their drops. They empty the entire bucket in one drop.

Type 1 helicopters with fixed tanks are called helitankers. These aircraft may also carry foam or retardant and are capable of splitting their load into multiple drops. To refill the tanks with water, helitankers hover over bodies of water and use a snorkel device.

Type 1 helicopters are most cost-effective if the water source is reasonable close to the incident. As a general guideline, a Type 1 helicopter should be able to reload and return to the scene within 10 minutes.

A Type 1 helicopter may be compared to a master stream appliance on a large structure fire. When large volumes of water are required, a Type 1 helicopter is well suited for the task.

Some Type 1 helicopters are carded for personnel transport missions. They can carry between 16 and 35 personnel to the fireline. They require a large helispot for landing. They may also carry large payloads of supplies and equipment.



Type 1 Helicopter

Type 2 Helicopters

Type 2 helicopters are the most versatile air asset on an incident. Type 2 helicopters can perform multiple missions including hot spotting, recon and mapping missions, firefighter and cargo transport, medevac and rescue missions, aircraft coordination, aerial ignitions, and drops of water, foam, or retardant.



Type 2 Helicopter

Type 2 helicopters can be configured with a bucket or a fixed tank. Some tanks can be refilled using a snorkel while others are refilled by engines. Type 2 helicopters can carry a minimum 300 gallons of water, foam, or retardant. In the WUI environment, when visibility allows, the accuracy of helicopter drops makes them an excellent resource for suppressing fire and supporting ground personnel. Many agency Type 2 helicopters can rescue civilians and firefighters utilizing a rescue hoist or short haul configuration.

Consider this option for life threatening situations in the WUI environment. Some Type 2 helicopters are restricted to drops and cargo delivery, and cannot carry passengers. Firefighters need to clearly articulate mission needs when ordering Type 2 helicopters.

Type 3 and 4 Helicopters

Type 3 and 4 helicopters are best suited for reconnaissance or to provide aircraft coordination as a Helicopter Coordinator (HELCO) or ATGS platform. These helicopters are often equipped with specialized mapping capabilities, forward-looking infrared (FLIR) cameras, and video cameras.

Type 3 and 4 helicopters have limited water dropping and crew transport capability but can deliver supplies. Firefighters need to clearly articulate mission needs when ordering Type 3 and 4 helicopters.



Type 3 and 4 Helicopter

Helitack Crews

Helitack crews are inserted by helicopter into sections of the incident to aggressively attack the fire with hand tools while the helicopter supports them with aerial drops. Many wildland agencies have dedicated helitack crews available for response to both initial attack and large fire incidents. The size of a helitack crew depends on the type of helicopter to which it is assigned:

- Type 1 = a minimum 10 people
- Type 2 = 5 – 9 people
- Type 3 = 3 – 5 people

Once inserted, the helitack crew establishes an anchor point and constructs control line while the helicopter cools hot spots ahead of the crew. The crew may also take advantage of roads or natural fuel breaks for perimeter control lines and conduct firing operations. The crew may also assist engine companies with hose lays and structure defense operations.

Some helitack crews have specialized capabilities to conduct rappel operations and rescue missions. They can also assist with medevac missions for injured civilians and firefighters. Agency helitack crews are trained to manage helibases and helispots. This includes providing a safe environment to support and oversee:

- Loading and offloading personnel, cargo, and supplies
- Fueling operations
- Helibase crash/fire protection
- Air traffic around the helibase and incident area
- Air frequencies
- Flight time, costs, and other administrative requirements



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The most effective and efficient use of a helitack crew is to work it in unison with its helicopter. Separating a helitack crew from its helicopter makes both resources less effective. One exception would be pairing a helitack crew with air tankers after the helicopter inserts the crew on the scene. Exercise caution when deploying helitack crews in high wind fires. If high winds ground aircraft after the crew is inserted, it may become stranded in a remote location. During high wind situations, a helitack crew may be most effective establishing and coordinating the incident helibase.

Night Flying

Some agency helicopters are authorized, trained, and equipped to fly after dark. Night flight operations are dangerous and should only be considered when firefighter or civilian lives, structures, or critical infrastructure are threatened. ICs must evaluate the risk versus gain and determine if a night operation will have a direct influence in incident mitigation or personnel safety.

Air Tankers

Air tankers are a valuable resource for direct fire suppression and constructing direct, indirect, and parallel line in support of ground personnel. Direct line is constructed along the fire edge. It is good for reducing fire intensity and slowing fire spread, but missed drops may drift into the burn and be ineffective. Indirect line is constructed some distance ahead of the fire in anticipation of it reaching that point. Parallel line is constructed a short distance from the fire edge taking advantage of barriers and lighter fuels. This is the most common type of air tanker drop. Air tankers are categorized by their size and payload.

ICS MINIMUM STANDARDS – AIR TANKERS				
COMPONENTS	TYPES			
	1	2	3	4
Gallons (min.)	3000	1800	800	200
Examples	C-130, P-3	SP2H, P2V	S-2T	SEAT

Air tanker drop configurations include a salvo drop (dropping the entire payload at one time) or a split drop (dropping portions of the payload at different times).

Ground personnel, the ATGS, or HELCO should use target descriptions to describe drop locations to the air tanker. Utilize parts of the fire and terrain features rather than cardinal direction. Indicate where the drop should start and end and the desired coverage level (amount of retardant dropped in a 100 square foot area). Coverage levels range from 1 to 9. Lighter fuels (grass or light brush) require a lower coverage level than heavy brush or timber. When communicating the target description include information on surface wind speed and direction, and any potential flight hazards (tall trees, antennae, wires, power lines, or other aircraft in the area).

Avoid using air tanker drops mid slope. The fire may burn through or around the retardant line and continue to the top of the ridge. Drop the retardant at the top of the ridge and work the flanks of the fire downhill. Mid slope drops can be used to defend a structure but will unlikely reduce fire spread.

Air tankers can drop retardant to create check lines for structure defense. This may slow the fire spread and intensity and extend the available time for ground resources to prepare the structure for defense. A V pattern drop around a structure creates an effective check line.



Visibility impacts drop capabilities around structures. Drops should be made well in advance of the fire front and smoke column. Visibility also reduces the pilot's ability to navigate around hazards.

Air tankers are in limited supply and are always assigned to the highest priority fire. They must be re-ordered every day for the following operational period.

Type 1, 2, 3, and 4 Air Tankers

The difference between air tankers is their size and payload capabilities. All four are valuable in the WUI environment. Smaller air tankers (Type 3 and 4) are more maneuverable in steep topography and where numerous flight hazards are present. Type 1 and 2 air tankers have faster response times over large distances. All four tankers utilize the same tactics, but Type 1 and 2 tankers carry more retardant and are more effective at indirect attack.

VLAT – Very Large Air Tanker

VLATs hold more retardant and create a substantially larger drop pattern than conventional air tankers. VLATs have a retardant capacity of 10,000 gallons or more and are capable of multiple retardant drops. VLATs may drop anywhere from $\frac{1}{4}$ to $\frac{3}{4}$ of a mile of retardant line making them an effective resource with large fire fronts. VLAT retardant line is substantially wider than that of other air tankers, allowing the retardant to slow the advance of large fire fronts. Due to their large payload, VLATs can free up other air tanker resources for redeployment.



VLAT – Very Large Air Tanker



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When VLATs are used, ground resources must watch for spotting and increased fire behavior created by significant wing tip vortices from the aircraft. Consult with the ATGS to discuss tactical and logistical considerations before requesting a VLAT.

Specialized Equipment and Personnel

Specialized equipment may be used on a WUI fire such as foam application devices and thermal imaging. Advise your supervisor of any specialized equipment or personnel certifications (urban search and rescue, paramedic, etc.) you have during your initial briefing. Find out what type of specialized equipment is available to you from your adjoining resources.



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Topic 5-5: Size-up and Report on Conditions

Topic 5-5: Size-up and Report on Conditions

To properly attack any fire, the first-in Company Officer must make a mental evaluation of the situation. This evaluation is what current and future control action is based on. The ability to make a good size-up and then act on it can make the difference between whether the fire is contained with initial attack resources or requires additional alarms. The following size-up process is tailored for use in the wildland urban interface environment.

You observe, evaluate the factors as they become available, and make decisions on current and probable future conditions. This process also serves as a basis for your initial actions and those of other resources required to handle the incident. The size-up process is a continuous evaluation of many different components that occur throughout the incident. This process begins as soon you arrive at the station and prepare for duty.

Preincident Awareness

Considerations may include:

- Weather conditions/patterns
- General fire behavior in the response area
- Seasonal fuel conditions
- Topography in the local area including artificial and natural barriers
- Structure defense considerations in the area
- Available resources including skill and training of responding personnel

Dispatch Information

When receiving information from dispatch, write down the information:

- Type of fire
- Location of the fire
 - This could be in the form of a street address, local landmark, Public Lands Survey section, or very vague, depending on how the call was received
- Access or route of travel
 - Get a map system reference and use your maps (e.g., Thomas Bros. map page)
- Resources
 - What other resources have been dispatched?
 - Have aircraft been dispatched?
- Are there any special hazards?
- Communications plan
 - Command, Tactical, Air-to-ground
- Order and request numbers, if appropriate

En route to the Fire

When responding to a WUI fire, continue your size-up and gather the following.

- Where is the fire burning and are preincident plans available for the incident area?
- Which dispatched resources are responding and which likely arrive first?
- Do I need additional frequencies?
- What are the fuel, weather, and topography conditions?
- Are other incidents influencing resource availability?
- Will reflex time be an adverse factor affecting initial attack success?
- Will the topography require specialized resources?
- Will air resources arrive on-scene before ground resources?
- What does the smoke column look like?
- Does the column's condition match the information received?

Arriving at the Fire

When arriving at the fire, evaluate the critical factors and continue your size-up.

- What is the previous fire history for the area?
 - Knowing how the fire burned in this area before will influence incident objectives, strategy, and tactics for this fire
- Whose jurisdiction is the fire in?
 - Notify adjoining agencies of fire threat
- How far has the fire progressed between dispatch and the time you arrived on-scene?
 - Can be very useful in determining what type of attack method you decide to use
 - Direct/indirect attack
 - Perimeter control/structure defense
 - Mobile attack
- What is the size of the fire?
 - Area the fire has consumed at the present time
 - Indicated in terms of a "spot" to parts of an acre
 - A spot is less than a quarter acre
 - Parts of an acre are usually described as $\frac{1}{4}$ acre, $\frac{1}{2}$ acre, $\frac{3}{4}$ acre in size
 - ♦ One acre is approximately equal to the size of a football field
- What is the observed fire behavior?
 - Spotting, torching, crowning
 - Sheeting/running
 - Head, backing, or flanking
 - Smoldering or creeping

- What fuels are burning?
 - The actual fuel carrying the fire
 - Is there a fuel type transition?
- What are the current weather conditions?
 - Wind direction and speed
 - Sustained winds will make it difficult for initial attack resources to catch the forward progress of the fire
 - Speeds over 10 mph will hamper the ability of ground and air resources to contain the fire
 - Wind gusting or erratic
 - Wind upslope, across slope, or downslope
 - Wind event present
 - Humidity level
 - Red flag conditions
- What is the topography?
 - Lay of the land
 - Aspect
 - Slope/steepness
 - Position on slope
- What is the fire's potential?
 - Based upon the rate of spread, weather conditions, topography, and threatened structures in the fire's path
 - An imminent change in topography or fuels will have a dramatic effect on your assessment
 - Structures or exposures will be threatened if you cannot catch the forward progress of the fire with your initial attack resources
 - Natural or existing barriers that can be used as a control line
 - Make an effort to forecast where the fire will be in 30 minutes, 1 hour, 2 hours, etc.
 - Estimate in your mind when you think the fire will be contained and controlled
- What is the rate of spread (ROS)?
 - Slow
 - Indicates very little spread or a spread of no consequence
 - Usually a fire with little to no wind
 - You can probably pick it up with a portion of the first alarm or your engine company
 - Moderate
 - Moving less than 1 mile per hour
 - You can expect to catch it with a flanking action
 - First alarm assignment will probably continue due to resource needs

- Rapid
 - Moving between 1 to 3 miles per hour
 - Spreading faster than you can contain with a flanking action
 - You will probably need to order additional equipment in order to deal with the fire's potential
- Extreme
 - Moving over three miles per hour
 - Containment is not expected without significant augmentation of initial attack resources
- Are there life hazards to civilians or responders?
 - Include any safety hazards that are known
 - Downed power lines
 - Overhead obstructions for aircraft
 - Narrow, steep canyons or cliffs
 - Include any special information
 - Sensitive environmental areas
 - Archeological sites
 - Evacuation that may be in progress
- Is evacuation needed?
- Are any structures or others values at risk?
 - Immediate or potential threat
- Where did the fire start?
 - Preserve the heel of the fire
- What is your resource situation?
 - Arrival time of incoming resources
 - Additional resource needs
- What is your plan of action?
 - Incident objectives (based on priorities)
 - What you want to do? (strategy)
 - Actions to be taken (tactics)
 - Hand lines vs. progressive hose lays (tasks)
 - Resources needed to accomplish plan
 - Timeframe (how long it will it)
- What is your LCES plan?
 - Required in your size-up process

FPODP

Lloyd Layman developed the "FPODP" system. This acronym can assist you when evaluating the critical factors after arriving at the fire.

❖ **Facts**

- Data available through preplanning
- Data acquired upon receipt of the alarm
- Data acquired on arrival or observed at scene
- Implement policies or SOGs/SOPs based on facts

❖ **Probabilities**

- Anticipated fire growth
- Anticipated threat to life
- Anticipated threat to property and environment
- Reflex times
- Weather changes
- Abnormal conditions

❖ **Own situation**

- Apparatus
- Personnel
- Equipment
- Cooperating agencies available
- Extinguishing agents
- Fire protection equipment on site

❖ **Decision**

- The initial decision(s)
- Supplemental decisions

❖ **Plan of operation**

- Issue orders/instructions that will initiate actions
- Provide management and supervision

Report on Conditions

The IC begins the command, control, and communications process with the report on conditions process, which is broken into three separate and distinct actions, which include the initial radio report, the follow up report on conditions and additional incident updates. This series of communications that make up the report on conditions process are directed to everyone responding

to the scene, in addition to dispatch. It connects those listening to the initial and ongoing incident status.

It is important to remember that the report should be concise and factual. It is also important to think about what you are going to say before you say it to help alleviate any missed information that needs to be communicated. Remember, editorializing on the radio can be confusing and misunderstood by those listening.

Initial Radio Report

The initial radio report is not an affidavit of absolute accuracy. The IC takes a quick snapshot of the incident upon arrival to quickly develop and extend a word picture of what the IC can see. The initial radio report is can be unforgiving because everyone can hear it broadcast over the radio. If the IC sounds in control, the operation will likely get off to a good start. The initial radio report should be brief, concise, and clear. Allowing the IC to gain additional information for a follow up report on conditions requires a fair measure of responder maturity and discipline. The initial radio report should include:



Initial Radio Report

- Declare arrival on-scene and confirm incident location
 - Provide dispatch with correct address if the incident is not at the dispatched location
 - The location may include compass directions and GPS information
- Establish command and name the incident
 - Incident name is determined by a road, street, or landmark
- Identify jurisdiction (if applicable)
 - Agency with jurisdiction
 - Affected jurisdiction and agencies
 - Threatened jurisdiction
- Identify incident type
 - Vegetation (grass, brush, or timber) fire
 - Threats to life, structures, and infrastructure

Follow-up Report on Conditions

The follow up report forces the IC to slow down and capture a more detailed situational awareness in order to provide a more detailed description of the event. This can be an incredibly helpful routine to get the IC started in an effective manner. The follow up report on conditions allows the incident

commander to gather pertinent information on the critical incident factors that will influence the incident strategy and resource deployment.

- Estimate incident size
 - Estimated in acres
- Define wind speed and direction
- Identify fuel type involved
 - Light fuels (grasses)
 - Medium fuels (brush type)
 - Heavy fuels (timber type)
- Define the topography
 - Slope
 - The steepness of the topography determines the slope and is measured in percentage of grade
 - A slope of 45 degrees equals 100 percent
 - Aspect
 - Aspect refers to the direction the slope faces
 - Due to more sun exposure and less annual rainfall, south and southwest aspects usually have light and flashy fuels
- Define rate and direction of spread
 - Slow (little or no spread)
 - Moderate (<1 mph)
 - Rapid (1–3 mph)
 - Extreme (>3 mph)
- Identify hazards or special considerations
- Provide instructions to incoming resources
 - Access routes
 - Use flagging material or road cones to identify access points for incoming units
 - Location of staging areas
 - Location of ICP
- Identify additional resources needed
 - Based upon the above factors, you must decide if the initial response will be adequate or if additional resources will be needed
 - The need for additional units should be included and requested as soon as appropriate

- This prepares the initial attack units to be expecting additional resources and initiates dispatch to perform the order requests
- If no additional resources are needed, dispatch can also make that information known to the rest of the response

Describe incident potential

Incident Updates

The incident is then updated on a semi-regular basis as conditions change or additional information is received. This is usually in the form of a status report that would include ***condition, actions, and needs***. This update may include increased rate of spread, fire intensity, weather changes, and additional structures threatened. In addition, report any “good” news in your updates. This may include your progress toward containment and availability of resources whether en route or on scene.



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Topic 5-5: Size-up and Report on Conditions

REPORT ON CONDITIONS TEMPLATE		✓
INITIAL RADIO REPORT		
1.	Declare arrival on-scene and confirm incident location	
	<ul style="list-style-type: none"> ▪ Provide dispatch with correct address if the incident is not at the dispatched location ▪ The location may include compass directions and GPS information 	
2.	Establish command and name the incident	
	<ul style="list-style-type: none"> ▪ Incident name is determined by a road, street, or landmark 	
3.	Identify jurisdiction (if applicable)	
	<ul style="list-style-type: none"> ▪ Agency with jurisdiction ▪ Affected jurisdiction and agencies ▪ Threatened jurisdiction 	
4.	Identify incident type	
	<ul style="list-style-type: none"> ▪ Vegetation (grass, brush, or timber) fire ▪ Threats to life, structures, and infrastructure 	
FOLLOW-UP REPORT ON CONDITIONS		
1.	Estimate incident size	
	<ul style="list-style-type: none"> ▪ Estimated in acres 	
2.	Define wind speed and direction	
3.	Identify fuel type involved	
	<ul style="list-style-type: none"> ▪ Light fuels (grasses), Medium fuels (brush type), Heavy fuels (timber type) 	
4.	Define the topography	
	<ul style="list-style-type: none"> ▪ Slope - Steepness of the topography determines the slope and is measured in percentage of grade ▪ Aspect - Refers to the direction the slope faces 	
5.	Define rate and direction of spread	
	<ul style="list-style-type: none"> ▪ Slow (little or no spread), Moderate (<1 mph), Rapid (1–3 mph), Extreme (>3 mph) 	
6.	Identify hazards or special considerations	
7.	Provide instructions to incoming resources	
	<ul style="list-style-type: none"> ▪ Access routes 	
8.	Use flagging material or road cones to identify access points for incoming units	
	<ul style="list-style-type: none"> ▪ Location of staging areas ▪ Location of ICP 	
9.	Identify additional resources needed	
10.	Describe incident potential	



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Topic 5-6: WUI Fire Suppression Considerations

Topic 5-6: WUI Fire Suppression Considerations

Successful firefighting operations in the WUI are accomplished by selecting appropriate strategies supported by effective tactical actions that keep firefighters safe, protect the public, and minimize property loss or damage. Suppressing the fire before it reaches threatened structures is often the most effective way to defend assets at risk and must remain the focus of resources tasked with structure defense. Firefighters must understand tactical terminology, structure defense preparation tactics, firing methods and protocols, crew safety, and contingency planning in order to be safe and effective on any incident.

WUI Incident Priorities

The initial attack Company Officer plays a pivotal role in establishing the incident plan and organization. The plan of action, whether written or verbal, is based on incident priorities. Incidents may vary in size, but the overall priorities stay the same. The three priorities are:

- ❶ **Life safety** – The protection of human life is always the first priority. This includes the lives of firefighters
- ❷ **Incident stabilization** – This priority deals with the organization that is developed to ultimately control the incident
- ❸ **Property/environment protection and conservation** – The protection of structures is usually the next priority as well as the protection of natural resources

Incident Objectives: What Needs to be Accomplished

Incident objectives are guidance and direction statements necessary for the selection of appropriate strategies and the tactical direction of resources. They describe what must be accomplished and provide substantive direction for work at the incident. For full effectiveness, incident objectives must be SMART.

- ❖ **Specific** – Is the wording precise and unambiguous?
- ❖ **Measurable** – How will achievements be measured?
- ❖ **Action oriented** – Is an action verb used to describe expected accomplishments?
- ❖ **Realistic** – Is the outcome achievable with the given available resources?
- ❖ **Time sensitive** – What is the timeframe (if applicable)?

Incident objectives are usually divided into two categories: management and control. **Management objectives** are general and list the priorities for life and property protection such as providing for firefighter and public safety, protecting of the environment, and using minimal impact suppression tactics. These objectives are related to the overall management of the incident.

The incident **control objectives** determine the incident strategies and tactics; this is commonly referred to as “building the box.” Building the box means setting control objectives and their locations. For example, “Hold the fire west of Main Street, east of First Street, north of Smith road and south of Raging River, while minimizing structural loss.” Clear control objectives are crucial for



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firefighters to understand what the IC wants them to do. Unrealistic or unobtainable control objectives show a general lack of leadership.

SAMPLE OBJECTIVES	
MANAGEMENT OBJECTIVES	CONTROL OBJECTIVES
<ul style="list-style-type: none"> Firefighter and civilian safety Structure and infrastructure defense Keep suppression costs commensurate with structures at risk Protect sensitive environmental and cultural sites 	<ul style="list-style-type: none"> Keep fire north of County Road 6, east of Meadow Park, south of County Road 8, and west of the Parker Ridge

The Incident Commander will use the incident objectives to develop a general plan or strategy and will then deploy or direct resources to accomplish the objectives designated by that strategy.

Strategy/Mode of Operation

Strategy (also called mode of operation) is broad in scope and provides a realistic approach and direction for meeting the incident objectives. After taking into account current and forecasted fire behavior, and gathering intelligence from as many sources as possible, you must determine the appropriate strategy for your situation.

Strategy is the overall plan used to determine and prioritize the major objectives needed to manage a fire and describes the general method(s) that should be used either singly or in a combination that will result in achieving the incident objective. Your strategy depends on the rate of spread, intensity, spotting potential, values at risk, size, resources available, and other factors based upon initial size-up. Remember that during size-up, you need to evaluate facts, probabilities, own situation, available options, and any plan of operation already implemented.

An **offensive strategy** is one that confines and controls the fire by constructing a control line. Structure defense may be required, but the majority of the fire suppression effort is focused on line construction. Before deciding on an offensive strategy, you must be certain that your personnel can implement it safely and you have ample resources available. An offensive WUI operation can utilize direct or indirect attacks, while in structural firefighting; an offensive action is usually a direct attack on the interior.

A **defensive strategy** is taken when the fire behavior is such that an offensive operation would not be productive, loss of structures would occur, or is too dangerous. You might also have to take defensive positions if there are limited firefighting resources or if the resources are focused on protecting life, property, or natural resources. In most cases, a defensive strategy of operation is taken to minimize the damage, not contain the fire. A defensive WUI operation to defend structures, the moving fire controls the action. In structural firefighting, a defensive operation is usually an exterior attack.

There will be cases where the strategy on one Division may be defensive but the rest of the fire is being attacked using various offensive operations. It is very important that you know which strategy you are in. You must now determine the proper tactics for attacking the fire.

OBJECTIVE	STRATEGY
Keep the fire north of County Road 6	Offensive direct attack on the right flank
Keep the fire east of Meadow Park	Offensive direct attack on the right flank
Keep the fire south of County Road 8	Defensive indirect attack on the left flank
Keep the fire west of the Parker Ridge	Direct attack on Parker Ridge Defend homes along Parker Ridge Road

A strategy must take into consideration the numbers and types of resources necessary to meet the incident objectives and the time required to put them in position. A strategy that requires a large number of resources to execute the plan will fail if the necessary resources cannot arrive in a timely fashion.

The strategy is also subject to change due to changes in weather, fire behavior, resource availability, or any other variable prompting a change to the incident objectives. For example, firefighters planning to execute a burnout from a road system a mile from the fire front may be forced to change to a direct perimeter control suppression action if cool, moist weather is forecasted to arrive before the burnout can be executed.

Offensive

The IC should always consider an offensive strategy first. With an offensive strategy, suppression resources vigorously and aggressively attack the fire, often with multiple suppression tools, from



multiple anchor points, using a variety of tactics. This strategy is especially prudent if the fire has not reached the threatened structures.

Obviously, attacking the fire at the point of threat and cutting it off from the structures, is an important part of this strategy.

An aggressive, offensive, direct attack on the fire perimeter may be the best course of action to stop the spread of the fire and eliminate the threat to life and property. Suppression resources are actively engaged in direct attack tactics on the edge of the fire with “one foot in the burn.”

An offensive strategy may be used when:

- There are ample resources to engage the fire at multiple points
- Fire behavior is such that control efforts at the fire’s edge are safe and efficient
- The assets at risk can be defended with a minimal resource commitment allowing most of the effort to be focused on the fire perimeter
- Resources are containing the fire faster than the fire is progressing

Defensive

If the fire has already reached the area of structures or fire impact is imminent, a defensive strategy may be needed to defend as many structures as possible. Taking a defensive stance at a structure and allowing the fire front to impact the location is unsafe and unlikely to succeed. Likewise, concentrating solely on structure defense allowing the fire to spread unchecked is unacceptable, but sometimes unavoidable. There are times when this may be the only acceptable means of defending structures that are immediately threatened or involved in fire, but it compounds the problem by allowing the fire to expand its perimeter, possibly threatening more structures.

A defensive strategy may be used when:

- There is a lack of resources
- There is extreme fire behavior
- Conditions are unsafe for firefighters
- There is a threat to life or property that supersedes fire suppression
- The terrain is such that control actions must occur some distance from the fire's edge

Combination

A combination operation is the preferred strategy when adequate resources are available. Both offensive and defensive strategies will often be used on different parts of the fire at the same time. Take aggressive action on the fire perimeter while defending structures at the same time. Near the heel and flanks where the fire behavior is less intense, direct attack tactics may be used to aggressively attack the fire perimeter at multiple points. Near the shoulders and the head, resources may have to establish control lines using indirect tactics some distance from the fire.

Tactics

Where strategy gives you a general plan designed to accomplish incident objectives, tactics focus on the specific actions firefighters will take on the fireground. In a WUI incident, **structure defense or perimeter control** are your two tactical options.

Tactical Actions

They involve the actual number of resources and the individual designation of the units that are to accomplish the objectives. An attack of a WUI fire may involve one of the follow tactical actions. The chosen tactical action must be capable of stopping the fire's advance or preventing the fire from damaging property without incurring injuries to firefighting personnel. When choosing a tactical action, it is very important to know what the fire behavior will be at the time firefighters engage the fire.

Making an accurate fire behavior forecast in advance of the fire's arrival is your greatest challenge. An accurate fire behavior forecast is difficult to make with absolute certainty, but it serves as the basis for determining if a tactical action will be effective and safe. Recognizing that there is always the potential for error in your fire behavior forecast means that we must compensate for the uncertainties by having alternative actions (tactical maneuver) built into the plan. The key point here



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is to never be locked into a single plan of action. In addition to your primary plan, always have an alternate plan, a contingency plan, **and** an emergency plan (PACE).

Effective Tactical Action

Effective tactical action relies on agility as its core operating principle. Predict all tactical decisions on the idea that the selected tactics will be successful. The chosen tactics must be capable of stopping the advance of the fire or prevent the fire from damaging property and do so without injury to firefighters.

When choosing a tactic or developing a tactical plan it is important to anticipate what the fire behavior will be when firefighters engage the fire. A fire behavior forecast is difficult to make with absolute certainty but is crucial when determining if a tactical plan will be effective and safe. Recognizing that there is always the potential for error when making fire behavior forecasts, build alternatives into the incident plan, and remain flexible to alternative plans.

Tactical Maneuver

Tactical maneuver builds agility into a tactical plan by allowing resources to work and move around in a hazardous environment without injury, while remaining effective. It encompasses both a thought process and movement or purposeful reaction to change. Tactical maneuver is most effective when potential changes to the primary plan have been identified and firefighters have an opportunity to plan reactions to those changes.

Tactical planning must be developed in conjunction with anticipated changes in the fire environment, or fire behavior. Tactical maneuver (agility) is essential to ensure firefighter safety since legitimate safety zones are not always immediately present in the WUI environment.

Firefighters must be prepared to utilize tactical maneuver when changing from structure defense mode (defensive) to suppression mode (offensive) when fire behavior allows. It is imperative to take advantage of situations that allow firefighters to take perimeter control actions and suppress the fire.

For example, an engine crew may go from one structure to another, moving with the fire, or staying behind a house (TRA) when the fire is hitting hard, then moving into full suppression mode again when the fire subsides. This requires a continuous assessment of the fire and its potential.

Structure Defense Tactics

Structure defense actions are taken in advance and are centered on the concept of preventing the fire from reaching structures or other improvements and/or reducing the intensity of fire. These actions involve the use of structure triage, evacuation, structure preparation, tactical patrol, and control methods to minimize the risk of fire from damaging or destroying these values at risk.

Structure Triage

The presence of civilians and structures in the WUI environment increases the complexity of a wildland incident. In addition to typical firefighting challenges, firefighters face unique problems in the WUI environment including evacuating civilians and animals; hazardous conditions such as propane tanks, power lines, and hazardous materials; and protecting and high value assets at risk including homes and businesses. In these situations, firefighters must rapidly assess a structure to



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determine whether it can be defended safely and successfully. This evaluation process is called structure triage.

Structure triage is the process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels. The decision to engage in structure defense should always be based on a determination that the structure is in fact defensible and that any risks to firefighters can be safely mitigated. Therefore, structure triage decisions must be based on current and forecasted fire behavior. Any change in fire behavior can quickly change the defensibility status of a structure.

When making a decision to defend a structure, firefighters must continually assess the fire environment as well as the physical features of the structure and its surroundings, and make a reasonable forecast of what will happen when the fire impacts the location. Accurate fire behavior forecasting is essential to effective structure triage and conducting safe structure defense operations. Firefighters have been injured and killed during structure defense operations in which firefighters underestimated fire behavior.

Structure Triage Categories

During an incident, firefighters use the S-FACTS process to categorize structures as not threatened, threatened defensible, or threatened non-defensible. However, structure triage is a dynamic process and any change in the fire environment can quickly alter the defensibility of a given structure at any time. For example, a structure categorized as not threatened could be re-categorized as threatened defensible or threatened non-defensible based on a change in fire direction or intensity.

Strategies and tactics can also alter the defensibility of a structure. For example, if firefighters have time to adequately prepare a structure before the fire front arrives, the structure category for that particular could change from threatened nondefensible to threatened defensible.

Not Threatened

A structure that is not threatened is either out of the path of the fire front or its construction and clearance characteristics are such that there is minimal threat, even if the fire front impacts the immediate area.

These structures have more than adequate flammable vegetation clearance and are constructed of fire-safe materials. They will require minimal resource time commitment and prep work and should be a high priority for structure defense. Do not overlook or neglect not threatened structures, include them in tactical patrol.

Threatened Defensible

A threatened defensible structure has an adequate safety zone **and** temporary refuge area nearby, but there is a high probability that the structure will be damaged or destroyed without some intervention by suppression resources. Structures in this category typically have some degree of clearance from surrounding fuels and limited fire-safe construction features.

Fire department interventions may include removing fuels, closing windows, covering vents, and applying foams or gels. Intervention may require that fire department resources remain at the

structure during the fire front impact. Residents are usually evacuated, but if they elect to stay, ensure they understand the situation and are prepared to shelter in place.

If there is not enough time to perform the necessary intervention measures or fire behavior changes adversely, structures classified as threatened defensible may be downgraded into the nondefensible category.

Threatened Nondefensible

A threatened nondefensible structure does not have an adequate escape route to a safety zone and a temporary refuge area nearby, and based on current and forecasted fire behavior, the structure cannot be safely defended.

Structures in this category typically have little or no clearance from surrounding fuels and exhibit limited or no fire-safe construction features. The structure may be located midslope or in another dangerous topographical feature such as a chimney, saddle, or drainage.

Evacuate civilians from the structures that are threatened nondefensible. Even though it will not be safe for resources to remain when the fire arrives, there may be enough time to safely complete some structure defense preparation before resources leave the area.

S-FACTS Structure Triage Checklist

During a WUI incident, it may be difficult to remember all of the factors that must be considered during the structure triage decision process. The Survival Facts, or S-FACTS, memory aid is a useful structure triage tool.

- ❖ ***S - Survival***
- ❖ ***F - Fire environment***
- ❖ ***A - Access***
- ❖ ***C - Construction / clearance***
- ❖ ***T - Time***
- ❖ ***S - Stay or go***



Threatened Defensible



Threatened Nondefensible

Use the structure triage categories in concert with the S-FACTS memory aid in order to set priorities and make decisions about structure defense tactics and resource assignments.

Survival - Firefighter safety is the top priority on any incident. If firefighters cannot survive in a location, they must relocate to a safer location. Addressing firefighter safety is the first structure triage action. Use the following questions to determine whether a structure or location is safe or survivable.

- Initial Assessment: Can you survive here?
 - If not, LEAVE NOW
- Is there a safety zone nearby or can one be constructed near the structure?
 - If not, LEAVE NOW
- Is there a viable escape route or can egress be improved to create one?
 - If not, LEAVE NOW
- Is there a temporary refuge area on site or can one be constructed?
 - If not, LEAVE NOW
- What is the decision point at which you will leave based on fire behavior and rate of spread?
- Is the Prep and Go tactic an option?
- Do you have communications with your supervisor and adjoining forces?
- Can safety issues be mitigated?
 - If not, LEAVE NOW

If there is any safety aspect that cannot be mitigated and resources cannot safely defend the structure, resource should leave the structure and move on to another assignment.

Fire Environment - Triage includes onsite observations of current fire behavior and predictions of what the fire may do in the near future. Evaluate the fuel, weather, and topographical features around the structure and estimate the intensity of the expected fire behavior.

- Can you survive based on current and expected fire behavior?
 - If not, LEAVE NOW
- Look up, Look down, Look around indicators
 - Fuel
 - Fuel is the only fire behavior variable that firefighters can alter
 - What will the fire intensity be and how long will it take to consume the fuels?
 - Evaluate the fuel around the structure, its relationship to the current weather and topography, and what measures firefighters can take to reduce the fuel load
 - Fuel type
 - What fuel type is carrying the fire front and contributing the greatest heat and ember production?
 - Will fuel reduction efforts be easy or difficult (i.e. a grass model versus a brush model)?

- Fuel loading
 - How much fuel is present and how will that fuel load impact structure preparation timetables?
 - Is there so much fuel that reduction efforts are impractical?
 - Should fuel reduction efforts be focused on smaller areas around the structure, concentrating on the fire impact zone where at least some fuel may be removed?
 - When vegetation is cut, can it be stacked or spread without creating large piles that contribute to the fire intensity problem?
- Fuel continuity
 - Assess vertical and horizontal continuity and how it will impact structure preparation efforts
 - Evaluate vertical fuel ladders that will allow the fire to spread from the ground into the crowns of trees and large brush species
- Wind
 - What is the current speed and direction?
 - Are changing winds expected?
- Terrain
 - What is your position relative to topography?
 - Are you in a chute, chimney, or saddle?
 - ◆ If yes, LEAVE NOW
 - Are you midslope or on top of a ridge?
 - Is wind in alignment with topography?
- Atmospheric stability
 - Is the atmosphere stable or unstable?
 - ◆ Unstable atmospheres can lead to rapid fire growth
 - Are thunderstorms forecasted?
- Fire behavior
 - Is the fire spotting, crowning, or sheeting?
 - What is the rate of spread?
 - What is the current and forecasted flame length and height?
- Other weather considerations
 - What is the current relative humidity?
 - Is there an expected change?

Access - Access to the structure must be safe for suppression resources to enter and exit the area. It must also allow enough time and distance to serve as an escape route to a safety zone or temporary refuge area.

Smaller engines such as type-3 or type-6 engines may be able to access a structure more easily than a type-1 engine or water tender. Resources should scout ahead before committing apparatus to specific locations.

- Is the road surface adequate for the speed necessary?
- Is the road an adequate width?
 - If not, consider removing vegetation along the sides of the roadway, if time permits, to make access feasible for larger engines
- Are there appropriate turnarounds or turnouts?
 - Resources may need to back into driveways under firefighter guidance so that they can pull forward out of a location that becomes inaccessible
 - If vehicles cannot pass one another, implement traffic control
- Are bridges within load limits for fire apparatus?
- Are bridges constructed of nonflammable material?
 - If not, fireproof the bridge or post an engine at the bridge for fire protection
- Are there drainage ditches or culverts that could collapse or create obstacles for the apparatus?
- Are road surfaces adequate for the road grade?
 - If not, consider an alternate route to the structure
 - It is much easier to descend a steep grade than to ascend one
- Is there a safe place to spot apparatus?
 - Could the apparatus be safely used as a temporary refuge area?
 - There should be adequate clearance for anticipated fire behavior
 - Remove overhanging vegetation and avoid power lines, propane tanks, structures that may ignite, and saddles and chimneys
- Do resources have access to an adequate water supply (fire hydrant, pond, swimming pool, water tank) to defend the structure?

Construction/Clearance - Evaluate the structure to determine how it was constructed and what materials were used.

- Is the construction wood siding or shake shingle?
- Have these materials been pretreated with a fire retardant or not?
 - If untreated, shake and shingle roofs will require foam or gel treatment
 - Untreated, these materials are far more flammable than noncombustible roofing or siding such as stucco, brick, or concrete

- If wood or other combustible siding is present, the fire side of the structure may require treatment with foam or gel
- Remove flammable debris from shake or shingle roofs and even composition roofs when possible
- Most rain gutters contain flammable debris and must be cleaned or wetted down
- Are there vent openings, open eaves, or decks with vegetation below?
- Will ember intrusion through attic or foundation vents be a problem?
 - Most residential structures have numerous ember traps such as gable end vents, foundation vents, decks and overhangs, and numerous nooks and crannies
 - Clean decks, especially underneath where leaves and needles accumulate
 - Cover vents if possible
 - If eaves are not boxed, evaluate the attic vent system and take measures to keep sparks or embers from entering the attic by this route
- Are there large glass windows facing the fire front?
 - Windows facing the fire impact zone are a particular concern. Intense radiant heat directed through the window could ignite flammable material inside the structure, even without direct flame or ember impingement
- Do you have access to the interior of the structure?
 - Consider entering to close curtains and windows
 - Remember that structures may be used as temporary refuge areas, so leave doors unlocked
- Is there clearance around structures?
 - Heavier fuels take longer to burn out than lighter fuels, requiring more mop-up and longer resource commitment time
 - It also takes longer to prep heavier fuels to provide adequate clearance for the expected fire behavior and fire front impact
 - Triage efforts should focus on the fire impact zone with the goal of mitigating radiant and convective heat, as well as reducing ember production
- Does the structure have adequate defensible space, based on topography, fuels, and current and expected fire behavior?
- Can defensible space problems be mitigated quickly?
- Does yard clutter or the contents of the garage or outbuildings compromise safety?
 - Outbuildings may contain hazardous materials
- Are there hazardous materials present and should you write them off or protect them?
 - Hazardous conditions, not generally considered structures, must also be triaged and catalogued for future defense preparation efforts

- Do propane tanks, fuel tanks, or power lines have adequate clearance?
- Is the structure surrounded by non-native or ornamental vegetation?
 - It may be just as flammable as native vegetation and should be gelled or foamed if it presents a defensible space problem
- Are the Prep and Go or Prep and Defend tactics an option?

Time Constraints - The final triage variable to consider is time.

- How soon will the fire front impact the structure?
- Is there enough time for an adequate size up of the structure defense problem?
- Is there enough time to mitigate safety concerns?
- Is there enough time and adequate resources to properly prepare and defend the structure before the fire front arrives?
- Is there enough time to retreat to a safety zone, if necessary, if fire conditions change?
 - If not, LEAVE NOW

Stay or Go - After considering all of the facts, categorize each structure as not threatened, threatened defensible, or threatened non-defensible. Based on defensibility, choose a tactical action:

- Check and Go
- Prep and Go
- Prep and Defend
- Bump and Run
- Fire Front Following
- Anchor and Hold
- Connect the Dots
- Tactical Patrol

Structure triage will help determine if resources are able to stay at a structure or if they will be forced to leave. Time is a critical factor during triage. At first glance, a structure may appear to be defensible with little or no intervention. Suppression resources must always remember that as fire behavior changes, the classification of a previously triaged structure may change as well, leaving no choice but to retreat to a safety zone or temporary refuge area.

Top Down Structure Triage

Although it sounds simplistic, the concept of top down triage ties numerous principles together and provides a systematic analysis of the structure and the surrounding ignition zone to aid in the rapid sorting of structures. Triage must be completed without hesitation, as fire progression in the WUI does not often afford us the luxury of time. This triage method brings focus and confidence that all structures are analyzed with specific criteria and in a consistent manner.

The Sky

Start by reading the smoke. Observe the color, density, definition, direction, and amount of rise of the smoke column to help you determine not only the fuel type but also the atmospheric and wind conditions. Where is the smoke column going? How is it behaving? Where are the embers going to fall?

If there is no visible smoke in your area, then look to the clouds. Observing the cloud shape and movement, you can begin to estimate the fire's current potential. You cannot safely commit to structure defense, even with defensible space and favorable construction, if the indicators of the fire's potential places you in the path of the proverbial "freight train."

Overhead Fuels

Look at the amount of not only fuels present directly above the structure, but also the aerial fuels in the surrounding area. Fuel arrangement and continuity in the aerial fuels can be just as problematic as fuels on the surface. With the right combination of overhead fuels and a weather forecast that identifies potential fire movement, the house may not be a safe location.

The Roof

The roof of a structure in the WUI is its first line of defense. The type of roofing material is the most critical, but also important is the shape of the roof. Note the amount of valleys and pitch steepness to help determine where dead and dry vegetation debris accumulates. As wind currents flow over and around structures, natural eddies are formed and are responsible for depositing this debris in certain locations. These locations are where embers will also be deposited.



It is not the direct flaming front that impacts and destroys the structures, it is the ember shower produced by the fire. Ember showers transport and deposit embers in distant locations, remain undetected, and then grow to consume structures.

Gutters

Gutters, or specifically the amount of vegetation material they harbor, are critical pieces of information when triaging. Firebrands can quickly become seated in the light fuels that collect in gutters and burn undetectable until it involves most of the roof and attic. Removal of the fuel is always the best course of action; however, if time does not permit you an opportunity to clean the gutters out, you may have to wet the fuel with enough water, given the conditions, to lower the possibility of a firebrand finding a receptive fuel bed.



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The Eaves and Soffits

The eaves are a significant heat trap and collection point for ember turbulence during a fire's approach to a structure. The pathway is usually the attic vents. As embers are blown in, detection of fire presence in the attic is nearly impossible due to drift smoke until it is well established. A thermal imaging camera can aid in the detection of heat both inside and outside of the attic. The presence of enclosed soffits or small diameter screens over vents can greatly improve the structure's survivability.

Siding

Like the roof, siding materials have different strengths and weaknesses. The more likely fire will walk up the siding, the lower the chances for the structure to survive alone. Note the amount, placement, construction materials, and privacy coverings of the windows and doors within the various walls. Much like how skylights weaken the roof, windows and doors weaken the walls. Once these features fail, fire will enter the structure and quickly involve interior contents.

Also, note any heat traps around the structure. Decks and exposed crawl spaces are examples of problematic heat traps. These areas, much like the attic, can become perfect areas to trap embers and with the available fuel, allow hidden fires to grow undiscovered until the house is significantly involved.

Surface Fuels

Generally, your initial observations during triage will be the fuels directly adjacent to the structure. This almost automatic response is logical because these fuels provide the fire's best access to the structure. Some key factors to identify in surface fuels include:

- Arrangement
- Continuity
- Moisture content
- Size
- Type/class
- Volatility
- Age
- Native or ornamental
- Loading
- Density
- Yard accumulation

This area is also the circle of ignition potential and is used to determine the classic idea of defensible space. Do not forget, however, the simple things like the location of fences or landscaping features that provide flammable pathways to the structure.

Placement in the Topography

Of all the areas for consideration during top down triage, the structure's location in the greater topography needs to be given the most thoughtful analysis. Regardless whether all previous steps of

your triage were positive, if the structure is placed in a location that the fire’s approach would decimate it, this structure is no place to stay. Recognition of the topography is possibly the most difficult area of consideration for several reasons - unfamiliar with the area, operating at night, or been given limited briefing information. Recognition of topography can be accomplished in the most unfamiliar country using inexpensive and readily available technologies in the form of smart phone applications and handheld GPS systems. If you intend to respond to and participate in wildland incidents outside of your familiar surroundings, consider acquiring one of these technologies to guide your decision-making. Intuitive fire behavior analysis in unfamiliar topography has led to many injuries and fatalities on wildland fires. For you to make successful triage and crew safety decisions, determination of the path of the fire’s approach is mandatory. If the approach is in full alignment with fuel, weather, topographic variables, and there is a complete lack of a safe refuge site, the structure defense assignment must be declined.

Structure Defense Tactical Actions

Tactical terminology has been developed to create a common language that describes actions intended to put firefighter safety ahead of structure defense assessment. Because firefighter and civilian safety is always the first consideration, any tactical action should reflect that concern. There are eight tactical actions used to defend structures in the WUI environment. The three primary tactics are geared toward defending a single structure and should be used to ensure the correct and safe application of individual secondary tactics. The use of secondary tactics will change throughout the operational period as fire conditions dictate.

PRIMARY TACTICS	SECONDARY TACTICS
<ul style="list-style-type: none"> ▪ Check and Go ▪ Prep and Go ▪ Prep and Defend 	<ul style="list-style-type: none"> ▪ Bump and Run ▪ Fire Front Following ▪ Anchor and Hold ▪ Connect the Dots ▪ Tactical Patrol

Primary Structure Defense Tactical Actions

The three primary tactical options when considering structure defense preparation actions: Check and Go, Prep and Go, and Prep and Defend. Use these three tactics throughout the fire progression, even while using other secondary tactics. For example, in a Bump and Run scenario, suppression resources must still evaluate each individual structure and determine if one of the primary tactics will be used. Focus your primary tactics on defending a single structure.

Check and Go

Check and Go is a rapid evaluation to check a structure for occupants at risk. In some instances, it may be necessary for firefighters to assist with evacuations prior to leaving. This tactic is appropriate when fire spread, intensity, lack of time, or inadequate defensible space prohibits resources from taking action to defend the structure.



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Check and Go should be used when there is no safety zone or temporary refuge area available near the structure. It is a hasty evaluation due to expected fire behavior and fire impact time with the purpose of civilian life safety and a quick evaluation of the structure for follow up action after the fire front passes.

Resources should contact any occupants at the structure, advise them of any evacuation warnings or orders, and assist with potential evacuations if it is still safe to do so. Document any civilians who choose to stay at the structure and relay the information to a supervisor.

The most mobile resources should be assigned to Check and Go operations. Check and Go is not suitable for fire crews or dozers because of the need for mobility and rapid withdrawal from the structure site.

Prep and Go

Prep and Go is an appropriate tactic to use when it is not safe for resources to remain when the fire arrives, but there is enough time to safely complete some structure defense preparation before resources leave the area.

It is a quick strike maneuver where bare minimum tasks are quickly addressed by resources who may return after the fire front passes. Evaluate the structure for follow-up action when additional resources become available, the fire front passes, or fire behavior intensity has diminished.

Use Prep and Go when no safety zone or temporary refuge area is present or when fire spread and intensity are too dangerous to stay in the area when the fire front arrives. Prep and Go should be considered for defending structures in heavily vegetated areas with minimal clearance, structures upslope from the fire, and structures located in chimneys and saddles.

To prepare a structure for defense, firefighters should:

- Reduce or treat flammable vegetation from around the structure (a minimum 100 feet or as needed)
- Remove, reduce, or treat other flammable items (wood piles, patio furniture, decks, propane tanks, outbuildings, hazardous materials)
- Treat flammable building construction features (roof, siding, eaves) with foams or gels
- Remove flammable materials from roofs and gutters
- Cover vents if possible to keep sparks and embers out of the structure
- Consider entering the structure to close curtains and windows
- Remember that structures may be used as temporary refuge areas, so leave doors unlocked

Depending on the situation and resource availability, structure prep time will vary and you should plan for a hasty retreat. When implementing the Prep and Go tactic, post lookouts and establish decision points to ensure adequate time for withdrawal.

Prep and Go is well suited for engine strike teams and taskforces. Strike team and taskforce leaders should familiarize themselves with the target area and sketch maps showing the location and address



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of structures. WUI pre-plans and maps, prepared prior to the incident by local agency personnel, should be distributed to strike team leaders and line supervisors to facilitate area orientation.

Resources should contact any occupants at the structure and advise them to evacuate if it is still safe to do so. Document any civilians who choose to stay at the structure and relay the information to a supervisor.

Prep and Defend

Prep and Defend is an appropriate tactic to use when a structure is threatened but, based on forecasted fire behavior, it will be relatively safe for resources to defend the structure when the fire front arrives. Use Prep and Defend when there is adequate time to safely prepare the structure for defense and ready access to a safety zone or temporary refuge area. Firefighters must maintain situational awareness and be prepared to move to the temporary refuge area or withdraw along the escape route to the safety zone when necessary.

Firefighters will both prepare the structure for defense (remove flammable vegetation, apply foams or gels) and stay onsite to defend the structure as the fire front passes.

Prep and Defend is an ideal multiple resource tactic especially in neighborhoods containing small lots and homes close to each other. In these areas, numerous tasks may be coordinated at the same time over a wide area.

If the structure is deemed defensible, all safety concerns have been mitigated, and enough time exists to perform any structure preparation tasks, consider the following:

- Spot apparatus using the structure as a shield from radiant heat
- Immediately select at least one temporary refuge area near the structure
- Brief personnel on the structure defense plan and a safety contingency plan, discussing fire behavior and the tasks that must be completed prior to fire front impact
- Deploy only as many hoselines as necessary for the forecasted fire behavior
- Identify the engine protection line
- Commence structure defense preparations and monitor the main fire

Parcels with multiple structures or large structures might require additional resources to defend. If there is not enough time or resources to defend every threatened structure, prioritize the order of protection among the assets at risk and order additional resources as needed.

Secondary Structure Defense Tactical Actions

Secondary tactics are more specific and support the goals of the primary tactics. They generally require more resources, coordination, and supervision, and cover a wider operational area.

Bump and Run

Bump and run is a defensive tactic used when fire front impact is imminent or the fire is already burning structures and there are not enough resources to effectively take perimeter control action. It is an offensive tactic when resources are steering the head of the fire to a desirable end point.



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When using the Bump and Run tactic, resources move at or near the fire front, often in the spotting zone ahead of the fire, to extinguish spot fires and hot spots, and to defend as many structures as possible. Bump and Run may be effective in the early stages of an incident when the resource commitment is light and structure defense is the priority.

Bump and Run may also be used on fast-moving incidents when there are adequate resources available, but when incident objectives dictate controlling or steering the head and shoulders of the fire to a desired endpoint. Perimeter control and structure defense preparation may be secondary considerations with the Bump and Run tactic. Resources must constantly identify escape routes to safety zones or temporary refuge areas as they move with the fire front.

This tactic is very useful when resources are able to maintain their mobility. Resources must be able to remain agile and transition back and forth between perimeter control and structure defense as needed. Fire line supervisors and strike team/taskforce leaders must realize that Bump and Run may place resources in front of the advancing fire front and exercise extreme caution. With low to moderate rates of spread, resources may utilize other tactics in conjunction with Bump and Run, establishing multiple anchor points and preparing the endpoint for eventual fire front impact. Control lines in front of the fire should be identified and prepared with dozers and fire crews enabling the Bump and Run resources to direct the fire to secured control lines. The endpoint should be reinforced with retardant drops, control lines, and coordinated firing operations.

Bump and Run is well suited for Type 3 engine strike teams and taskforces. Engine strike teams and taskforces engaged in Bump and Run must understand the tactic and the mission. Engines should utilize WUI hose brackets for rapid deployment and redeployment of hose. Establishing long hose lays is not part of the Bump and Run tactic. Suppression efforts should be limited to extinguishing spot fires, hot spots, and fire perimeter around structures and then moving on to the next structure.

Resources that finish an assignment should leapfrog around resources to keep the process moving. Close communication is essential to move Bump and Run resources in the desired direction and to monitor incident progress.

Dozers may be effective during Bump and Run actions. They can be used to control the perimeter, control large spot fires, construct firebreaks and control lines around structures, or enclose areas of multiple spot fires. Fire crews, if they are able to remain mobile, may be useful during Bump and Run actions, but are generally ineffective due to their lack of mobility.

When adequate resources are available, engine strike teams or taskforces should be deployed behind Bump and Run resources to extinguish any spot fires and perimeter fire still threatening structures using the Fire Front Following tactic, the Connect the Dots tactic, or reverting to direct attack perimeter control tactics.

Fire Front Following

The Fire Front Following defensive tactic allows resources to defend structures while staying *behind* the fire front in the black, normally one of the safest places on a wildland fire. This fast-paced tactic requires engines to continuously move just behind the flame front in order to extinguish fires around structures before those fires can ignite the structure.

The main goal of Fire Front Following is to extinguish spot fires and hot spots burning around structures, and to defend as many structures as possible from direct flame impingement and radiant heat. Resources can also check for civilians who did not evacuate and render aid if needed.

Fire Front Following is commonly used in conjunction with Check and Go, Prep and Go, and Bump and Run. Fire front following resources may recheck structures that were previously classified as Prep and Go or Check and Go during earlier structure triage evolutions.

Fire Front Following can also be used when there is insufficient time to safely set up ahead of the fire or the fire intensity would likely cause injury to personnel located at the fire front.

During the early stages of an incident, or when there are insufficient resources on an incident, single resource engines may use the Fire Front Following tactic to defend structures using mobile attack or hoselines. Engine strike teams and taskforces may also be deployed to cover large geographic areas quickly. Hand crews can be very effective during Fire Front Following if the fire behavior and rate of spread are not extreme. Resources should utilize foams and gels to enhance knockdown and mop-up efforts.

Depending on the terrain, dozers may be able to construct perimeter control lines; however, dozers may cause unnecessary destruction in and around structures.

Air tankers may not be effective due to poor visibility, concentrated groups of civilians and firefighters in the area, and numerous homes and other structures in the drop zones. Helicopters can be used for hot spotting around structures, pinpointing their drops to avoid personnel and structures.

As with other defensive tactics, you must maintain situational awareness and be prepared to switch to offensive strategies and tactics as soon as conditions change or sufficient resources arrive on scene. Fire Front Following may be followed up with resources assigned to Tactical Patrol to ensure no secondary structure ignitions.

Anchor and Hold

Using the Anchor and Hold tactic, resources utilize established control lines and large water streams in conjunction with fixed water supplies in an attempt to stop fire spread from structure to structure in communities or subdivisions. The goal is to extinguish structure fires, protect exposures, and reduce ember production.



Anchor and Hold

The Anchor and Hold tactic is more effective in urban neighborhoods where the fire is spreading from structure to structure. Anchor and Hold is often utilized in conjunction with the Bump and Run tactic. Bump and Run is used to extinguish spot fires down wind, while Anchor and Hold is used to prevent structure-to-structure ignition and ember production.

Establishing an Anchor and Hold line requires considerable planning and effort, and is an



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excellent tactic for engine strike teams and taskforces. One engine from a strike team or taskforce must be committed to a dependable fixed water supply, either a hydrant or drafting source, and supply a hose lay or supply line that covers the target area. The fixed engine must be spotted in a safe area and must not be threatened during fire front passage if the tactic is unsuccessful.

Mobile engines from the strike team or taskforce engaged in individual structure defense actions or perimeter control are able to resupply from this water source as well. Mobile engines should be prepared to redeploy to secondary control lines should the fire escape the Anchor and Hold line. Ground resources, such as engine companies and fire crews, should staff hoselines and be prepared to extinguish hot spots, fire perimeter, and structures.

Connect the Dots

Using the Connect the Dots tactical action, resources assigned to structure defense operations effectively stop forward fire spread in a particular area. This area becomes a “dot” in the overall perimeter control effort. Connecting controlled portions of the fire perimeter, connecting one dot to another dot, is the foundation for this approach. Connecting the controlled section of fireline at one structure, where the fire has been stopped, to a driveway or road where the fire is holding, can be an effective method to contain portions of the fire perimeter.

All structure defense operations should emphasize perimeter control as part of the structure defense plan; stopping fire spread significantly reduces the threat to structures. Resources assigned to structure defense should not only defend structures, but also take full advantage of perimeter control opportunities as they arise. It is unacceptable to simply defend a structure when there is also an opportunity for the same resources to control portions of the fire perimeter.

Using a combination of Connect the Dots and direct attack (“one foot in the burn”) and indirect attack (using barriers such as ponds, canals, roads, and cultivated fields as part of the control line), resources can gradually connect sections of the fire perimeter to stop the fire’s spread around structures.

Resources engaged in structure defense operations may also encounter numerous spot fires around a target structure. Unless completely overwhelmed by extreme fire behavior, resources defending structures should use Connect the Dots to take action on these spot fires, while simultaneously defending their assigned structure. Resources cannot confine their activities to only the structures and allow nearby spot fires to grow into larger fires, which in turn will threaten downwind personnel and additional structures.

Connect the Dots is an effective tactic to contain areas of multiple spots and connect those areas forming a contained perimeter. Firing operations should be a part of this tactic to create a “black line” when applicable.

Almost every type of firefighting resource should be considered for an assignment using Connect the Dots. Multiple single resource engines coordinated and supervised by the IC are as effective as a strike team or taskforce. Engine crews must pay close attention to their surroundings and be prepared to change tactics from structure defense to perimeter control. Communication between resources is critical to share intelligence on where the gaps in the perimeter line are located. Engines



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should use mobile attack and progressive hose lays; however, do not rule out forming engine companies into hand crews for hand line construction.

Fire crews are also well suited for this tactic. Line supervisors should remember that hand crews, once deployed, are not easily redeployed over long distances. Hand crews engaged in Prep and Defend tactics may easily change tactics to perimeter control, constructing hand line to connect areas of uncontrolled perimeter line to secured areas.

Dozers should be deployed to corral areas of multiple spot fires or connect open perimeter line to secured line over long distances. There is always the threat of damage to private property and infrastructure when dozers work in the WUI environment. Exercise caution to avoid damage without compromising safety and the control effort.

Fixed wing aircraft use may be limited depending on how much open line there is between areas of secured fire perimeter. Helicopters are better suited for this close-quarters tactic. Ground resources may need to communicate directly with helicopters to cool hot sections of line then move on to the next area of concern.

Tactical Patrol

Initiate Tactical Patrol after the main fire front has passed and flames have subsided but when the threat to structures from smoldering or creeping fires remains. Use this tactic to extinguish hot spots or secondary structure ignitions, and address safety issues such as downed power lines, weakened trees, and other hazards. The key element of Tactical Patrol is to remain mobile and continuously monitor the tactical area while taking appropriate actions to defend structures and secure perimeter lines. Numerous structures in the WUI are destroyed after the main fire front passes a threatened area.

A Tactical Patrol should be assigned to areas exposed to downwind ember showers and areas where the fire has passed but the structures remain at risk. Vigilance and effective suppression actions must continue focusing on residual burning such as woodpiles, lawn furniture, and secondary structure ignitions caused when wind stirs up embers in attics and eaves, under decks, and in other hidden locations. Identify and mitigate hazards such as islands of unburned vegetation, burning power poles, downed power lines, fire weakened trees, and rolling rocks.

Tactical Patrol is well suited for all types of taskforces and engine strike teams but especially Type 1 and Type 2 engine strike teams. Strike team/taskforce leaders should deploy their resources over a wide area and encourage personnel to quickly recon their assignment areas on foot. Extinguish hot spots and creeping fires immediately and monitor throughout the operational period. Resources should gain entry into any structure that may be involved in the fire to ensure it is completely secured.

Fire crew strike teams should be deployed to grid the burned area and extinguish any hotspots they find. Fire crews should work in tandem with engines but should be encouraged to use backpack pumps as well as hoselines. Dozer strike teams are limited during patrol operations, but should be available for escape fire contingencies.

Tactical Patrol is a continuous process of frequently rechecking structures, even those categorized as not threatened to ensure that the fire is completely suppressed. You must remain vigilant to prevent reignition.

Tactical Combinations

With most WUI incidents, firefighters will use a combination of tactics in the same area on different structures at the same time. Resource capability and availability, the number of structures threatened, and fire behavior will ultimately determine which combinations resources will use.

For example, fire breaks out on a five-house cul-de-sac on a ridge. An engine strike team is assigned to the subdivision. One structure is partially involved in fire so firefighters use Check and Go to assist occupants in a hasty evacuation. At another house, flames are already burning through the backyard and fire impact is eminent. Firefighters utilize Prep and Go by applying foam to the house and the vegetation surrounding it. At the third house, fire intensity is too great for firefighters to directly engage. They will need to utilize Fire Front Following after the main fire burns through. The fourth and fifth structures at the end of the cul-de-sac have adequate defensible space and there is enough time for firefighters to complete some preparation before the fire front arrives. They will use Prep and Defend on these structures.

STRUCTURE DEFENSE CATEGORY	APPROPRIATE TACTICAL ACTIONS
Not Threatened	Tactical Patrol
Threatened Defensible	Prep and Defend Bump and Run Anchor and Hold Connect the Dots Tactical Patrol
Threatened Nondefensible	Check and Go Prep and Go Fire Front Following Tactical Patrol

Guidelines for Structure Fire Engagement in the WUI

Each situation is different and no clear operating guideline can be used to provide absolute direction regarding when to engage or not engage a burning structure. ICs and officers need to evaluate the amount of resources available, structures burning, and cause and effect of leaving or extinguishing the structure in order to have a high probability of success. For example, in some cases it may be more important to focus on perimeter control in order to reduce the spread of fires into other structures. In other cases, the burning structure may contribute to fire spread by producing embers and resulting spot fires.

The decision to engage a partially involved structure in the WUI is subjective. The bottom line is whether the effort will accomplish the goal of stopping the spread of the fire from house to house or eliminating the production of embers. A prolonged engagement with limited resources at the expense of continued perimeter control action or defense of defensible structures must be



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evaluated. If an involved structure cannot be extinguished safely and quickly with limited resources, it must be abandoned.

Structure involvement is more than assigned resources can handle	Do not engage
No TRA for apparatus placement at the involved structure	Do not engage
Structure has multiple areas of fire involvement	Engage with caution
Less than 25% of roof involvement	Engage
Fire confined to exterior siding	Engage
Outbuildings threatening other exposures	Engage with caution, determine the presence of hazardous materials

Perimeter Control Tactics

This is the most commonly used tactic on wildland fires. Roads, rivers and other barriers can be used in conjunction with constructed lines, whether hand lines, dozer lines, water or foam lines to create a control line around the entire perimeter of the fire. Firing operations are often used to reinforce these control lines. In the end, a physical barrier exists completely around the fire's perimeter.

Perimeter control attack methods are applied actions used to accomplish the overall objectives that were identified in the strategy.

Direct Attack

On a direct attack, you work directly on the fire's edge and includes any action applied directly to the burning fuel such as wetting, smothering or chemically quenching, or physically separating the burning fuel from the unburned fuel. The type of fuel and flame length will dictate if you can use a direct attack.

Direct attack is most commonly used on smaller fires with lighter fuels, and on the heel and flanks of larger fires.

FIRE BEHAVIOR HAULING CHART	
FLAME LENGTH	INTERPRETATIONS
Less than 4 feet	<ul style="list-style-type: none"> • Fires can generally be attacked at the head or flanks by firefighters using hand tools • Hand line should control the fire
4 to 8 feet	<ul style="list-style-type: none"> • Fires are too intense for direct attack on the head with hand tools • Handline cannot be relied on to hold the fire • Dozers, tractor-plows, engines, and retardant drops can be effective
8 to 11 feet	<ul style="list-style-type: none"> • Fire may present serious control problems: torching, crowning, and spotting • Control efforts at the head will probably be ineffective
Over 11 feet	<ul style="list-style-type: none"> • Crowning, spotting, and major fire runs are probable • Control efforts at the head of the fire are ineffective

The key to using this type of attack is whether the fire's intensity allows the firefighters to work directly on the fire's edge. Unless special situations dictate otherwise, anchor your line and start construction. There are several approaches to performing a direct attack on a WUI fire – flanking, pincer, tandem, and envelopment.

ADVANTAGES AND DISADVANTAGES OF DIRECT ATTACK	
ADVANTAGES	DISADVANTAGES
A minimal area is burned; no additional area is intentionally burned	Firefighters can be hampered by heat, smoke, and flames
Safest place to work; firefighters can usually escape into the burned area	Control lines can be very long and irregular because the line follows edge of the fire
Full advantage is taken of burned out areas	Firefighters may accidentally spread burning material across the line
May reduce the possibility of the fire moving into the crowns of the trees or brush	Does not take advantage of natural or existing barriers
Eliminates the uncertain elements of burning-out	Usually more mop-up and patrol is required

Indirect Attack

Indirect attack is a method of suppression in which the control line is located some distance away from the fire's active edge. This attack is generally performed on a fast-spreading or high-intensity fire and uses fabricated or natural barriers and a constructed control line. The intervening fuel is then burned out or the main fire is allowed to burn up to the fabricated or natural barrier depending on fire conditions.

In this method, you select the "ground" on which to meet the fire to gain the greatest advantage in suppression and control. Topography, fuel type, fire behavior, and available firefighting resources will dictate fireline placement. Since an indirect attack is used when the fire is burning too hot for a direct attack, it is the method of choice on most large fires or anytime you confront a very fast and hot-burning fire. Under normal weather conditions, you may find an indirect attack best during the heat of the day, and a direct attack at night.

ADVANTAGES AND DISADVANTAGES OF INDIRECT ATTACK METHOD	
ADVANTAGES	DISADVANTAGES
Takes advantage of natural or existing barriers	More acreage will be burned
Can locate the control line along favorable topography	May be dangerous to firefighters; they are working some distance from the fire and cannot observe it
Firefighters work out of smoke and heat	Fire may cross the control line before it is burned-out
Allows more time to construct the control line	Burning-out may leave unburned islands
Allows the line to be constructed in lighter fuels	Brings into play the dangers of burning-out
May be less danger of slopover	Fails to take advantage of the control line that has already burned-out

It is a common practice for an Incident Commander, after sizing-up the fire situation, to decide to use the direct method on one portion of line and use the indirect method on another. Match the method to the problem. Such strategy becomes more common as the fire grows in size and there is a greater variation in weather, fuel types, and topography.

Parallel Attack

Parallel attack is primarily used by hand crews and dozers and is especially effective when you can combine engine companies, bulldozers, and hand crews together in a coordinated attack. It works best on relatively light fuels and small fires where you can maneuver to your advantage, incorporating spots or pockets; at the base of slopes, when the fire is above you; and only when you have adequate forces. The parallel attack constructs a control line parallel to, but further from the fire's edge. This allows you to work close to the fire's edge, but be able to drop back when the intensity increases. A parallel attack control line is usually constructed from 5 to 50 feet from the fire's edge. The control line is immediately burned-out after construction. You "carry" the fire as you go; this is crucial to the success of a parallel attack.

The parallel attack differs from the indirect attack in that the control line is burned-out as you proceed. Burning out should be coordinated with adjoining resources with good control lines in place to meet the weather conditions. Be cautious using this tactical action if there is any danger of not being able to burnout the fuel between the fire and the control line.

ADVANTAGES AND DISADVANTAGES OF THE PARALLEL ATTACK METHOD	
ADVANTAGES	DISADVANTAGES
Firefighters can drop back from the fire's edge, getting away from the smoke and heat	Fire may cross fireline before it is burned-out
Can cut control line across pockets and fingers	Burned area is not readily available as a safety zone
Crews work out of the heat and smoke and on shortened control lines	Fails to take advantage of fireline that has burned-out on its own
Usually shorter and straighter line	Will increase the area burned
Less chance of slopover because the attack takes advantage of fabricated or natural barriers	The need to burnout unburned fuel between the crew and fire

Choosing the Correct Attack Method

The attack method chosen for an incident is the result of the chosen strategy. An offensive, direct attack should employ the resources best suited for the task. Where dozers are more appropriate, they are the better tool. However, when topography or fuels prohibit their use, consider deploying hand crews. In light fuels where mobile attack is possible, utilize Type 3 engines. Support direct line construction efforts with aircraft. When a defensive, indirect attack is chosen, utilize available natural and artificial fuel breaks to hasten control line construction and burnout operations. Use roads, ridges, and wide drainages for locating control lines. Locate indirect lines away from heavy fuel beds and topographical features that adversely affect fire behavior and hamper line construction efforts.

Direct fireline supervisors to deploy their resources where needed while following the incident plan. Get feedback from them on whether the tactics are working or not, on resource needs, and on problems and potential problems that may affect the plan.

OBJECTIVE	STRATEGY/ MODE OF OPERATION	TACTIC	TACTICAL ACTION
Keep the fire north of County Road 6	Offensive	Perimeter control	Direct attack on the right flank
Keep the fire east of Meadow Park	Offensive	Structure defense	Anchor and Hold
Keep the fire south of County Road 8	Defensive	Perimeter control	Indirect attack on the left flank
Defend structures on Parker Ridge	Defensive	Structure defense	Prep and Defend

Perimeter Control Tactical Actions for Direct Attack

Flanking

Flanking is the most common direct attack and starts simply at an anchor point and progresses along one or both flanks of the fire. The fire is contained and extinguished as forward progress is made. Make sure the fire is contained before moving forward so the fire does not slopover. Resources are assigned to a flank depending on the fire's intensity, values at risk, natural or fabricated firebreaks, or resource type.

Pincer

This form of direct attack involves units working in a coordinated attack. Pincer can be performed on any size fire, but is most effective on small fires. This task is primarily used with engines on fast-moving fires, although using dozers can also be very effective. Engines, crews, dozers, aircraft, or any combination of resources attack along both flanks of the fire with the intention of eventually encircling or pinching off the head of the fire.

Both flanks are attacked at the same time. This can be from the head or heel of the fire. The point from which the engines start the attack is the anchor point. The suppression effort moves up or down the flank in a coordinated effort, stopping when the fire is contained.

Tandem

Tandem is another form of direct attack and involves two or more resources (engines, air tanker, bulldozer, hand crew, etc.) working in tandem. The lead resource takes the heat out of the fire and the second resource follows behind, picking up hotspots and securing the line. The lead resource can move faster knowing the tandem resource will pick up any hotspots. After one resource ties-in with the other, they leapfrog ahead allowing the lead resource to get a break from the heat and smoke. For this type of task to be successful, all resources must work in concert with good communication and teamwork.

Envelopment

Envelopment is a direct attack on the fire's perimeter at several places, at one time, with numerous anchor points. Envelopment is very effective when protecting structures in a WUI fire. The critical areas are attacked first using the hotspotting technique, then the resources move toward each other ("connect the dots"), tying the lines together.

Hotspotting

Hotspotting is the stopping of the spread of hot-burning points along the fire's edge. These spots are usually in the form of fingers, racing ahead of the main fire. The purpose of this dangerous task (working without an anchor point at the head of the fire), is to check these rapidly advancing fingers until control lines are constructed. Hotspotting is also used to defend property and resources of high value. Resources assigned to hotspotting must use extreme caution. Only the most experienced personnel should be utilized.

This task utilizes small crews that move out in front of the fire. Their sole mission is to slow the progress of the fire. Helitack crews and retardant drops are often used for this purpose. The firefighters "scratch" a control line around hotspots and fingers of fire. These lines most likely will not be part of the final control line. Close air support should be considered for resource protection.

Perimeter Control Tactical Actions for Indirect and Parallel Attacks

Control Lines

Control line is a comprehensive term used for all the constructed or naturally existing fire barriers and treated fire edges used to control the fire. Some examples of existing control lines include streams, lakes, ponds, rockslides, areas of sparse fuels, roads, canals, or previously burned (cold) control lines.



Control lines are constructed to control the spread of fire using a variety of methods and equipment. Control line refers to any cleared strips or portion of a fireline from which flammable material has been removed by scraping or digging down to mineral soil.

A control line is constructed for two purposes: 1) to create a “safe strip” to start burning out to remove fuels between the control line and advancing fire and 2) to isolate the burned area from the unburned area. The goal is to create a gap in the flammable materials, which prevents the fire from continuing to spread.

Because you want to put this line in only once, ask yourself, “Where should it be placed?” “How wide does it have to be?” “What method will you use?” “Do you have the firefighting resources to construct and hold the line?” The success of your attack is often dependent on where the control line is placed and how it is constructed.

Control Line Construction Considerations

In wildland firefighting, the construction of control lines is often the primary goal. You may encounter a critical situation such as saving lives and/or property, but ultimately, constructing and holding a control line is your primary mission. The following are some factors that will influence the type of control line you construct.

- ❖ ***Personnel safety:*** Inexperienced, minimally qualified, or unfit/fatigued personnel may not recognize hazards, risks, and changing conditions that could lead to near miss or fatal consequences.
- ❖ ***Values at risk:*** The value of what is being threatened by fire has a significant influence on where and when you will construct a control line. If a fire is moving toward homes, you may place a priority on constructing a control line to protect them first. The key is to know the values at risk and to prioritize them accordingly.
- ❖ ***Land use restrictions:*** If an area has been designated wilderness, involves archeologically sensitive materials, or if the landowner has special restrictions, you may be limited in placement and type of control line you construct. If there are such restrictions in your area, become familiar with them. It will be imperative to ask permission before considering line construction.
- ❖ ***Terrain features and access:*** You may be restricted from an area by the terrain; it may be too steep for bulldozers or unsafe for hand crews to work. The terrain may be too rocky for a mobile attack with engines. Alternatively, the fire may be deep in a narrow canyon where air tankers cannot safely operate. Unfavorable terrain features may require your retreat to areas that are more favorable.
- ❖ ***Fire behavior:*** Flame length, intensity, and resistance to control will have a significant influence on control line construction width.
- ❖ ***Ability to hold:*** You oftentimes will feel the pressure to construct a line quickly, however focus on constructing a line that will contain the fire.

Types of Control Lines

A control line is an inclusive term for all constructed or natural barriers and treated fire edges used to control a fire. ICs must consider identifying both primary and secondary control lines.

- ❖ ***Dozer line:*** Constructed using bulldozers or tractor-plows. In lighter fuels, other types of mechanized equipment, such as graders and scrapers.



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- ❖ **Hand line:** Constructed using hand tools.
- ❖ **Hot line:** A line that still has active fire along it.
- ❖ **Open line:** Refers to an open fire front, where no line has been constructed.
- ❖ **Retardant line:** Usually constructed by an air tanker or helicopter. Follow-up ground action is required at all times.
- ❖ **Scratch line:** A hasty, narrow line cut in the fuels to temporarily stop the spread of the fire. It can be widened later.
- ❖ **Wet line:** Constructed using water or foam and used to extinguish the flame front or as a safe strip to burn from.

Control Line Placement Considerations

Line placement is critical to the containment and control of the fire. Selecting line placement may be as simple as using roads, trails, or other existing barriers. These visible control points or landmarks where the fire will be contained is known as "building the box." Alternatively, it may be quite complicated, such as when you have to deal with heavy fuel concentrations, steep topography, or certain land use restrictions. There are several simple principles of control line placement.

- Utilize natural or existing barriers
 - Use roads, trails, streams, lakes, rock outcroppings, or any other break in the fuel
 - Use them only if they will help you
 - The key is not to construct a line if a barrier already exists
- Go around heavy fuel concentrations
 - If possible, keep your control line in the lightest fuels possible
 - Do not make the task of line construction and mop-up any harder than you have to
 - Avoid snag patches
 - Burning snags will throw firebrands into the area and across control lines
- Include spot fires in your control lines
 - If an area is saturated with spot fires, construct your line around all of them and burnout
- Keep the line as straight as possible
 - The key here is to avoid sharp turns in your line, however some turns and bends are inevitable
 - Bends, sharp turns, and corners put more fuel closer to the burning fuel
 - Fire is more likely to cross control lines at turns and bends
 - Construct sweeping turns or widen the line
 - Keep a special watch on these areas, especially when the fire is still active
- Place the line close to the flame front
 - This action tends to keep the fire smaller
 - It is also much safer to work close to the "black"; you can use it as a safety island

- Place the line at the base of a hill
 - Avoid sidehill control lines to reduce the need for an undercut line to catch burning material that may roll down the hill
- Place the line on the backside of a ridge
 - You can construct a narrower line because the heat from the advancing fire will be less likely to cross the control line
- Take advantage of sparse fuels for placing the line
 - Intensity of the fire will be less
- Plan for fire spread
 - Allow enough time and distance to construct, burn out, and hold the line
 - If you do not plan ahead, all of your effort will be wasted

Control Line Width

The width of the control line is dictated by the fuel, topography, and fire behavior. As a rule, the control line should be at least 1½ times as wide as the predominant fuel is tall. In areas where you normally expect extreme fire behavior, the width of the control line should be two or more times the fuel height. Many times control lines will have to be much wider, compensating for expected flame length and wind direction. Fire can cross a control line in several ways. The potential for one or more of these events will dictate line width.

- Radiant and convective heat may ignite fuels outside the line if it is too narrow or does not have adequate overhead clearances
- The fire may cross a control line that has not been cut to mineral soil
- Burning snags may fall and cross the line
- Fire may pass under a control line by burning along a buried tree root

Firing Operations Awareness

The following information is intended as an overview only for firing operations you may encounter at a wildland fire. The use of fire to fight fire is very common in wildland urban interface firefighting. While common, it is also extremely hazardous and involves a high degree of liability. You should only engage in firing operations if you have been trained and qualified.

Firing entails the starting and spreading of fire from a control line toward the fire's edge. You may witness the use of a wet line, road, stream, or constructed control line as the base of this operation. Fuses, drip torches, matches, helitorches, or most any ignition device can be used to start a firing operation.

The objectives of burnout are used as a direct method of attack; to strengthen, widen and secure control lines; to reduce the required holding force; to reduce mop-up and the need to cold trail; to cut across fingers, incorporate spot fires, move a line to light fuels, or utilize natural or existing barriers; and to provide safety zones. It is sometimes be used to create a safety zone and escape routes.



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Firing operations must not adversely affect the actions of other firefighting forces. Keep those around you informed if firing operations have been authorized. If not, other firefighters may see the firing operation and think it is a flare-up or slopover. An unwelcome retardant drop has stopped many firing operations.

Some general rules for firing operations:

- Firing operations must not jeopardize safety or adversely affect other divisions on the fire
- Do not start the firing until the line has been prepared and there are adequate firefighting forces available to hold the line
 - Falling snags, removing ladder fuels if necessary
 - Briefing the participants on the plan
- Always have an anchor point for your operations
 - However, you may not actually start the firing at the anchor point
- Whenever possible, fire from the top down in steep terrain; fire into the wind; from the leeward side or tops of ridges; from the bottom of wide canyons; and from roads or benches
- Adjust to fit changes in conditions and situation
- There are potential problem areas or situations that you must consider when firing a section of line

WUI firing techniques are based on observed fire behavior factors (fuel, weather, and topography) and the number of resources participating in the operation. The proximity of the main fire to the applied fire and the proximity of threatened structures to the main fire and applied fire should also be considered.

The Firing Group may modify or mix the firing patterns to safely achieve the desired results. One firing pattern is rarely used throughout an entire firing operation. Typically, the Firing Group uses a combination of patterns as it moves around the structure(s) or along the control line.

Firing Techniques

- ❖ **Backfire:** A fire set ahead of the main fire with the expectations it will influence and/or be influenced by the main fire. It is set with the intent of slowing, stopping, or redirecting the spread of the main fire.
- ❖ **Burnout:** Setting fire inside a control line to consume fuel between the edge of the fire and the control line, creating blackline.

	BACKFIRE	BURNOUT
Advantages	<ul style="list-style-type: none"> • Indirect attack • Eliminates fuel • Reduces fire intensity • Increases tactical options 	<ul style="list-style-type: none"> • Direct attack • Strengthen/secure control line • Reduces holding needs • Reduces mop-up • Provides safety zones

	BACKFIRE	BURNOUT
Disadvantages	<ul style="list-style-type: none"> • Firefighter safety • Additional planning, preparation, and coordination • Increases acreage burned • May negatively influence other divisions 	<ul style="list-style-type: none"> • Increased risk of spotting across control lines • Smoke management issues • Increased acreage burned

Because backfire is rarely used around structures, burnout is far more common in the WUI environment.

Firing Patterns

- ❖ ***Dot firing:*** When using a dot firing technique, individual ignition points set to interact with each other. The fire intensity can be increased or decreased depending on the placement, spacing, and number of dot ignition points.
- ❖ ***Strip firing:*** The strip firing technique is used when you want to widen a fireline quickly. In this firing pattern, fire is set in strips parallel to the fireline. With close coordination of the firefighters doing the firing, the intensity of this type of firing can be controlled.
- ❖ ***Ring firing:*** This type of firing is used when you are trying to save a valuable resource such as a structure or a historic or archeological site. It is designed to create an unburned island. This method of firing should not be used unless a holding plan is in place.

There are several other firing techniques, but they are not commonly used and require very experienced people in order to be used safely and properly. Unless these techniques are used cautiously and skillfully, you could turn a good tool into a real disaster. Once you introduce your own fire, you change the dynamics of the whole event. Think out your plan and what it will do to the main fire before you light the match or fusee.

Immediate Need Firing

Immediate need firing operations are used for situations such as structure defense, when a delayed firing decision may compromise incident objectives or assets at risk, or when the fire activity threatens to overwhelm suppression resources. Immediate need firing operations generally involve minimal use of applied fire. Firefighters apply only enough fire to protect the threatened area or asset.

The applied fire is usually of low intensity and must be controlled by firefighters prior to leaving the tactical area. Immediate need applied fire is not intended to move beyond the assets being protected which would adversely affect downwind firefighters or structures. Immediate need firing operations are defensive firing operations.

Regardless whether a firing operation is an immediate need, suppression personnel must still obtain approval from the appropriate supervisor ultimately responsible for the firing operation, and make the necessary notifications to adjoining forces prior to initiating the burn. The start and endpoint for the firing operation must be identified and those points must be known to all resources involved directly or indirectly in the operation.

When there is not enough time to prepare a formal or written plan prior to starting a firing operation, use the Immediate Need Firing Operation Checklist to ensure that appropriate items are considered.

IMMEDIATE NEED FIRING OPERATION “GO/NO GO” CHECKLIST

- All personnel briefed
- Weather forecast reviewed
- Resources in place
- Lookouts posted as needed
- Anchor and termination firing points identified
- Communications systems in place
- Fire behavior forecast reviewed
- Escape routes and safety zones established and made known
- Adjoining forces/air attack notified
- Approval and notifications prior to firing

Authority

Under Public Resources Code 4426, a person shall not set a backfire or cause a backfire to be set except under the direct supervision or permission of state or federal forest officer, unless it can be established that the setting of such backfire was necessary for saving life or property.

Health and Safety Code 41801 can apply to local responsibility areas (cities, fire districts, counties, etc.). It states, “Nothing in this article shall be construed as limiting the authority granted under other provisions of law to any public officer to set or permit a fire when such a fire is, in his/her opinion, necessary for any of the following purposes:

- The prevention of a fire hazard, which cannot be abated by any other means
- The instruction of public employees in the methods of fighting fire
- The instruction of employees in methods of fighting fire, when such a fire is set, pursuant to permit, on property used for industrial purposes
- The setting of backfires necessary to save life or valuable property pursuant to Section 4426 of the Public Resources Code”

The Incident Commander, regardless of the size or magnitude of a wildfire incident has the overall authority and responsibility for all incident command operations including firing authorization.

There will be circumstances that, due to political, jurisdictional, department policy, or other reasons, require a higher level of authority to approve the decision to backfire or burnout. If you are



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requesting approval from a higher authority, be prepared to provide information that supports your request. This information should include:

- Size-up
- Resources needed
- Long range impacts/risks
- Established escape routes and safety zones
- Identified anchor and termination points
- Established radio communication network
- Overall safety of personnel and equipment

Aircraft Utilization

The importance of aircraft in modern day wildland firefighting cannot be overemphasized. Air tankers and helicopters are tools to be considered in the WUI firefight. Fixed and rotary winged aircraft may have a significant influence on the outcome of an incident and contribute to the overall safety of incident personnel. To maximize the effectiveness of incident aircraft, Incident Commanders must have a working knowledge of the aircraft most often used in wildland firefighting. This does not require ICs to be aircraft experts. ICs should take it upon themselves to become familiar with the capabilities and limitations of the most commonly used firefighting aircraft.

Tactical Support with Aircraft

The objective of tactical air operations is to aid in safe, effective, and efficient fire suppression activities. Aircraft are most effective when used during initial attack (when the fire is small) **and** when they work in conjunction with ground forces. They are also very expensive, so they should be released when they are not effective. Safety is the most important consideration when using aircraft. Air tankers and helicopters can provide excellent tactical support for ground forces.

Air tankers can deliver retardant or suppressant drops to knock down the fire so that ground forces can safely advance. They can also hotspot, slowing the fire and trying to buy time, or place a drop to protect a structure or other valuable resource. Air tankers are most effective during the initial attack phase when the fire is small. This is why aircraft may be diverted to new fires, from fires in the extended attack phase. Keep this in mind when establishing your plan of action.

Helicopters can provide close-in tactical support with water, foam, or retardant drops. They can move personnel to remote sections of line, transport supplies, be used to start backfires, and evacuate injured personnel. They also provide an excellent vantage point for reconnaissance and mapping.

Air Attack provides an aerial platform to control and coordinate the air operations on an incident, including air operations safety and coordination between air and ground forces.

Limitations of Air Operations

Aircraft have different limitations than other resources.

- Winds over 30 mph may sharply reduce effectiveness

- Dense smoke may make operations both hazardous and ineffective on all or part of the fire
- Heavy/tall fuel canopy limits penetration of the retardant
 - May require drops to be higher than desirable
- Must avoid aerial hazards (tall towers, wires, power lines, trees, terrain, other aircraft)
- Drops may be restricted by the presence of civilians, resources, and hazards on the ground
 - Cannot drop within 300 feet of waterways unless there is a threat to life
- Turnaround time
- Subject to flight time restrictions
- May be diverted at any time for a higher priority need

Any portions of the IAP that depend on aircraft must have an alternate and contingency plan in place. Do not depend on aircraft to ensure firefighter safety.

Air Tactical Group Supervisor (Air Attack)

While dealing with air tankers and helicopters, do not forget the all-important Air Tactical Group Supervisor. This single aircraft will hold a prominent place in the strategy and tactics for your incident. When you request air tankers to your incident, Air Attack will automatically be dispatched.



Air Tactical Group Supervisor

Air Attack acts as the air traffic controller for all incident-assigned aircraft. They will be your "eyes in the sky," offering you the best overall view of the incident and assisting you with strategy and tactics when using air tankers.

Orientation to the Fire

It is imperative that the IC and Air Attack both have the same orientation to the fire before discussing strategies. Orientation may be confusing in a dynamic, fast moving fire. Orient Air Attack (or pilot of an air tanker) to your location. Use simple language and consider the pilot's point of view. To guide the aircraft, use known topographic features, reference the part

of the fire, and use "clock" orientation. The IC and Air Attack must refer to the same side of the fire by the same designator, keeping it simple and within ICS protocols: The left flank is Division A and the right flank is Division Z, etc.

Size-up

When the aircraft arrives over the fire, ask for an assessment of the situation and outline your objectives to Air Attack. They should provide a verbal assessment to the IC of what the incident has done, what it is doing now, and what it may do over the next several minutes or hours. Air Attack should also inform the IC of critical infrastructure or assets at risk in the path of the fire.



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If Air Attack is not on-scene when the first air tanker arrives, you will have to establish communications and provide direction. Advise the pilot your objectives, safety hazards, and overall plan.

Air Tankers

Air tankers have only one purpose: to deliver fire retardant or suppressant to the control line. They can do this very quickly over wide areas and deliver large volumes of retardant/suppressants.

Most air tankers have the ability to deliver their loads in several different combinations using three main tactics: direct attack, indirect attack, and structure defense drops. Each has a different set of circumstances that can only be effectively evaluated by the crew on-scene. The IC and Air Attack must work as a team to obtain the most effective use of firefighting aircraft. They must continuously evaluate the need for further airdrops.

On fast moving fires with a broad front, attacking the active flanks is probably the most profitable use of air tankers. Do not consider a retardant drop the final suppression action on a section of line. Many a fire has been lost because there was no follow-up and the fire burned through the retardant line. Without successful ground holding action, any drops on the active flank may be wasted.

If a fast moving head is narrow enough, several drops may be adequate to stop the forward progress of the fire. Air tanker drops used midslope can be effective, but only if the frequency of the drops can overcome the fire's rate of spread, preventing the fire from outflanking the retardant line.

During critical periods of firing operations, an orbiting air tanker may be desirable to furnish immediate action on spot fires. If there are a series of separate fire starts occurring almost simultaneously in the same general area, air tankers can normally be most effective on the small and isolated fires first.

When requesting an aircraft to drop on a specific location, remember to give a good target description such as "right flank," "across the head of the fire," or a landmark such as a road or an isolated rock outcropping. Avoid using compass directions.

Air tanker effectiveness

- Predominately grass or light brush fuels
- Decreased wind speed
- Less steep topography
- Time of day
- Decreased distance to the airbase
 - Ideal maximum 20-minute initial attack response time
- Providing one drop every five minutes
- Standard drop height for air tankers is about 150 feet above the vegetation for best coverage

Air tanker limitations

- Topography
 - Early morning and late afternoon periods, when deep shadows are produced on certain aspects of topography, make it difficult for pilots to see fire targets or ground obstructions

- Drop heights
 - If the drop is higher than 150 feet, the coverage will be thin and uneven
 - If the drop is too low, the forward motion of the retardant will limit the coverage area and could uproot trees, dislodge limbs or tops, and injure people on the ground
- Night availability
 - Air tankers cannot be used at night and shut-off time is 30 minutes before sunset
- Vortices
 - Wing tip vortices may create significant turbulence affecting surface winds and fire behavior causing flare-ups or spot fires

Helicopters

Helicopters are one of the most versatile tools on a wildland urban incident. They can be used in a tactical role with water or foam drops and assisting directly with fire suppression. If a reliable water source is close by the drop area, helicopters can deliver more gallons of material per hour than an air tanker. They are ideal for working around structures and pinpointing their drops, avoiding personnel and structures.

☐ Helicopter effectiveness

- Hot spotting fire in support of hose lays, fire crews, or dozers constructing control lines
- Recon and mapping missions
- Moving personnel and supplies
- Medevac and rescue missions
- Dropping water, foam, and retardants
- Aircraft coordination
- Aerial ignition

☐ Helicopter limitations

- Payloads
 - The hotter it gets and the higher the elevation, the less they can carry
- Night availability
 - Limited to flights from lighted field to lighted field
- Rotor wash
 - May create significant turbulence affecting surface winds and fire behavior causing flare-ups or spot fires
- Can easily be affected by high-heat or extreme fire behavior

Firefighting Chemicals

Fuel is the one element that can be significantly affected by prudent and knowledgeable use of fire chemicals. There are three categories of fire chemicals: 1) long-term retardants, 2) foams, and 3) water enhancers (gels).

Long-term Retardants

Long-term retardants contain salts (typically fertilizers) that alter the way the fire burns, decreasing the fire intensity and slowing the fire's advance, even after the water they originally contained has evaporated. The water contained in retardants serves primarily to aid in uniform dispersal of the retardant over the target area. Retardants may be applied in a colored or un-colored format. Because retardant still works after it has dried, it may be applied far ahead of the fire front and will remain effective until washed away. Retardant may be applied directly to the fire's edge and its extinguishing factors will be as effective as water. It may also be applied indirectly allowing the fire to burn into the retardant line. Unburned material will also benefit from the retarding effect of the retardant.

If there is an accidental application of retardants onto structures, vehicles, or equipment, the retardant should be removed as soon as operationally possible to prevent damage. When retardant has been dropped on a roadway, exercise caution with vehicle operations and wash off as soon as possible to avoid accidents. Advise your supervisor of any hazardous condition resulting from the use of retardants.

Foams

Class A wildland fire foams have no chemical or long-term retardant effect. The availability of moisture is altered by water containing foam by controlling the rate at which moisture is released. The released water has wetting characteristics similar to conventional wetting agents, and a greater ability to penetrate many types of fuel. Once the water it contains evaporates, foam ceases to be effective. The penetrating ability of foam makes it a superior product for mop-up operations. It is also a very effective suppressant when mixed with water. Foam is the most toxic of all fire chemicals to the aquatic environment.

Water Enhancers (Gels)

Like the foams, water enhancers (also referred to as gels) have no chemical or long-term retardant effect. They depend on the water that they contain to suppress the fire. Once that water evaporates, they are no longer effective. Gels contain ingredients designed to alter the physical characteristics of water to increase its effectiveness, drop accuracy, and adhesion to fuels. Gels may also be colored or uncolored.

Gels' ability to hold water, in a compact layer, makes them very effective for fire knock down and short-term pretreatment of fuels, for holding actions in support of a firing operation. Because of their propensity to hold water, gels will not penetrate fuels like foam and water. Therefore, it is advisable to not use water enhancers for mop-up operations, unless the goal is to keep the area moist.

Deploying Resources to Mop-up a WUI Fire

When the fire has been contained, the real work begins. If not all the material near the fireline is extinguished, you run the risk of the fire rekindling and escaping. This is something you do not want to experience or contribute to. Remember, it is common that hot material could still be found on large fires months after the fire was controlled.



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Mop-up is one of the most important phases of fire suppression because any remaining burning debris may rekindle the fire making all previous efforts worthless. Many fires have been lost because of sloppy mop-up.

Do not think that because you are mopping-up that the fireline is no longer dangerous. That thinking is wrong! In some ways, it may be more dangerous because your guard and your adrenaline may be down. Lives have been lost during mop-up. Every firefighter must remain diligent to the principles of safety and awareness.

There are two types of mop-up, dry and wet. Both involve separating burning and unburned material, and then extinguishing the remaining hot material. Some mop-up actions can be described in these terms: scraping; digging; stirring; mixing; separating; and turning logs and other heavy material.

Rules of Mop-up

- Start work on each portion of line as soon as possible
- Secure and extinguish burning materials
- Deal with special hazards inside the fireline
- Deal with special hazards outside the fireline
- Reinforce the fireline
- Check for spot fires

Releasing and Returning Resources to Service

When considering releasing resources, the extent of commitment will vary with every situation. Successful structure defense requires that you make the commitment to stay with the assigned structure or structures until such time that all the fire exposure hazards are abated. You will want to do a complete check for fire extension. Limit mop-up to structural threats.

As you go about the business of protecting structures, all of the factors previously discussed will dictate your action. At some point, you will have to determine the results and the effects of your actions. Many times an effective structure defense effort will allow you to change tactics from defensive to offensive. Consider this option as a part of your ongoing size-up of the situation. The extent of commitment will depend on the size of the incident, number of structures, available resources, and mop-up and rehab periods.

At some point during the life of the incident, the IC will conclude that adequate resources are in place to successfully contain and control the incident. If the IC no longer needs the additional resources en route, they should be cancelled as soon as possible. Agency policy will dictate release priorities, but resources with the longest travel distances are usually the first to leave the incident. However, other incidents may be in critical need of certain resources and if so, those resources would have the priority for release from the current incident.

Topic 5-7: WUI Plan of Action

By definition, a plan is an organized sequence of events over a specified period of time in order to accomplish specific objectives or goals. Developing a plan requires an understanding of the fundamentals of risk management. In addition to understanding fire history, you must take into account the fuel, weather, and topography influencing the fire and the resources available to implement the plan.

Management Cycle for Initial Attack

When size-up is complete, numerous decisions must be made in order to develop an effective plan. The foundation for the decision-making process is the management cycle – plan, organize, staff, direct, control, and evaluate.

- Plan
 - Consider incident priorities
 - Determine incident objectives
 - Formulate strategies
 - Develop tactics
- Organize
 - The organization structure established by the first-in Company Officer sets the stage for the logical expansion of the incident organization
 - Form branches and division as needed
- Staff
 - Assign resources by task and capability
- Direct
 - Ensure assignments are clear and understood
- Control
 - Establish feedback, decision points, and timetables to ensure assignments are carried out
- Evaluate
 - Is the plan working?
 - Are objectives being met?

The Plan

Consider incident priorities – Your plan of action, whether written or verbal, is based on incident priorities. Incidents may vary in size, but the overall priorities stay the same. Remember, your incident priorities are life safety, incident stabilization, and property/environment protection and conservation.

Determine incident objectives – You will use the incident objectives to develop a general plan or strategy. They are guidance and direction statements necessary for the selection of appropriate

strategies and the tactical direction of resources. They describe what must be accomplished and provide substantive direction for work at the incident. Your management objectives cover life and property protection and your control objectives determine the incident strategies and tactics (building the box).

Formulate strategies –After taking into account current and forecasted fire behavior, and gathering intelligence from as many sources as possible, you must determine the appropriate strategy for your situation. Your strategy depends on the rate of spread, intensity, spotting potential, values at risk, size, resources available, and other factors based upon initial size-up.

Develop tactics –In a WUI incident, structure defense or perimeter control are your two tactical options.

THE PLAN				
Priorities	Life Safety			
	Incident Stabilization			
	Property/Environment			
Objectives	Management			
	Control			
Strategy or Mode of Operation	Offensive			
	Defensive			
	Combination			
Tactics	Structure Defense (S-FACTS)	TRIAGE CATEGORY	TACTICAL ACTIONS	
		Not Threatened	Tactical Patrol	
		Threatened Defensible	Prep & Defend Bump & Run Anchor & Hold Connect the Dots Tactical Patrol	
	Threatened Nondefensible	Check & Go Prep & Go Fire Front Following Tactical Patrol		
	Perimeter Control	Attack Method	Tactical Actions	
		Direct	Mobile Attack Hose Lay Control Line	Flanking Pincer Tandem Envelopment Hot Spotting
Indirect/Parallel		Control Line Firing		



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Topic 5-7: WUI Plan of Action

Organizing the Incident

After developing a plan, organizing the incident is the next step to ensuring successful incident command. Early in the incident, the IC will perform numerous functions including command, planning, logistics, operations, safety, and public information.

- If there is no Planning Section Chief on the incident, the IC develops the plan and accounts for resource status.
- The IC places orders for incident logistical support such as food, drinking water, hoses, etc.
- Until the arrival of a Public Information Officer, the IC fields questions from the media regarding incident status, potential evacuations, or structure loss.

To avoid becoming overwhelmed it is important for ICs to organize early and delegate. Begin this process by determining the span of control necessary to accomplish incident objectives. Effective span of control is between three and seven resources per supervisor with five resources being the optimum. A rule of thumb is to divide incident resources by five to arrive at the number of line supervisors needed. As the incident increases in size and complexity, span of control increases as well. The IC should establish divisions and/or branches as needed based on span of control.

Geographical Divisions or Branches for Structure Defense and Perimeter Control

Integrating structure defense and perimeter control within geographical divisions or branches is a sound tactical decision that may reduce the IC's span of control while maintaining consistent incident objectives. Groups are functional in nature and historically have dealt only with the function they have been assigned to perform. Groups are highly mobile and may be moved within Branches or around the incident by the IC or Operations Section Chief. In the past, the common practice has been to form structure groups to deal with structure defense issues within a geographical division. Although an acceptable strategy in certain situations, forming structure groups may limit the ability of the Division Supervisor to effectively manage resources within the geographical division to meet operational needs. A structure group creates a second supervisory level within the division. By ICS standards, a Structure Group Supervisor is not accountable to the Division Supervisor; they are at the same supervisory level. This creates a problem when the Division Supervisor needs extra resources to mitigate a perimeter control problem and the Structure Group Supervisor is unwilling to assign structure defense resources to perimeter control. The opposite may also be true.

Staffing the Incident

In some cases, the initial attack resources may be enough to implement the initial plan. After establishing the plan and organizational structure, the IC may need to order additional the resources necessary to implement the plan.

- Isolated residences need 1 engine per residence
- Common neighborhoods need 1 engine per 2 residencies
- Multifamily or commercial occupancies need 2-3 engines per structure
- Strategic reserves need 1 Engine Strike Team or Task Force per planned Division or Group

- Each Engine Strike Team or Task Force needs 1 water tender
- Request enough dozers and hand crews for prep work

Resource availability and reflex time are critical concerns. Resource availability is always determined by local, regional, statewide, and national fire activity. Reflex time is the elapsed time between ordering the resource and when the resource is deployed on the fireline. Reflex time depends on how far the resource must travel to reach the incident, and in what configuration the resource is ordered. If resources must travel long distances to reach the incident, they may be delayed further by feeding and rest stops.

There are three ways to order resources: initial attack, immediate need, and planned need.

- Initial Attack
 - Usually a Code-3 response for protection of life and property
 - Instantly or as quickly as possible
 - Closest available resources should be utilized
 - Resources will normally rendezvous at the incident
- Immediate Need
 - May or may not be a Code-3 response
 - Responding within 30 minutes
 - Resources respond to incident within 30 minutes from time of dispatch
 - May or may not rendezvous prior to departure
- Planned Need
 - Normally not a Code-3 response
 - Planned incident arrival time determines departure time
 - Should be en route within one hour of request
 - Will usually rendezvous before departure and travel together

Directing the Incident

ICs must direct incident activities and adjust the strategy and tactics based on what is or is not working. Ensure that all incident resources understand the plan and the strategies and tactics being employed. Positive feedback from fire line overhead that all branch and division resources have been briefed on the plan is essential for effective teamwork and accountability. Ensure that safety and communication considerations are addressed. Make adjustments to the incident plan based on the intelligence gathered from air attack and line supervisors.

At this point, the IC is directing the incident from an ICP, which is most often the IC's vehicle located near the incident. The location of the command vehicle/ICP is very important. If the IC cannot observe the fire, it may be difficult to effectively position resources or determine if strategies and tactics are working. Avoid locating a mobile ICP too close to a staging area. Resources en route to the

staging area are prone to bypassing the staging area and going directly the ICP, compromising resource accountability.

ICs set the tone for the incident and communicate their expectations to assigned resources via an incident briefing. Instructions should be direct and to the point and must be understood by the recipient. Ensure that recipients understood the information by having them repeat the information. Keep radio transmissions to a minimum in favor of direct contact. This will initially be done through direct verbal orders and eventually become a formalized process. The *Incident Response Pocket Guide Briefing Checklist* includes specific information that should be communicated during an incident briefing.

Controlling the Incident

To put controls in place is to establish feedback, decision points or triggering events, and timetables to ensure that assignments are carried out. This enables the IC to evaluate the effectiveness or failure of a strategy or tactic, or the completion or inability to complete a task, not unlike a conditions, actions, needs (CAN) report used in structural firefighting. To simply give instructions and not monitor the progress of the assignment is unacceptable.

For example, a hand line must be constructed in Division A. The crew supervisor should provide a status report to the division supervisor at designated intervals regarding the crew's progress, problems associated with the assignment, and when the assignment is complete. Require line overhead to check back at predetermined intervals, when their assignment is complete, or if any problems arise that prevent them from completing their assignment.

Evaluating the Plan

The most important element of the management cycle is evaluating the plan. Evaluating the success of the incident plan will dictate changes to objectives, strategy, and tactics affecting resource orders, logistical needs, and overhead support. The dynamic nature of a WUI incident requires you to broaden your perspective and gather intelligence from multiple sources as part of your evaluation process. If the current plan is not working, the plan must be changed. Some reasons for changing an incident plan include:

- Unforecasted changes in fire behavior
- Incident resources lacking WUI capabilities
- Air and ground resources are diverted to a new incident, delayed, or are responding from long distances

The decision to change the incident plan should not be taken lightly. You must understand precisely why your original plan is not working and make changes accordingly. After creating a new plan, you must communicate it to all incident personnel and ensure that line supervisors pass the information on to their subordinates.

Applying the ICS at a WUI Fire

The Incident Command System works only if all those assigned to the incident understand and use it. You should use ICS all the time, even on the routine, small grass fire, a structure fire, or medical aid. This does not mean that you have to set up a 40-person command structure for a grass fire. It does mean that you have to have an Incident Commander (someone is in charge). The first-in Company Officer assumes command of the incident. He or she is the IC and is responsible for setting the objectives, selecting the strategy, and assigning resources to meet the tactical direction. The IC is also initially responsible for incident operations, planning, logistics, and finance.

The need for all other positions is dictated by the size and complexity of the incident. Do not ever let the system run the incident. All too often, the IC will fill boxes just because they are there. Fill only the positions you need to meet your incident objectives, strategy, and tactics.

ICS on a Small Incident

As an example, you are dispatched to a small roadside fire. You are the first unit there. As you arrive, you see a small spot of grass burning very slowly. You feel that you can handle the situation and tell dispatch the following:

"Engine 45 is on scene at 1000 Main Street. We have a small spot fire along the road burning very slowly with no values at risk. There is no wind. Engine 45 can handle this incident and will be committed for 15 minutes."

You might not think you have used the ICS, but you have. You have used just as much of the ICS as you needed. You took charge (as the IC) and reported the situation and resource needs to dispatch. If the situation was a little different and you needed traffic control and an investigator, you would add that information to your report on conditions. You have now functioned as the IC, Planning Section Chief, and Logistics Section Chief.

ICS on an Expanded Incident

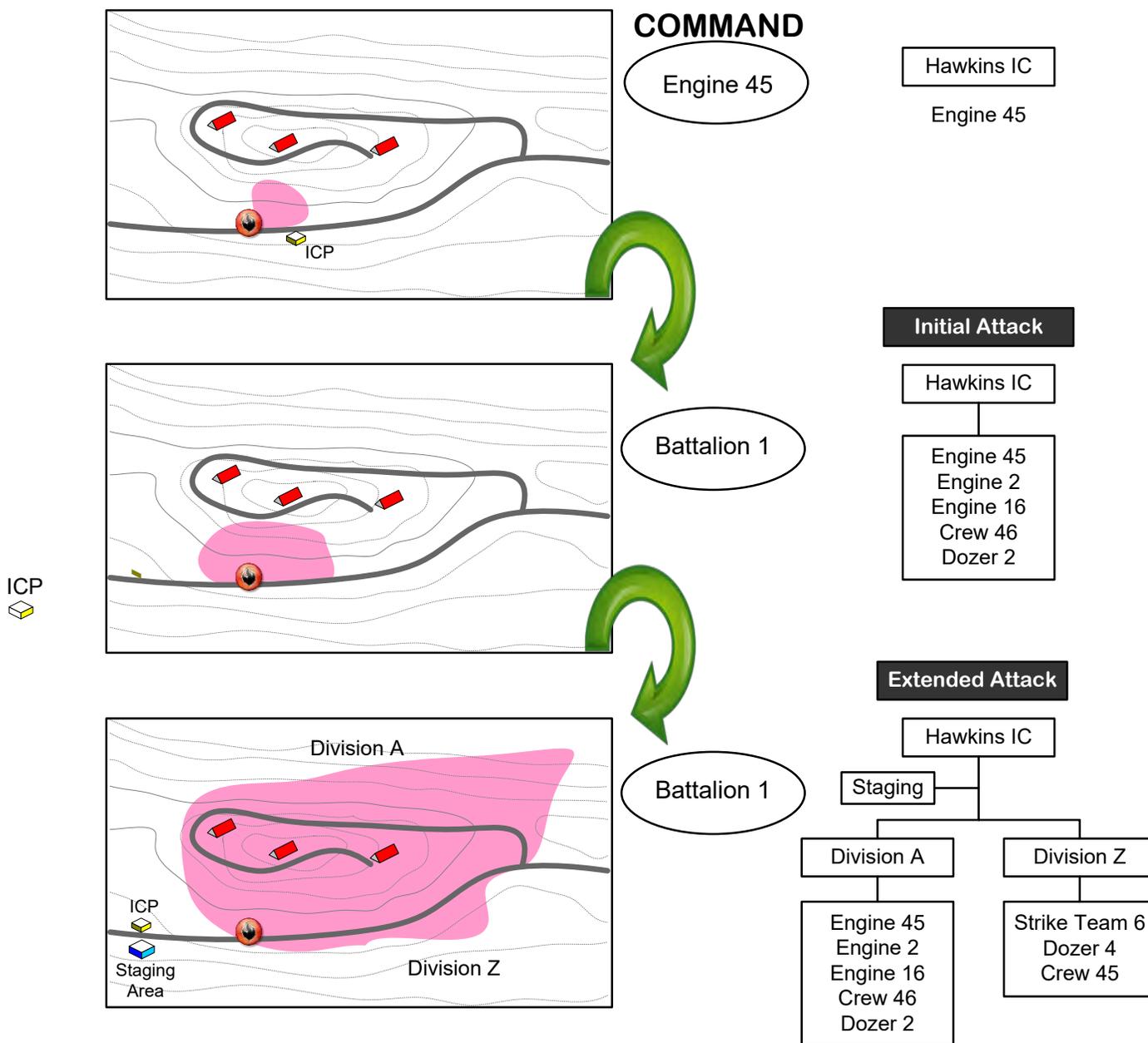
The small grass fire has turned into a larger brush and timber fire. You are the first-in unit and realize that you will need assistance. Your report on conditions may sound like this:

"Engine 45 is on scene at 1000 Main Street. We have a 20-acre brush and timber fire with a moderate rate of spread. It is moving uphill toward structures with a 5 mph southwest wind. All resources will be committed an undetermined amount of time. Request a second alarm brush assignment."

Dispatch should acknowledge your message and then assign the incident an incident designator. In this example, "Hawkins" will be the name of the incident. From that point forward, refer to the IC for this incident as "Hawkins IC." As long as you are the IC, you will use "Hawkins IC" as your radio call sign, not Engine 45.

As additional units arrive at the fire, they will call "Hawkins IC" on the radio and ask for instructions. If a Chief Officer arrives and decides to take command of the incident, he or she becomes "Hawkins IC." If utilizing Air Attack, refer to it as "Hawkins Air Attack."

If the IC needs to divide the fire and assign two Division/Group Supervisors, they will be designated Divisions A and Z. If a Staging Area needs to be established, select an appropriate site, assign a manager, and tell everyone to hold their location. Designate the manager as "Hawkins Staging." See how easy it is to use just as much of ICS as you need?



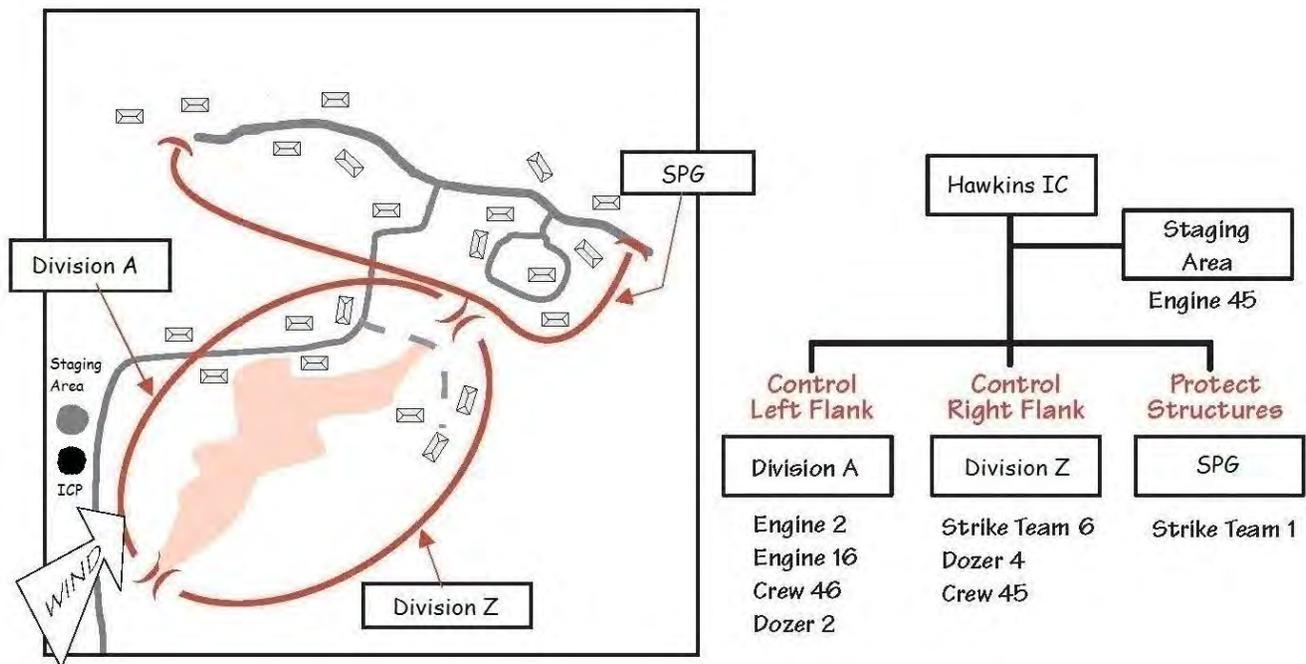
The IC has the capability to organize the fire using a group for structural protection. If the structures are not adjacent to the perimeter on Division A or Division Z, assign a Structure Protection Group. Structure Protection Groups usually are labeled or named according to the street or housing subdivision name, i.e., Oak Structure Protection Group. In this situation, the Structure Protection Group is positioned along the northern road, not involved in line production, but rather to protect the structures if the forces assigned to Divisions A and Z cannot stop the fire. Note: The structure defense responsibilities within Divisions A and Z are the responsibility of each of the divisions.

In this example, there are three stages of the incident. 1) When Engine 45 goes on-scene and the Company Officer assumes the role of "Hawkins IC." 2) When Battalion 1 arrives and the battalion chief becomes the IC. 3) As the fire moves up the hill and a second alarm is requested, the fire moves into an expanded attack operation with an IC and two divisions.

If requesting fixed or rotary aircraft, establish an Air Operations Branch or Group. Air Operations is responsible for the tactical operations of all aircraft assigned to the incident. Air Operations works for the IC or Operations Section Chief if assigned.

Major Incident Management

Every so often, a fire or series of fires grows large enough to be called a major incident. You might think that an acreage threshold turns a fire into a major event. However, acreage is only one factor that needs to be considered. What turns a fire into a major event is how the fire itself affects people, property, or resources.



This fire is divided into two divisions (A and Z) and a Structure Protection Group (SPG). The ICP and Staging Area are located on the road. Division A is responsible for controlling the left flank and



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Division Z has the right flank and its associated structures. The SPG is responsible for the protection of the structures in front of the fire.

When a situation turns bad, several other things occur. More than one agency or jurisdiction becomes involved. The number of resources assigned usually increases, or resources become scarce and priorities have to be set. The Incident Command System also addresses these concerns with Unified Command, Complexes, Area Command, and Multiagency Coordination.

Unified Command

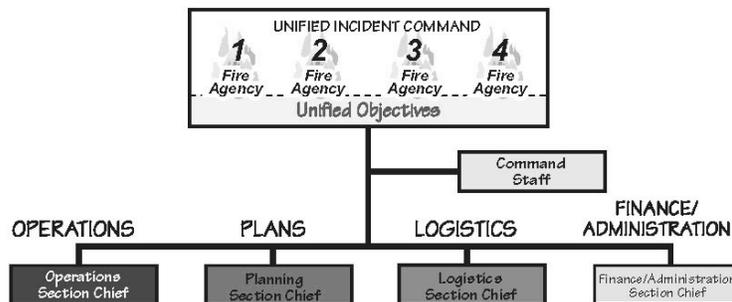
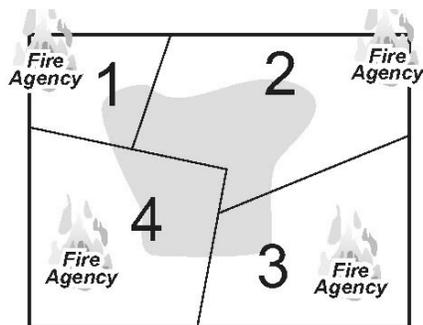
Unified Command allows all agencies that have jurisdictional or functional responsibility for part of the incident to develop a common set of incident objectives and strategies jointly. This can be accomplished without the initial responding agency losing or giving up its authority, responsibility, or accountability. Unified Command is an important feature of ICS. It allows agencies having a legitimate responsibility at an incident to be part of the command structure. Specifically, Unified Command provides the following advantages:

- The incident is managed under a single set of objectives, coordinated in the Incident Action Plan
- There is one Operations Section Chief who is responsible for implementing the plan
- There is one Incident Command Post
- All agencies with responsibility for the incident have an understanding of one another's priorities and restrictions
- No agency's authority or legal requirements will be compromised or neglected.
- The combined efforts of all agencies are optimized as they perform their respective assignments under a single plan
- Duplication of effort is reduced or eliminated, thus reducing cost and chances for frustration and conflict

The great thing about the ICS Unified Command setup is that it will accommodate almost any jurisdictional arrangement. The simplest form is when there are several fire agencies fighting a fire that crosses jurisdictional boundaries. Things get a little more complicated when the incident involves several different agencies (police, fire, medical, etc.) in one jurisdiction. The most complicated form is when the incident involves several different agencies from several different jurisdictions.

Under a Unified Command structure, the various jurisdictions/agencies are blended together into an integrated team. The resulting organization may be a mix of personnel from several agencies, each performing functions as appropriate, and working toward a common set of objectives.

The proper mix of participants will depend on the ***location of the incident***, which often determines the jurisdictions that will be involved and the ***kind of incident***, which dictates the agencies that will be involved.



This Unified Command structure is one of the simplest in that it involves several fire service entities fighting a fire that is burning in several jurisdictions. Each of the fire departments may be from differing jurisdictions, but they are from one kind of operation (the fire service), and here is one common “enemy,”...the fire.

One of the biggest hurdles in any multijurisdictional incident is determining who is going to pay for what. Smaller jurisdictions do not usually budget for major disasters. Larger state or federal agencies usually have emergency funds they can use, but in many cases, the largest cost item (structure defense) really is not their responsibility. Therefore, the early development of a cost-share plan is very important.

Another issue that will take some coordination is the establishment of a plan regarding who will order what resources through what channels. If everyone involved orders separately, it may facilitate payment (you ordered it, you pay for it), but it can lead to some costly duplication. In addition, it is very difficult to order scarce resources, such as air tankers and helicopters, if everyone is doing their own thing.

Ordering can be streamlined in two ways: designating a single ordering point (all orders for the incident go to one dispatch center for processing), or giving the Logistics Section direction on which kinds of resources will be ordered through which dispatch office. The issue of who pays is still there, but the main thing is that the needed resources are ordered and the orders are processed.

Some of the other issues the Unified Command will have to deal with are:

- Selecting an Operations Section Chief that they all feel comfortable
 - This person should be highly qualified and experienced
 - There must be full agreement with the choice
 - He or she is given full authority to implement the plan
- Designating one spokesperson for Unified Command
- Designating the lead Public Information Officer

Completing the ICS Form 201 for a WUI

The ICS Form 201: Incident Briefing is a tracking document used to facilitate incident management and personnel briefings. This form provides a record of incident activity; assists the Incident



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Commander when completing incident management functions; facilitates situation status documentation and resource status tracking; provides a medium for briefings and command transition. The initial attack IC must initiate incident documentation on an ICS Form 201: Incident Briefing as soon as possible.

Minimum Information

- Incident name
- Date prepared
- Time prepared
- Incident map
- Incident objectives
- Summary of actions or chronological log
- Current incident organization
- Resource summary
 - Resource ordered
 - Resource identification
 - ETA
 - At scene
 - Location and assignment

A sketch map of the incident is an important tool for tracking incident progress and noting the location of incident overhead and resources. A map creates special relationships for the IC helping to better visualize necessary, prioritized actions. The map need not be precise or to scale, but should show an approximate footprint of the incident, branch and division breaks, the location of assigned resources, hazards, and assets at risk. Important landmarks such as roads, ridges, and major drainages that may be used as access routes, control lines, or decision points should be included in the map. Using ICS symbology, the IC should identify portions of the fire perimeter that are uncontrolled, contained, or proposed as contingency lines. Indicate the location of secondary lines, dozer lines, established drop points, and staging areas.

A summary of incident actions, or a chronological log, is similar to a diary of the incident and should contain documentation of important incident information and actions taken. Chronological log notations should give a brief description of the event or action, what area or individual was affected by the action, and the time the event or action took place.

An organizational chart of the incident is an efficient way to account for incident resources and determine their location at a glance. An organizational chart allows for expansion of the incident organization in a logical manner.

Resource accountability is one of the most important sections of the ICS Form 201. ICs must know what resources are currently assigned to the incident, where those resources are located, and the



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nature of their assignment. ICs must keep track of the resources they have ordered and in what configuration they were ordered. Document the estimated time of arrival of resources ordered and the time they arrive at scene.

Transferring Command

The ICS Form 201: Incident Briefing is critical when transitioning from initial attack to extended attack or from extended attack to a major fire organization. The information documented on the form is a compilation of everything that has occurred on the incident since the arrival of the first units, and must be passed on to successive Incident Commanders as the organization expands. During a face-to-face transition, the incoming IC may visualize the current fire situation, resource locations, and incident organization as the outgoing IC describes it.

Several questions should be asked: What has happened? What is the plan? What needs to be done? Are there any hazards or safety concerns? Is the situation getting better or worse?

When transitioning from extended attack to a major fire organization, the ICS Form 201 may be split, with one part going to the Planning Section and the other going to the Operations Section in order to facilitate strategic planning and document resource status. The *Incident Response Pocket Guide Briefing Checklist* includes specific information that should be communicated during transfer of command.



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Topic 6-1: Mobilization and Response to an Expanding Incident

Topic 6-1: Mobilization and Response to an Expanding Incident

Due to the potential of large WUI incidents occurring throughout California, it should be anticipated that fire resources under mutual aid agreements, may be moved around the state, often great distances from their jurisdiction. These resource movements may take a particular resource away from home for many days, therefore its apparatus and personnel should prepare for out-of-county or out-of-area stay.

Consideration should be given for equipping responding apparatus and personnel to be able to function "on their own" without any logistical support for at least 48 hours. In anticipation of this lag in logistical support, it is recommended that equipment bags be assembled and packed with the necessary support materials. These out-of-area bags should be stored in a convenient location for quick deployment for a mutual aid response. When packing for a faraway response remember to limit the number items to those that are necessary since there is limited available storage space on the apparatus.

Types of Mobilization

The Requesting Agency should determine whether a Code-3 response is necessary. For initial attack or immediate need, a Code-3 response is generally warranted for response within an Operational Area or to an adjacent Operational Area to protect life or property imminently threatened by the event.

If the assignment is a planned need, and will not begin until the next operational period, or a designated time subsequent to the next period, it will be determined how much time is needed for the resources to prepare and respond, and whether they will assemble at an established rendezvous point or at the incident. This will in turn determine the departure time of the resources. If time permits, it is desirable for the resources to assemble and be briefed by the Strike Team/Task Force Leader prior to arriving at the incident.

MODE	TIME FRAME	INCIDENT LOCATION
Initial Attack Usually a Code-3 response for protection of life and property	<ul style="list-style-type: none">Instantly or as quickly as possible	<ul style="list-style-type: none">Closest available mutual aid resources within operational area or adjacent operational areaResources will normally rendezvous at the incident
Immediate Need May or may not be a Code-3 response	<ul style="list-style-type: none">Responding within 30 minutes	<ul style="list-style-type: none">Mutual aid resources respond to incident within 30 minutes from time of dispatch within operational area, adjacent or other operational areaMay or may not rendezvous prior to departure

MODE	TIME FRAME	INCIDENT LOCATION
<p>Planned Need Normally not a Code-3 response</p>	<ul style="list-style-type: none"> ▪ Planned incident arrival time determines departure time ▪ Should be able to be en route to rendezvous within 1 hour of request 	<ul style="list-style-type: none"> ▪ Mutual aid resources respond within the operational area, adjacent operational area, region, or state- as needed for the next operational period or as determined by requesting agency ▪ Usually will rendezvous before departure and travel together

Dispatch Information

When dispatched to a WUI response, it is incumbent upon you to obtain some critical information before responding. This information is important and may be utilized before, during, and after the incident.

Incident request numbers and resource numbers are generated as the resources are dispatched. These numbers are all-important, as each unit responding to the incident will need to be positively identified for both tracking as well as reimbursement. You must record these numbers, as well as other dispatch information, in order to complete forms and other materials as needed at the incident and afterward.

Incident Name

All fires are given an incident name for identifying that particular incident from any others. Responding units must obtain the incident name they are responding to in order to avoid confusion when multiple incidents are occurring at the same time.

Incident Order Number

You will receive an incident order number upon dispatch if requested by a forestry agency. If requested by local government, you may receive it after arrival. The number starts with the "ordering" state's designator (i.e., CA, AZ, NV) followed by the "ordering" unit's three-letter designator (i.e., AEU=Amador/El Dorado Unit). The last four digits are the incident number for that unit (i.e., call number 4006). An incident order number for Placerville may look like this **CA AEU 4006**.

Incident Request Number

When an agency needs resources outside local agreements, the requesting agency makes an incident request number. An incident request number begins with the requesting agency's three-letter designator. For most WUI fires, this will be the forest or CAL FIRE unit designation (CNF or MVU). All three-letter designators for local, state, and federal agencies are in the Field Operations Guide (FOG). The three letter designator is followed by a single-letter resource designator (i.e., E=equipment, A=aircraft, C=crew), and ending with the number of requests for that type of resource for the region (i.e., E 003 = third request for equipment). An incident request number may look like this **MVU E 003**.



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Resource Designator

A strike team number begins with the three-letter designator of the OES Region (i.e., Sacramento = XSA), followed by a four-digit preassigned number. For example, the Sacramento area is assigned number 4150 through 4174. The first strike team out of the Sacramento area would be 4150, the second 4151, and so on. The strike team numbers conclude with single-letter resource designator (i.e., A = Type 1 engine). A strike team number may look like this **XSA 4150 A** and identified as **Strike team forty-one fifty Alpha**.

Sample Resource Orders for Overhead and Equipment

RESOURCE ORDER			Initial Date/Time			2. Incident / Project Name				3. Incident / Project Order Number				Financial Codes					
OVERHEAD			01/01/11 0000			CNF ABC MISC 2011				CA-CNF-000004				P5EKIT-0502 [P] P5EK5L 0502 WGEX4-0520					
5. Descriptive Location			6. TWN			RNG		SEC		Base MDM		4. Office Reference Number				9. Jurisdiction / Agency			
MVICC MONTE VISTA DISPATCH			18S			1E		30		San Bernardino, CA		8. Incident Base / Phone Number				10. Ordering Office			
			LAT. 32 44 52 N			LONG. 118 55 34 W					Lance Heister 619-557-5262 Ryan Johnston 951-678-3136 CA-MVIC (Dispatch) CA-CNF Dispatch 619-557-5262 Ryan Johnston (951) 678-3136				Cleveland National Forest Monte Vista Interagency ECC				
11. Aircraft Information																			
Bearing	Distance	VOR	Contact Name				Frequency Type			Assigned Frequency			Reload Base		Other Aircraft / Hazards				
4	9	PGY					Command			168.750 (CNF Dispatch)			RNM						
110	13	NKX					Tactical			168.200			HMT						
83	15	MZB					Air Tactics			166.675 (Air Tactics 1)			WJF						
12. Request Number	Ordered Date/Time	From	To	City	Resource Requested	Needed Date/Time	Deliver To	From Unit	To Unit	Assigned Date/Time	Resource Assigned Unit ID	Resource Assigned	M/D Ind	Estimated Time Of Departure	Estimated Time Of Arrival	Released Date	Released To		
O-2	06/08/11 1919 PST	CA-MVIC (Dispatch)) CA-CNF Dispatch 619-557-5262	CA-MVIC 1		SUPERVISORY DISPATCHER (EDSP) (FLANNERY, WENDY (CA-STCC)) (T-R)	06/20/11 0800 PST	MVICC MONTE VISTA DISPATCH	CA-STCC	CA-MVIC	06/14/11 0952 PST	CA-STF	FLANNERY, WENDY (CA-STCC) (T)	D	07/04/11 0500 PST	07/04/11 1600 PST	07/03/11 1630 PST	SACRAMEN INTL (SMF)		
Travel Mode		Financial Code		Special Needs		Reporting Instructions													
POV		P5EK5L 0502																	
13. User Documentation																			
Req. No.	Documentation															Entered By			
O-2	Request O-2 - SUPERVISORY DISPATCHER (EDSP) - [CA-CNF-000004] CNF ABC MISC 2011 has been filled with FLANNERY, WENDY (CA-STCC) by WENDY.FLANNERY@CA-STCC.ROSS.															WENDY.FLANNERY@CA-STCC 06/14/2011 0952 PST			
O-2	POV authorized.															Suzy Walton (CA-MVIC) 07/03/2011 1459 PST			

RESOURCE ORDER			Initial Date/Time			2. Incident / Project Name				3. Incident / Project Order Number				Financial Codes					
EQUIPMENT			01/13/12 2328			DEER				CA-STF-000098				P5GLBY 0516 [P]					
5. Descriptive Location			6. TWN			RNG		SEC		Base MDM		4. Office Reference Number				9. Jurisdiction / Agency			
DEER FLAT			2S			18E		24		Mt. Diablo, CA		8. Incident Base / Phone Number				10. Ordering Office			
			LAT. 37 44 46 N			LONG. 119 56 09 W					WENDY.FLANNERY 2095331130 CA-STCC (Dispatch) STF DISPATCH 209-532-3786				Stanislaus National Forest Stanislaus ECC				
11. Aircraft Information																			
Bearing	Distance	VOR	Contact Name				Frequency Type			Assigned Frequency			Reload Base		Other Aircraft / Hazards				
22	39	HYP					Air Tactics			169.150			O22						
322	42	FRA					Air to Air			122.575									
67	49	MOD					Command			168.750 Rx 170.500 Tx 110.90									
12. Request Number	Ordered Date/Time	From	To	City	Resource Requested	Needed Date/Time	Deliver To	From Unit	To Unit	Assigned Date/Time	Resource Assigned Unit ID	Resource Assigned	M/D Ind	Estimated Time Of Departure	Estimated Time Of Arrival	Released Date	Released To		
E-1	01/13/12 2340 PST	CA-STCC (Dispatch)) STF DISPATCH H 209-532-3786	CA-STCC 1		Engine, Type 3	01/13/12 2334 PST	DEER FLAT	CA-MMCC	CA-STCC	01/13/12 2356 PST	CA-MMU	ENGINE - T3 - 4271 (CA-MMCC)	D	01/14/12 1335 PST	01/14/12 1354 PST	01/14/12 1331 PST	Madera-Maniposa-Merced Unit - CDF (CA-MMU)		
Travel Mode		Financial Code		Special Needs		Reporting Instructions													
		P5GLBY 0516																	
13. User Documentation																			
Req. No.	Documentation															Entered By			
E-1	Request E-1 - Engine, Type 3 - [CA-STF-000098] DEER has been filled with ENGINE - T3 - 4271 (CA-MMCC) by Sandra Harsh@CA-MMCC.ROSS.															Sandra Harsh (CA-MMCC) 01/13/2012 2356 PST			

Travel Information

Travel Channel

The California Emergency Services Radio System (CESRS) may be utilized as a travel channel in the simplex, direct mode only by federal, state, and local government agencies. Strike Teams or other resources in travel status should use the “CESRS Direct” talk-around channel. Use of CESRS repeaters is currently not authorized for use as a travel net unless an executed use agreement is in place with OES. Communication Centers do not monitor this channel.

The Federal Communications Commission prohibits the use of local frequencies away from your service area. These channels may be licensed for use as command and tactical frequencies by other agencies.

Travel Route

A designated route may be issued by the dispatching agency so your team can avoid road closures and any incident detours. When traveling to an incident, there may be more than one check-in location for your team to go to when it first arrives. It is important for you and/or your Strike Team Leader to note these various locations, since they could be miles apart on a large incident.

Rendezvous Location

The rendezvous location can be determined by the Strike Team Leader, dispatching agency, or predetermined geographical areas. This location should be selected for the most convenient and effective site for a strike teams deployment. The location is usually based on the direction of travel, significant area for staging apparatus available, and any necessary services that might be needed.



Rendezvous Location

Documentation

The process of responding to an out-of-county fire is demanding. It requires ongoing planning and communications in order to be successful. At the same time, proper documentation must be completed as the incident evolves. Proper reports and records at the Company Officer level for an out-of-county response requires, at a minimum, a unit log, emergency activity record, vehicle inventory, and incident demobilization. All forms come with a complete set of instructions.

ICS Form 214: Unit/Activity Log

A unit log is the daily documentation filled out by the Company Officer on the strike team for each operational period. The Strike Team Leader will collect these forms and give them to the Documentation Unit Leader for the overall report at the conclusion of the event or when demobilized. All significant activities that occur within your company for an operational period must



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be noted including times, assignments, injuries, damaged apparatus and equipment, and any unusual events. This log is a legal document that may be referenced in the future.

Emergency Activity Record: F-42

This form is available through your Strike Team Leader and helps ensure accurate reimbursement for the departments participating in the incident. The emergency activity record is usually completed during the demobilization process.

Vehicle Inventory: F-157

It is suggested that a vehicle inventory form be carried on all responding units to a mutual aid operation. The vehicle inventory provides a record of all equipment on the unit at the start of the incident. This form is useful should any equipment be lost or broken during the incident so replacement equipment can be requested. In addition, should someone find equipment he or she believes is not a part of the engine compliment (during demobilization), it can be confirmed with this form.

Logistical Support En Route To or From an Incident

Fuel, lodging, and meals (if needed) are the responsibility of the agency or individuals depending on agency SOPs/SOGs. Company Officers should be familiar with their department protocols for logistical needs while en route to or from an incident.

Accident and Equipment Breakdown Procedures

Section 23 of the California Fire Assistance Agreement states that "loss or damage to local agency apparatus or support equipment while en route to or from an incident and repairs due to normal wear and tear or due to negligent or unlawful operation by the operator shall be the responsibility of the local agency providing the apparatus or equipment." Agency SOGs/SOPs should be reviewed.

During an incident however, Section 24 of the California Fire Assistance Agreement states, "loss or damage to local agency apparatus or support equipment occurring on an incident is to be reported to the incident finance section to ensure proper documentation and investigation."



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WUI Command Operations for the Company Officer



Topic 6-2: Written Incident Action Plan Familiarization

Topic 6-2: Written Incident Action Plan Familiarization

The Incident Action Plan (IAP) begins in the mind of the first-in Company Officer. It may stay a mental picture throughout an incident, or if the incident grows in size and complexity, the plan is converted from memory to paper. The IAP is then a written account detailing the strategy and tactics being utilized by the Incident Commander. A formal IAP helps ensure that all responders have access to the plan in order to mitigate the incident. Oftentimes on larger incidents, staff is requested to the incident just for the purpose of assembling the IAP, making copies, and then distributing to incident personnel. It is the duty of the Company Officer to be familiar with each incident's IAP.

The Incident Action Plan is the document that provides all supervisory personnel with information about the incident and how it will be managed for a specific period, called the "operational period." The written plan should provide a clear statement of the objectives and actions; the basis for measuring work effectiveness and cost effectiveness, and a way to measure progress and accountability. There are several important pieces to this plan: the Incident Objectives; the Incident Organization; the various assignment lists; weather and safety statements; and other supporting material, such as a Communications and Medical Plan, a Traffic Plan, etc. It is the responsibility of the Planning Section Chief and staff to prepare an Incident Action Plan for each operational period. The plan is then used as the script for each shift briefing.

It is vital that the planners have a good understanding of the situation. To meet this requirement, planners need to know:

- What has happened to date?
- What progress has been made?
- How good is the current plan?
- What is the incident growth potential?
- What is the present and future resource and organizational capability?

It is especially important that planners know in advance what the likelihood is of obtaining additional resources support from outside sources, for use in the next operational period. If there are readily available resources of the proper kind and type, then the planning process can encompass a wider variety of potential strategies than would be possible under very limited resource constraints.

IAP Forms

A standard IAP contains a set number of forms. The forms can be used singularly, as well as in sequence for this report. Each form is identified by a number that closely corresponds to the order of the pages in an IAP.

ICS Form 202: Incident Objectives

This form provides personnel on the fireline with an overall incident objective for a given operational period. The ICS Form 202 includes incident information, a listing of the Incident Commander's objectives for the operational period, pertinent weather information, a general safety message, and a



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WUI Command Operations for the Company Officer



Topic 6-2: Written Incident Action Plan Familiarization

table of contents for the plan. Both the Planning Section Chief and Incident Commander indicate approval with their signatures.

ICS Form 203: Organization Assignment List

This form provides a full accounting of incident management and supervisory staff for that operational period.

ICS Form 204: Assignment List

This form is based on the organizational structure of the Operations Section for the operational period. Each Division or Group will have its own page and describes in detail the specific actions that the Division or Group will be taking in support of the overall incident objectives. This page will also list who is supervising the Division or Group and include the Branch Director if assigned. Staging will also have its own page.

The ICS Form 204 includes specific assigned resources with leader name and number of personnel assigned to each resource. Special instructions may include the hazard mitigations identified on the ICS Form 215A for the specific work assignment. Communications assignments are specified on the Assignment List. Information from several forms is integrated on the Assignment List in order to inform members of the Operations Section about assignments, instructions, and communication protocol/frequencies.

ICS Form 205: Incident Radio Communications Plan

This form summarizes the communications plan for the entire incident and identifies all incident frequencies and their use. It may also include cell phone and pager numbers. Make sure your radios are programmed to match the frequencies being used on the incident.

ICS Form 206: Medical Plan

This form presents the plan for providing care in the case of responder medical emergencies. Block 8 provides for specific instructions to be added for medical emergencies as per the needs of the incident/event. These instructions should provide for timely and effective treatment of responders with minimal impact on tactical operations.

Additional Attachments to an IAP

There are other elements, in addition to the ICS forms, that may be a part of an IAP. They usually include a cover page (frequently a drawing or name of the incident with a title), any maps that are needed for different assignments, an individual safety message created by the scene Safety Officer, weather forecast issued by a Planning/Technical Specialist, and any incident information provided by the Public Information Officer.

Maps

Symbology

The quality of a map's design affects its reader's ability to extract information and to learn from the map. Since a map is a reduced representation of the real world, map symbols are used to represent real objects. Without symbols, we would not have maps.

Both *shapes* and *colors* can be used for symbols on maps. A small circle may mean a point of interest, with a brown circle meaning recreation, red circle meaning services, and green circle meaning rest stop. Colors may cover larger areas of a map, such as green representing forested land and blue representing waterways.

To ensure that a person can correctly read a map, a map legend is a key to all the symbols used on a map. It is similar to a dictionary so you can understand the meaning of what the map represents.

* ICS MAP SYMBOLOGY *

Suggested for Placement on Base Maps

* ASTERISK DENOTES ITEMS TO BE USED ON INCIDENT BRIEFING MAPS AND INCIDENT ACTION PLAN MAPS

BLACK	(x x) (● ●) ()	HIGHLIGHTED GEOGRAPHIC OR MAN MADE FEATURES
	●●●●●●●●●●●●●●●●	COMPLETED DOZER LINE
	—————	* COMPLETED LINE
	~~~~~	LINE BREAKS COMPLETED

<b>RED</b>	( X )	FIRE ORIGIN
	( 10 AUG. 14:30 )	* HAZARDS
		( Identify Types of Hazards...eg. Power Lines, Radio Towers )

<b>BLUE</b>	■	* INCIDENT COMMAND POST
	ⓑ	* INCIDENT BASE
	ⓒ	* CAMPS, spikes etc... ( Identify byName )
	● H3	* HELISPOTS ( Location and Number )
	ⓓ	* HELIBASES
	Ⓡ	* REPEATERS / MOBILE RELAYS
<b>OPTIONALS</b>	Ⓣ	TELEPHONES
	ⓕ	FIRESTATIONS
	Ⓦ	WATER SOURCES ( Identify Type Ponds, Hydrants, Cisterns )
	Ⓧ	MOBILE WEATHER UNITS
	Ⓛ	IR GROUND LINKS
	+	FIRST AID STATIONS

#### Suggested for Placement on Overlays

ALL MAP OVERLAYS MUST CONTAIN REGISTRATION MARKS. THESE MAY CONSIST OF IDENTIFIED ROAD INTERSECTIONS, TOWNSHIP AND RANGE COORDINATES, ETC.....

	( 10 AUG 11:30 )		* UNCONTROLLED FIRE EDGE
<b>RED</b>		♂ ( 10 AUG 17:30 )	SPOT FIRE
		● ( 10 AUG 17:30 )	* HOT SPOT

<b>ORANGE</b>	—————	( 11 AUG 17:30 )	* FIRE SPREAD PREDICTION
---------------	-------	------------------	--------------------------

<b>BLACK</b>	-----	* PLANNED FIRE LINE
	.....	* PLANNED SECONDARY FIRELINE
	[ I ] [ II ] [ III ]	* BRANCHES
		( Initially Numbered Clockwise From Fire Origin )
	( A ) ( B ) ( C )	* DIVISIONS
		( Initially Lettered Clockwise From Fire Origin )
	( W / 10 16:00 9 / 7 )	* WIND SPEED and DIRECTION
	*...*...*...*	* PROPOSED DOZER LINES
	~~~~~	* FIRE BREAKS
		(Planned or Incomplete)

BLUE	Ⓢ	* STAGING AREAS (Identify by Name)
	CARBON CANYON	



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WUI Command Operations for the Company Officer



Topic 6-2: Written Incident Action Plan Familiarization

STAND

All maps should "STAND" alone. What this means is that every map should have, at a minimum, the following five items somewhere on the map.

- S**cale: Show the scale on all maps using a bar graph scale, or state "Not to Scale."
- T**itle: Show the map's title along with its use. For example, "Cedar Fire, IAP Map"
- A**uthor: Place the name or initials of the person who made the map.
- N**orth Arrow: All maps must have a north arrow, even if it is obvious which direction is north. If possible, also include the local declination.
- D**ate and time: There may be several date and time groups displayed on the map. One may be showing when the information was gathered, and another the operational period during which the map will be used.

Maps are made for many different purposes, so their scale can differ. The greater the area a map covers, the smaller the scale. The smaller the area covered with more detail shown, the larger the scale. A map that only covers fifty square miles would be a large-scale map. The *Fireline Handbook* provides the conversion factors for some of the most common scales used on fire service maps.

Topic 6-3: Administrative Duties of Mobilization

There are a number of activities associated with mobilizing and responding to an expanding incident. Persons responsible for a responding resource or group of resources must make sure resources get checked-in, receive a briefing, and a get work assignment. While in staging, attention must be given to getting engine and personnel prepared for any upcoming assignments. It is important to be aware of services offered at larger incidents such as communications, ground support, medical, and supply. Being familiar with demobilization procedures will expedite release from the incident in a timely manner. Some final responsibilities are the completion of appropriate records and forms and participating in after action reviews and debriefing processes.

Check-in locations

One of the most important things you must do upon arrival at a WUI fire is to check-in. The purpose of check-in is simply one of accountability. Check-in records each resource's arrival time as well as the identity of each person and piece of equipment. This provides support documentation for reimbursement, emergency contact, and demobilization later. It is your responsibility to ensure proper check-in at the incident.

There are six locations to report to for check-in: 1) Base or Camp, 2) your Division, 3) your Group, 4) Incident Command Post, 5) Staging Area, or 6) Helibase. Most commonly, you will check-in at Base, but you could be assigned another location as needed.

- ❖ **Camp or Base:** When arriving at a camp or base, check-in with the Status Recorder or Resource Unit Leader. Many times this is where your unit will go when arriving as a "planned need" during the next operational period.
- ❖ **Division or Group:** When arriving directly to your Division or Group, check-in with the Division/Group Supervisor. After completing your first work period, follow up with the Plans Section to ensure your check-in has been initiated and you are accounted for correctly.
- ❖ **Incident Command Post:** On arrival to the ICP, you will check-in with the IC. The IC may then direct you to respond straight to the line in a particular division. You will be given the location or drop point in that area to respond to and will be expected to go right to work. Be sure to follow up with the Plans Section to ensure your check-in was initiated.
- ❖ **Staging Area:** For the staging area, check-in with the Staging Area Manager on arrival. On large incidents, staging areas will be preset so that the arriving units are all located in a single, ready-to-respond location. When in a staging area, the general rule is to be ready-to-roll within three minutes of a request. So keep your crews close and in communication range.
- ❖ **Helibase:** A helibase is located in and around the incident area, where helicopters may be parked, maintained, fueled, and loaded with retardants, personnel, or equipment. There may times when a Type 1 engine company is utilized for fire protection during fueling operations at the helibase or as a water point for helicopter support with refilling water tanks or buckets. At Helibase, the Check-in Status Recorder usually initiates check-in.



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WUI Command Operations for the Company Officer



Topic 6-3: Administrative Duties of Mobilization

Resource Status

When on larger fires, after checking-in, you will find your unit/team in one of three statuses.

- ❖ **Assigned Status:** These units are actively working on an assignment under the direction of a supervisor.
- ❖ **Available Status:** These units are available resources who are assembled, have been issued equipment, and are ready for assignment. If in base, these units must be ready for a three-minute dispatch.
- ❖ **Out-of-service Status:** These units are not ready for “available” or “assigned” status. These units are off the clock. They may be in their off-duty time or not available for other reasons.

Staging Area Activities

As was mentioned in the section above on check-in locations, you may be set up in a staging area in preparation for deployment. This staging may be in a designated staging area in Base Camp, or out on the line in a holding area. The three-minute rule will apply here in that your unit must be ready to roll out within three minutes of dispatch. If any of your team needs to do any personal things, tell them to stay close and in communications because of the mandated response expectations.

Engine Preparations

Engine preparation is critical on all types of incidents. This is especially true of WUI incidents where the situation can change rapidly. Before entering the fire area, make sure your engine is fully prepared to enter the WUI environment.

- Secure the engine against ignition
 - Close the doors
 - Roll up the windows
 - Remove combustibles from the exterior
 - Cover hose beds
- Deploy hose on the WUI hose brackets (if so equipped)
- Identify an engine protection line
- Set tactical and command channels on mobile and portable radios
- Remove necessary tools and equipment from the compartments
- Ensure all firefighters are wearing all necessary PPE
- Check water tank level
- Test the pump, hose, and nozzle to make sure they work

The minimum hose diameter should be 1½” for a WUI incident. Hoselines should correspond in number and length to the needs the current assignment. A single hoseline allows firefighters to remain together and assist each other with deploying and maneuvering the hoseline, enhancing communication and simplifying accountability. When defending large structures or multiple



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WUI Command Operations for the Company Officer



Topic 6-3: Administrative Duties of Mobilization

structures, more lines may be needed. Deploy only as much hose as needed to fulfill the assignment. The longer the hoseline, the less agility firefighters have and this affects their tactical maneuver.

For enclosed cab fire apparatus, a charged engine protection line may not be necessary. Engines with exposed crew compartments should maintain a readily accessible, charged 1½" hoseline for crew protection.

Engine companies should be prepared to engage in structure defense using only the water available on the engines. Take every opportunity to fill water tanks using:

- Hydrants or risers
- Water drafted from ponds, creeks, pools, and other static water sources
- Fixed water tanks around structures
- Water tenders
- Domestic water supply (garden hoses)

Keep supply line length to a minimum. Position water tenders with easy engine access in mind. Leave a short supply line attached to hydrants to reduce fill time for all resources. ***Always try to maintain a minimum of 100 gallons of water in the tank for engine and crew protection.***

Personnel Preparations

All personnel must gear up for their assignment and don all their wildland firefighting protective clothing and equipment including web gear.

Speak with your crew about any deployment and safety concerns at this time such as fuels, weather, topography, situations, and orders. Many Company Officers carry pocket cards for this briefing. If you have any way of obtaining a copy of the IAP, now would be a great time to review it with your crew as well. Consider all pages in the document, particularly the safety pages. Reflect this company briefing on your 214 Unit Log as soon as you have time to document it. It cannot be emphasized enough to keep this log up-to-date as the hours and days pass.

Communications Plan

In most cases, on the larger fires out of your area your engine company will have to change to radio frequencies that are different from your home operation. Upon arrival at this new assignment, find out what frequencies are assigned to this incident so you can communicate. In most cases, you may even have to have your portable radios reconfigured to capture these new frequencies. This is where the Communications Plan comes into effect.

A plan will be in effect and published in the IAP as ICS 205: Incident Radio Communications Plan. As you study this plan and determine your radios are not configured to pick up the frequencies needed, take your radios to the Communications Unit and have them cloned to the new frequencies. Do not hesitate; do this right away.

It is NOT acceptable to use your home or "talk-around" frequency on fires out of your jurisdiction. You could be sent home if you are caught doing this. It becomes a safety issue if someone transmits

emergency traffic on frequencies not monitored by incident communications or calls by neighboring units needing help may not be received.

Obtain Briefing and Work Assignment

Upon arrival at a large incident (any incident actually) you must obtain a briefing and work assignment before deployment. You can draw this information from any of several sources:

- Your supervisor
 - Strike Team Leader or Division/Group Supervisor
- Other Company Officers
- Air resources
 - Helitack
 - Air Tactical Group Supervisor
- Local knowledge
- Incident action plan if available
- Others

In addition to the response information already given, be sure to discuss the following:

- Size of the fire and potentials
- Name and location of supervisors
- Command intent (overall strategy/objectives)
- Specific tactical assignments
- Contingency plans
- Safety messages or warnings (medevac plan)
- Communication plan (frequencies and cell phone numbers)
- Other resources working nearby or available
- Logistics (supplies and locations of sources) (this includes fuel)

A good reference for this is the NWCG *Incident Response Pocket Guide*. You can find a short briefing checklist on the inside the back cover.

Obtaining Logistical and Administrative Support While on an Incident

Being familiar with the services offered at a larger incident is important. The services offered are many and are all connected with the incident command system. Most services will be in central locations near the fire, but hopefully not in the fire's path, but off to the side or behind the fire. In some cases, they have been located up to an hour or more travel time from the fire based on topography and/or fire behavior. The purpose of this unit will be to identify those services most commonly found on the larger incidents.

Base

There are a number of facilities located within Base. This is where you will typically find the Incident Command Post, primary staging, helibase, and other facilities crucial to the operation. On larger incidents, this location can morph into a small city with many of the services smaller cities have. You will find all food services here as well as sleeping accommodations (ground, trailers, or hotels).

The Logistics Section establishes and manages Base. A assigned Base Manager reports to the Logistics Section Chief. Some of the facilities most commonly found in Base and their descriptions are below.

Ground Support Unit

The Ground Support Unit is under the Support Branch of the Logistics Section and is responsible for the maintenance and repair of tactical equipment, vehicle and equipment fueling, incident transportation services, and an incident traffic plan. You should coordinate through the Strike Team Leader to obtain necessary resources from the Ground Support Unit. Typically you will use Ground Support if you need vehicle repairs and during vehicle demobilization inspections.

Medical Unit

The Medical Unit established in Base provides evaluation and treatment of firefighters for such things as minor burns, skin irritations, cuts, abrasions, and headaches. They also arrange transportation for persons with more serious injuries. The Medical Unit is available for dispensing sunscreen, lip protection, moleskin, bug spray, and other items to keep firefighters free of injuries and irritations. Larger incidents may also have EMTs and paramedics available to provide basic life support and advanced life support services if needed.



Medical Unit

The Medical Plan (ICS 206) is included in the Incident Action Plan and identifies medical aid stations, transportation services, paramedic availability, hospitals, and emergency medical procedures. In the event of an injury or medical emergency, notify your immediate supervisor within the incident command system.

Resource Unit

This unit is located in an office or trailer and is responsible for the tracking of every resource assigned to the incident. Normally you will not have any reason to visit the Resource Unit unless you are trying to locate where a specific piece of equipment. This unit can give you the resource's assignment and location.

Human Resources Liaison

Many larger incidents have a Human Resources Liaison on-scene to improve and maintain human relations for the personnel on the incident.

Supply Unit

On a large incident, the need to replace equipment can occur on occasion. The function of the Supply Unit is to replace any needed or broken equipment in order to make the units as efficient as possible for their next assignment. For example, an engine that lost 400 feet of hoseline on a burnover and needs to get it replaced before going back on the line the next day would go to the Supply Unit for more.



Food Unit

Food Unit

Besides providing hot meals at the incident, the Food Unit also provides sack lunches, water, ice, and hydration products to incident personnel. These items are generally located in refrigeration trailers near the Food Unit kitchen facilities.

Communication Unit

The strike team Company Officer should be familiar with the Incident Radio Communications Plan (ICS 205). This form lists the channel, function, frequency, and

assignment for each system on the incident. The Communications Unit can help you "clone" a radio for proper frequencies, obtain radios for crew communications, or get new batteries for your radios.

Training Specialist

The Training Specialist is located at the ICP and is assigned to Plans. If you or any of your crew is in the process of completing an ICS Position Task Book, be sure to meet with the Training Specialist as soon as possible. Prior to beginning your assignment, the Training Specialist will verify that your home agency issued the task book correctly. Then, when your assignment is completed and you are ready to return home, the Training Specialist will assist you with getting your task book and evaluations verified and processed properly.

Compensation/Claims Unit

This unit will be located with the Facilities Section. If your team causes damage to any private property or to your engine, you must report it to the Compensation/Claims Unit. For example, if your engine damages a private vehicle in the field, you would report it here as if this were your insurance agent.



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Topic 6-3: Administrative Duties of Mobilization

Time Unit

The Time Unit is responsible for equipment and personnel time recording and for managing the commissary operations. This unit oversees all private vendors on the incident including the food unit as well as private operators on the fireline (dozers, aircraft, etc.). Some departments run timecards on larger fires and this unit may be responsible for those as well.

Most local government agencies do not pass through the Time Unit, but must go to the OES representative to turn in their Emergency Activity Record (F-42 form) for equipment and personnel reimbursement.

Incident Demobilization

As the incident draws down, it becomes possible to release units back to their original cities, counties, states, or move them to other fires. An orderly process called "demobilization" (demob) is established and a systematic release of units takes place. The Demobilization Unit Leader is responsible for supervising demobilization of all resources. The demob process is concerned with three areas: personnel (their fatigue), apparatus (its condition), and inventory.

After you are identified as excess and available for demobilization, get and complete an ICS Form 221: Demobilization. Inspect the form to verify all the information is correct. In order to expedite demob, you must be prepared with the necessary paperwork properly completed and any other details that might be necessary before release. Anticipate problems before the demob process starts and have a plan to solve them. For example, if you lost or damaged some equipment at the incident and you cannot get it replaced, you will need documentation explaining what was lost or damaged and why it was not replaced before leaving the incident.

Demob Procedures

Demobilization actually begins upon assignment and you should be preparing for demobilization throughout your assignment. The last thing you want to happen when it is your time to demob is to have something you should have already taken care of delaying your return home.

- Vehicle inspection
 - A mechanic will check all fluid levels, tires, the electrical and brake systems, and chassis
 - Before your release, everything must be in a travel-safe condition
 - Something as simple as a brake light being out requires its repair before leaving the incident
 - Top off fuel, water, and other fluids or the trip home could involve another response
 - Apparatus driver/operator checks the unit completely before entering the demob area
 - Supply
- Turn in all borrowed supplies to the Supply Unit
 - In some cases, you may keep a borrowed item as a replacement for an item that was lost or broken

- Make it clear to the Supply Unit whether you borrowed or actually procured the item. In the case of a dispute, you should use his or her Vehicle Inventory form (F-157) to resolve any conflicts
- Documentation
 - Complete the Unit/Activity Log (ICS 214) and your timecard daily
 - Time cards can be very difficult to fill out at the end of the incident
 - If you have a liaison assigned to the incident, make contact with that person to find out what other forms will be necessary
- Communications
 - Reprogram all radios
 - Turn in any equipment issued to you for this incident

Return the ICS Form 221 to the Demob Unit Leader and tell him or her your estimated time of departure and arrival at home base, including stops along the way for food and rest. Some units will be held back from release if they are found not to be well rested since their last line assignment. Generally, if a unit comes right off the fireline, they will be given a rest period before sending them on their way. A unit could also be held back if their ETA at home base is later than 2200.



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Topic 6-3: Administrative Duties of Mobilization

DEMOBILIZATION CHECKOUT		ICS-221
1. INCIDENT NAME/NUMBER	2. DATE/TIME	3. DEMOB NO.
4. UNIT/PERSONNEL RELEASED		
5. TRANSPORTATION TYPE/NO.		
6. ACTUAL RELEASE DATE/TIME		7. MANIFEST YES NO NUMBER _____
8. DESTINATION _____		9. AREA/AGENCY/REGION NOTIFIED NAME _____ DATE _____
10. UNIT LEADER RESPONSIBLE FOR COLLECTING PERFORMANCE RATING		
11. UNIT/PERSONNEL YOU AND YOUR RESOURCES HAVE BEEN RELEASED SUBJECT TO SIGNOFF FROM THE FOLLOWING: (DEMOB. UNIT LEADER CHECK <input checked="" type="checkbox"/> APPROPRIATE BOX)		
<u>LOGISTICS SECTION</u>		
<input type="checkbox"/> SUPPLY UNIT _____		
<input type="checkbox"/> COMMUNICATIONS UNIT _____		
<input type="checkbox"/> FACILITIES UNIT _____		
<input type="checkbox"/> GROUND SUPPORT UNIT LEADER _____		
 <u>PLANNING SECTION</u>		
<input type="checkbox"/> DOCUMENTATION UNIT _____		
 <u>FINANCE/ADMINISTRATION SECTION</u>		
<input type="checkbox"/> TIME UNIT _____		
 <u>OTHER</u>		
<input type="checkbox"/> _____		
<input type="checkbox"/> _____		
12. REMARKS _____ _____		
221 ICS 1/83		

NFES 1353

INSTRUCTIONS ON BACK



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Topic 6-3: Administrative Duties of Mobilization

Incident Documentation Procedures for Completing Records, Forms, and an Incident Report

At the conclusion of every WUI event, every resource assigned to the event completes some sort of documentation. The most basic of the documentation requirements is the completion of the fire report or more specifically the National Fire Incident Reporting System (NFIRS). To assist in completing a NFIRS, keep and maintain an ICS Form 214: Unit Log.

Depending upon agency requirements, time keeping is essential in the compensation for services on a WUI event. Submitting an accurate account of an assigned resource's time ensures responsible use of taxpayer resources and proper compensation for services provided.

Other documentation may need to focus on unusual occurrences and private resource impacts. Should a fire or fire operations affect historical landmarks, environmentally sensitive areas, archeological sites, or private property, the assigned resource should make every effort to communicate the occurrence to the immediate supervisor and document the event. Many customers affected by the fire and fire operations may be dependent upon your documentation in order to receive compensation. Remember, if it was not documented, it did not happen...and write as if it was going to be read in court.

After Action Review and Debriefing

One of the best ways to learn is from one's actions, whether they were right or wrong, is a post fire review. Most firefighters feel that if an agency conducts a fire review, they are looking for someone to blame. This should not be the case. We should consider all fire incidents as learning experiences, and spend just as much time learning from the fires where events went well as the ones where things did not go so well.

There are times when good plans and intentions do not work out. Sometimes people make mistakes. Make it a habit to really analyze your responses and actions, and learn from them. Admit when you make an error, but also pat yourself on the back when things go well. Every fire is a learning experience. You will never stop learning. Use your experiences to teach others. Leading by example and good story telling is a part of what makes a good firefighter.

A competent organization always strives for improvement by reviewing the actions taken on a particular incident to identify what did or did not work well, identify challenges that were especially difficult, and make recommendations for improvement. Use after action reviews (AAR) to identify possible improvements to incident management activities.

Consider scheduling an AAR after all major incidents, unusually complex incidents, or incidents involving injury, near miss, or death. There are many ways to facilitate an after action review from a simple conversation over a cup of coffee to a formal board of review. Tailor an after action review to fit the complexity of the incident. The *Incident Response Pocket Guide* suggests some guidelines for conducting an after action review.

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WUI Command Operations for the Company Officer

Topic 6-3: Administrative Duties of Mobilization

The climate surrounding an AAR must be one in which the participants openly and honestly discuss what transpired, in sufficient detail and clarity, so everyone understands what did and did not occur and why. Most importantly, participants should leave with a strong desire to improve their proficiency.

- An AAR is performed as immediately after the event as possible by the personnel involved
- The leader's role is to ensure skilled facilitation of the AAR
- Reinforce that respectful disagreement is OK
- Keep focused on the what, not the who
- Make sure everyone participates
- End the AAR on a positive note

***What was planned? What actually happened? Why did it happen?
What can we do next time?***



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WUI Command Operations for the Company Officer



Appendix A: Glossary

Appendix A: Glossary

- Agency Administrator**Agency administrators may provide assistance to bring unified agencies to the table while continuing to command the incident.
- Agency Representative (AREP)**An individual assigned to an incident from an assisting or cooperating agency that has been delegated authority to make decisions on matters affecting that agency's participation at the incident. Agency Representatives report to the incident Liaison Officer.
- AHJ**The agency having jurisdiction and/or responsibility by statute or code for a specific geographical area or a mandated responsibility.
- Air Attack**The Air-to-air Net used by the air tanker and helicopter pilots to communicate among themselves and with the Air Tactical Group Supervisor (ATGS), commonly called "Air Attack." Provides an aerial platform to control and coordinate the air operations on an incident, including air operations safety and coordination between air and ground forces.
- Air Tactical Group Supervisor**Flies in an observation plane staffed with a pilot. Primary responsibility is the coordination and safety of all aircraft operations when fixed and/or rotary-wing aircraft are operating on an incident.
- Appropriate action**Tactics necessary under the incident objectives when situations change and/or communication with command and control cannot be established. Appropriate actions result from a firefighter's perception of the leader's intent based on incident objectives and normal policies, procedures, or accepted safety practices.
- AREP**See agency representative.
- Assistance by hire**.....The provision of fire suppression resources by one agency to another on a full reimbursement basis.
- Assisting agency**An agency directly contributing suppression, rescue, support, or service resources to another agency.
- Automatic aid**Immediate aid based on an agreement between two or more agencies wherein each agrees to assist the other and allow resources to be dispatched by the other agency to emergencies.
- California Fire Service Agreement**An agreement between the California Emergency Management Agency, California Department of Forestry and Fire Protection, USDA Forest Service, Pacific Southwest Region, USDI Bureau of Land Management (California Office), USDI National Park Service (Pacific West Region), USDI Fish and Wildlife Service (Pacific Southwest Region), and USDI Bureau of Indian Affairs (Pacific Region).



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Appendix A: Glossary

Agreement may be used to reimburse overhead for incident management teams or any other emergency apparatus where a local agreement is not in place.

- California Master Cooperative Wildland Fire Management And Stafford Act Response Agreement (CFMA) ...** An agreement that facilitates the coordination and exchange of personnel, equipment, supplies, services, and funds between the California Department of Forestry and Fire Protection, the United States Department of Agriculture Forest Service, Regions Four, Five, and Six, United States Department of the Interior, National Park Service, Pacific West Region The United States Department of the Interior, Fish and Wildlife Service, California/Nevada Operations, the United States Department of the Interior, Bureau of Indian Affairs, Pacific Region, and the United States Department of the Interior, Bureau of Land Management, California and Nevada.

- Command presence.....**How people see and react to a leader.

- Cooperating agency.....**An agency supplying assistance other than direct suppression, rescue, support, or service functions to the incident control effort such as law enforcement, utility companies, public works, Red Cross, etc.

- Decision point**Geographic points on the ground (map) or specific points in time where an escalation or alternative of management actions is warranted.

- Defensible space**The area surrounding a structure cleared of combustible material. The appropriate size is determined by numerous factors

- Demobilization (Demob)**An orderly process established to systematically release units back to their original cities, counties, states, or move them to other fires.

- Evacuation Order.....**Movement of community members out of a defined area due to an immediate threat to life and property from an emergency incident. An Evacuation Order may be issued when the threat to community members may occur in 1 to 2 hours, or when the reflex time is not sufficient for a planned evacuation.

- Evacuation Plan.....**A written or verbal plan that assists emergency responders to remove civilians from imminent or potential harm.

- Evacuation Warning**Alerting of community members in a defined area of a potential threat to life and property from an emergency incident. An Evacuation Order may be issued because of the threat.



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Appendix A: Glossary

- Extended attack**The fire can be contained within the first burning period, but requires substantial augmentation of the first-dispatched suppression resources - Substantial augmentation means the addition of multiple units of multiple types of suppression resources (e.g., two+ air tankers AND two+ fire crews, or dozers, or engines).
- Firing Plan**.....The Incident Commander has the overall authority and responsibility to set a backfire or burn should the need exist or delegate that responsibility. The Firing Plan may be verbal or written.
- Freelancing**Actions taken by resources, when either assigned or unassigned to an incident, without coordination with incident resources, the authority to act, or supervision from the command structure; similar to Independent Action.
- IAP**See Incident Action Plan
- IC**See Incident Commander
- ICP**See Incident Command Post
- ICS**See Incident Command Center
- ICT/IMT**See Incident Command/Management Team
- Immediate evacuation**An evacuation for a threat to civilian life within 1-2 hours.
- Incident Action Plan (IAP)**.....A document that provides all supervisory personnel with information about the incident and how it will be managed for a specific period, called the "operational period."
- Incident Command Post (ICP)**The location of where the primary command functions occur.
- Incident Command System (ICS)** .A standardized on-scene emergency management construct specifically designed to provide an integrated structure that reflects the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries. ICS is the combination of facilities, equipment, personnel, procedures, and communications operating within a common organizational structure, designed to aid in the management of resources during incidents.
- Incident Command Team/.....**
Incident Management Team An Incident Commander and the appropriate Command and General Staff personnel organized and ready to respond to an incident. The level of training and experience of the ICT/IMT members, coupled with the identified formal response requirements and responsibilities of the ICT/IMT, are factors in determining "type," or level of complexity of the ICT/IMT.



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Appendix A: Glossary

- Incident Commander (IC)**The individual responsible for all incident activities, including the development of strategies and tactics and the ordering and release of resources. The IC has overall authority and responsibility for conducting incident operations and is responsible for the management of all incident operations at the incident site.
- Incident Evacuation Plan**A plan, written or verbal, that provides for the removal of potential endangered persons and animals (may be domesticated or wild) from an area threatened by a hazardous incident. The plan may encompass the entire incident, or individual areas in or around the incident.
- Incident Safety Officer**.....A member of the Command Staff responsible for monitoring incident operations and advising the Incident Commander on all matters relating to operational safety, including the health and safety of emergency responder personnel.
- Independent action**Actions taken by resources, when either assigned or unassigned to an incident, without coordination with incident resources, the authority to act, or supervision from the command structure; similar to freelancing.
- Infrastructure**The large-scale public systems, services, and facilities that are necessary for economic activity, including power and water supplies, public transportation, telecommunications, roads, and schools.
- Initial attack**The fire can be contained by the resources first dispatched, without substantial augmentation, within two hours of the report time. Substantial augmentation means the addition of multiple units of multiple types of suppression resources (e.g., two+ air tankers AND two+ fire crews, or dozers, or engines, etc.)
- Interface**A condition where structures abut the wildland.
- Intermix**.....A condition where structures are scattered throughout a wildland area.
- Leader's intent**Leader's intent is a clear, concise statement about what our people must do to succeed in their assignments. It delineates three essential components including 1) The Task—what is the objective or goal of the assignment, 2) The Purpose—why the assignment needs to be done and 3) The End State—how the situation should look when the assignment is successfully completed.
- Leadership**.....A dynamic state that requires education, experience, and self-examination to guide, direct, or influence people.



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Appendix A: Glossary

- Leading from the front** Incident personnel know that the IC is definitely in charge of the incident, i.e., looking, listening, and directing incident activities.
- Liaison Officer (LOFR)** A member of the Command Staff and is the point of contact for the Agency Representatives assigned to the incident by assisting or cooperating agencies.
- Local agreements** Agreements signed at the local level that are usually more specific and binding than agency, state, or federal agreements.
- LOFR** See Liaison Officer
- Major incident** A fire cannot be contained within the first burning period, even with substantial augmentation of resources; long-term resource commitment and logistical support will be required. Substantial augmentation means the addition of multiple units of multiple types of suppression resources (e.g., two+ air tankers AND two+ fire crews, or dozers, or engines, etc.)
- Management cycle** An organized and possibly continuous sequence of steps or events, usually accomplished by the IC to focus the user toward successful strategy and tactics. Steps include "Planning, Organizing, Staffing, Directing, Controlling, and Evaluating"
- MTZ** See Mutual Threat Zone
- Mutual aid** A reciprocal aid based on an agreement between two or more agencies wherein each agrees to assist the other under certain conditions. Providing mutual aid is permissible on the part of the responding agency, based on its ability at the time the aid is requested. Responding mutual aid forces become subject to the direction of the chief of the requesting agency or to the incident commander, if assigned directly to an incident.
- Mutual Threat Zone (MTZ)** A geographic area identified near the boundary of two or more separate jurisdictions that, through a predetermined agreement, receives a certain response from the agencies to protect their jurisdictions
- Operations Section Chief** The individual responsible for all tactical incident operations and implementation of the Incident Action Plan. In ICS, the Operations Chief normally includes subordinate Branches, Divisions, and/or Groups.
- Overstory** The layer of foliage in a forest canopy.



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Appendix A: Glossary

- Personal protective equipment (PPE)**That equipment and clothing required to mitigate the risk of injury from or exposure to hazardous conditions encountered during the performance of duty. Structure and Wildland PPE, while usually different, may include but is not limited to: fire resistant clothing, hardhat, shroud, eye protection, lug sole boots, gloves, respirators, hearing protection, and shelter.
- Personnel accountability**The ability to account for the location and welfare of personnel, accomplished when supervisors ensure that the ICS principles and processes are functional and personnel are working within these guidelines.
- PIO**.....See Public Information Officer
- Planned evacuation**An evacuation for a threat to civilian life in excess of 2 hours.
- PPE**See personal protective equipment
- Preincident plan**A two-part document consisting of a written plan and a map.
- Public Information Officer (PIO)** ..Responsible for developing and releasing information, approved by the IC, about the incident to the news media, to incident personnel, and to other appropriate organizations.
- Reflex time**The time lapse between placing the order and when the resource is deployed on the line.
- Safe refuge area**A temporary safe location to hold evacuees until evacuation routes are open.
- S-FACTS**See Survival FACTS
- SFPE**.....See structural firefighting protective ensemble
- Situational awareness**The perception of environmental elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future - **LOOK, THINK, ACT.**
- Size-up**.....The mental evaluation of the situation or emergency made by an officer in charge of an emergency which enables him or her to determine the best course of action including facts, probabilities, situation (resources), decisions, and the plan of operation
- Span of control**Supervising between three and seven resources with five resources being the optimum.
- Staging Area**Critical areas for effective resource utilization and should be identified based on their capability to safely contain numerous types



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Appendix A: Glossary

- of suppression resources and efficiently dispatch them to any area of the incident.
- Strategic reserve**A group of resources formed form to suppress a new fire or reinforce critical situations.
- Strategy**Is broad in scope and provides a realistic approach and direction for meeting the incident objectives; also called mode of operation.
- Structural firefighting protective ensemble**NFPA Standard 1971 identifies the minimum design, performance, testing, and certification requirements for structural firefighting protective ensembles and ensemble elements.
- Structure triage**The process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels.
- Structure triage categories**Not threatened, threatened defensible, threatened nondefensible.
- Survival FACTS**Factors that must be considered in the safety assessment process of a structure (survival, fire environment, access, construction/clearance, time, stay or go).
- Tactical refuge area**An area that provides firefighters short-term relief.
- Tactical actions**Prep and Defend, Prep and Go, Fire Front Following, Bump and Run, Anchor and Hold, Check and Go, Patrol, Inappropriate Actions, Appropriate Actions, Connecting the Dots.
- Tactics**Specific actions firefighters will take on the fireground. In a WUI incident, structure defense or perimeter control are your two tactical options.
- Unified Command**Allows all agencies that have jurisdictional or functional responsibility for part of the incident to develop a common set of incident objectives and strategies jointly.
- WFPE**See wildland firefighting protective ensemble
- Wildland firefighting protective ensemble**NFPA Standard 1977 identifies the minimum design, performance, testing, and certification requirements for wildland firefighting protective ensembles and ensemble elements.
- Wildland urban interface (WUI)** ...The zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.



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Appendix B: Historical Fires

Appendix B: Historical Fires

- Tunnel Fire
- Calabaras Fire
- Cedar Fire
- Esperanza Fire
- Jesusita Fire
- Station Fire



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Appendix B: Tunnel Fire

Tunnel Fire

Summary

Sunday, October 20, 1991, will be remembered as the date of America's most costly urban-wildland fire and one of the worst fires involving loss of life and property since the Great San Francisco Earthquake and Fire of 1906. The magnitude and range of what is simply referred to as the "Tunnel Fire" is far beyond the experience of any living American firefighter. Only those who fought the Chicago Fire last century and those who battled the Great Fire in San Francisco would be able to identify with this conflagration and firestorm.

A firestorm is defined as a fire that creates its own weather. This was certainly the case in Oakland, California—the fire itself contributed to its own spread by supplying wind to an already very windy day. A conflagration has been described as a fire that exceeds the boundaries of the city block of origin. The Tunnel Fire did much more than this by burning neighborhood after neighborhood. Both firestorm and conflagration are accurate terms when applied to the Tunnel Fire; neither, however, comes close to adequately describing what actually transpired.

The origin of the fire was on a steep hillside in what some refer to as a box canyon, above California State Highway 24, near the entrance to the Caldecott Tunnel. This is a wooded area with heavy underbrush, narrow streets, and steep terrain, densely populated with expensive houses. The unusual weather conditions of that day resulted in a Foehn wind that, at speeds in excess of 65 mph, raced down from the crest of the Oakland-Berkeley Hills. Coupled with record high temperatures well into the nineties, the hot dry winds gusted and swirled through five years of drought-dry brush and groves of freeze-damaged Monterey Pines and Eucalyptus groves.

All the conditions for a major fire disaster were present that morning of October 20, 1991. Firefighters were on the scene overhauling hot spots from a fire the previous day. It is important to note that Saturday's fire had been completely doused, hose lines had been left in place surrounding the burn area, and the fire area had been checked by an Oakland Fire company during the night. Fire crews had returned that morning to check for any hot spots and to pick up equipment, and were on the scene for 2 hours before the fire suddenly escaped the area of origin because of high winds.

Eyewitness accounts testify that a sole ember blew into a tree just outside the burn area, and the tree exploded into flames. The resulting fire was quickly out of control—raging around and over firefighters who were suddenly fighting for their lives. Over the course of the next several days, the fire would leave 25 dead, 150 injured, and 3,810 dwelling units destroyed. The fire, which burned over 1,500 acres within an area of 5.25 square miles, would result in over \$1 billion in damages.

Rescue and evacuation efforts were made as firefighters were forced to fall back to defensible space. Immediately, calls were placed to request additional fire units and airdrops. Soon, streets were clogged with residents trying to get out, and sightseers and emergency personnel trying to get in. The fire quickly established four fronts: west downhill toward California Highway 24 and the Rockridge district, north toward the Claremont Hotel, south toward Broadway Terrace, and east toward Contra Costa County.

Narrative

The Oakland Fire Department

The Oakland Fire Department is composed of three geographic districts, known as battalions, which are commanded by district chiefs 24 hours a day. As the fire progressed, the on-duty chiefs assumed new roles. Assistant Chief Donald Matthews was the Incident Commander, Battalion Chief James Riley was assigned as Division "A" Commander, and Battalion Chief Ronald Campos responded to Oakland Fire Dispatch Center to coordinate logistics, recall, and dispatch functions. Later, Assistant Chief John K. Baker responded from home and was assigned the role of Incident Commander when



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Appendix B: Tunnel Fire

Assistant Chief Matthews became Operations Chief. At approximately 11:45 a.m., Fire Chief P. Lamont Ewell arrived on the scene at the Command Post and officially assumed command.

The Oakland Fire Department uses the Incident Command System (ICS) to manage all emergency incidents, as was the case with the Tunnel Fire. The system consists of an Incident Commander who directly supervises four functional groups: operations, planning, logistics, and finance.

The operations and planning functions were conducted at the scene from the Department's Mobile Command Post, while logistics and finance functions were conducted from the Dispatch Center. The Dispatch Center was the basic structure of initial management of the Tunnel Fire. This structure remained intact until late in the evening on October 20 when the California Department of Forestry and Fire Prevention (CDF) provided an overhead management team to assist with the enormous task of managing such a large fire.

At this point, a Joint Command was established that consisted of Oakland, Berkeley, and Piedmont Fire Departments and the CDF. Oakland firefighters were assisting with evacuation efforts as they were forced to retreat from the advancing inferno. Division "A" Battalion Chief James Riley and Oakland Police Officer John Grubensky were killed while trying to help citizens escape the fire. Both Battalion Chief Riley and Officer Grubensky were found with the remains of those people they were trying to help. These courageous men were very aware of their risky positions and had many opportunities to save themselves, but refused to leave before the evacuation of residents was complete.

The rapid spread of the fire in four different directions presented both line firefighters and chief officers with numerous strategic challenges.

Evacuation

Even though evacuation of residents is a responsibility assigned to the Oakland Police Department, fire units were heavily involved with this effort while trying to stop the advancing flames. It has been estimated that more than 10,000 people were evacuated from the burn area, some by way of very narrow streets, through blinding smoke and blowing debris.

The Wind

The wind played a most crucial part in the scenario, which manifested once the fire was established. The wind blew into the Oakland Hills from the east and over and down ridge tops. It forced flames to swirl in many different directions causing the fire to burn downhill as quickly as, and in some cases more quickly than, uphill. The strength and speed of the wind prevented firefighters on the scene from falling back to defensible space because there was no place to hide. Fire crews were trapped and forced to protect themselves under umbrellas of water as the flames roared over and around them. One veteran firefighter observed the fire progress 100 yards in 15 seconds.

This Santa Ana-type wind pushed the fire along wide fronts, bypassed firefighters who were making a stand, and then left them in isolated pockets of unburned areas. The wind whipped the fire into the Hiller Highlands Development and consumed all combustibles (homes, vegetation, and vehicles) in 16 minutes. The wind caused the fire to preheat everything in its path, which resulted in structures and contents exploding into flame almost instantly.

Pilots flying California Department of Forestry helicopters complained that their bucket drops were not effective because the water vaporized as the strong winds dispersed it over the intensely hot fire.

Communications

The Oakland Fire Department used two operational radio frequencies to communicate between the Dispatch Center and the 30 fire companies in the City. Communication with other jurisdictions is usually accomplished on the statewide mutual aid frequency that is referred to as the "White Fire" channel. The effectiveness of these frequencies was soon reduced because of the overwhelming load



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Appendix B: Tunnel Fire

placed upon them by fire units requesting assistance, commanders trying to place resources, and the Dispatch Center's attempts to send fire companies into the burn area.

These problems were compounded by additional fire units from surrounding cities as they began to arrive to assist with the fire. The steep hilly terrain in the Oakland Hills also interfered with radio signals, in some cases creating "dead spots" which drastically reduced radio effectiveness.

Mutual Aid

Requests for mutual aid in the form of air support and fire suppression units were made during the initial stages of the fire, and additional requests continued throughout the day. Mutual aid requests are processed through the California Office of Emergency Services (OES). Requests were channeled through Alameda County OES which is divided into north and south zones, and then from the county level to the state.

By late afternoon, 370 fire engines from as far away as the Oregon-California state line in the north, from Bakersfield in the south, and from Nevada to the east were in, or on their way to, Oakland. Aircraft in the form of helicopters and large air tankers from hundreds of miles away made hundreds of water drops on the fire. This was the largest mutual aid effort ever undertaken, at that time, in the State of California.

Water Supply

Fire units lost water at the height of the fire, forcing them to retreat because the supply tanks and reservoirs that provide water to the hill area were emptied. Reasons for the loss of water were:

- Extraordinary fire suppression efforts used a tremendous amount of water (an estimated 20 million gallons).
- Residents were hosing down their roofs and vegetation, and many sprinklers were left running after evacuation.
- As homes were consumed by the fire, the water service supplying those homes began to flow freely. Hiller Highlands alone accounted for over 400 water services.
- Water supplying the tanks and reservoirs is pumped from lower parts of Oakland to the higher elevations. The electrically powered supply pumps could not replenish depleted tanks once the fire destroyed power lines to the pumps.
- Some areas, such as the Rockridge district (which was developed in the 1920s), were supplied by 4-inch mains that are considered to be insufficient by today's standards. They could not supply enough water to fight a fire of this magnitude. Many mutual aid fire engine companies could not hook up to Oakland fire hydrants because their 2.5-inch hose couplings were not compatible with Oakland's 3-inch couplings.

Aftermath

The Tunnel Fire will long be remembered for the magnitude of its destruction. The fire was viewed on prime time television around the world; it has been documented by professionals and nonprofessionals alike. The origin of the fire has been and continues to be the focus of investigation.

The Fire Investigation Unit of the Oakland Fire Department Fire Prevention Bureau has ultimate responsibility for finding the cause of the fire. Inspectors from the Fire Investigation Unit have worked with the Governor's Task Force, which is represented by the California State Fire Marshal's Office and the Alameda County Fire Investigation Team. The Alameda County Fire Investigation Team is composed of representatives from the District Attorney's Office and the Bureau of Alcohol, Tobacco, and Fire Arms, along with investigators from the surrounding fire districts.

Fifteen hundred hours were spent in the first week following the fire, most of that time conducting interviews with survivors and performing overhaul operations by sifting through debris, searching for evidence.



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Appendix B: Tunnel Fire

The origin of the Tunnel Fire is located next to 7151 Buckingham Road. The cause of the fire, however, is still under investigation.

The Oakland Fire Department, as well as every other fire department in the state, has learned much about wildland/urban intermix fires. Much has been accomplished in the past 3 years since the fire. The Oakland Fire Department is committed to doing everything possible to prevent a repeat of the 1991 Firestorm. The following is a partial account of actions taken by the Oakland Fire Department since the conflagration.

Firefighting Training and Tactics

OFD personnel have received intensive wildland training from the California Department of Forestry and Fire Prevention as well as other agencies with wildland expertise. New tactics include cold trailing (scraping the perimeter of the burn area to reveal unburned soil), utilizing new technology, such as Forward Looking Infrared Radar to find subterranean hot spots, and testing new products such as Class "A" foam.

Weather Monitoring

Two "Remote Automated Weather Stations" (RAWS) have been installed in strategic locations in the Oakland Hills. These weather stations continuously provide the Fire Department with updates in weather conditions. The Fire Department increases its level of response accordingly, as the wind speed and the temperature rise and the humidity drops. Initial response to the report of fire varies with the severity of weather conditions. For example, low hazard dispatch requires three fire engines and two patrols. Response on high hazard days requires six fire engines, four patrols, and a helicopter, as well as the predeployment of engine companies to locations in and around high fire hazard areas.

Communications Improvements

The Oakland Fire Department has recently converted to an 800-megahertz radio system that provides a virtually unlimited number of radio talk groups. It is expected that this will mitigate much of the overload of tactical channels that was experienced during the initial stages of the fire.

In addition, proposals have been made to fire departments surrounding the City of Oakland to permit those jurisdictions to participate in the 800-megahertz radio system.

Water Supply

Adapters have been purchased and installed on all fire hydrants within the City of Oakland. These adapters will change the coupling size on the hydrants to 2.5 inches. This will standardize Oakland's hydrants, thus allowing mutual aid fire departments to hook up to Oakland's water supply.

Vegetation Management

Approximately 16,000 Oakland Hills area parcels have been inspected by Oakland Fire Department units. Fire inspectors are requiring brush to be cleared 30 to 100 feet away from structures, and at least 10 feet away from property lines and the street. All chimneys are required to have an approved spark arrestor with no trees or bushes within 10 feet. Compliance has been for the most part good, and violators have been cited and forced to abate their hazardous conditions.

Mutual Aid

Oakland has negotiated agreements with the cities of Berkeley, San Leandro, Alameda, Piedmont, and with the East Bay Regional Parks District to establish Mutual Response Area (MRA) Agreements. These agreements provide for an automatic response when a fire is reported within the MRA.

Borderline residents who report a fire will have a response from both sides of the City limits, and in many cases, they will receive a faster response. The Oakland Fire Department is committed to providing the highest quality of fire protection to the residents of Oakland.



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Appendix B: Calabasas Fire

Calabasas Fire

Summary

On October 22, 1996, an event occurred at a fire incident that resulted in injuries to several fire fighters. The name of this incident is the "Calabasas Incident." An analysis team was formed to learn the facts related to the event. The team was also to identify areas where improvements in training, operations, and administrative procedures that might help fire agencies understand the events that occurred and prevent similar recurrence.

Several unique events added to the significance of the incident and these events, along with other factors, suggest that additional emphasis is needed in training and reinforcing previously established procedures, directions, and guidelines. These needs are identified in the report.

The team was formed jointly between the County of Los Angeles Fire Department (LAC), Los Angeles City Fire Department (LFD), Glendale Fire Department (GLN), and the California Department of Forestry and Fire Protection (CDF). The LAC was designated as the lead agency due to the incident having occurred in the County of Los Angeles jurisdiction.

This report will discuss the events leading up to and following the entrapments of the members of the various companies who were victims of this incident. The circumstances involving the various entrapments occurred almost simultaneously. They each occurred less than 1000 feet apart. The exact events affecting each were different however, and this report will describe the various operations within the one major event, that being the rapid increase in the intensity of the fire, which caught all involved by surprise.

Entrapment: A situation where personnel are unexpectedly caught in a fire behavior-related, life-threatening position where planned escape routes or safety zones are absent, inadequate, or have been compromised. An entrapment may or may not include deployment of a fire shelter for its intended purpose. These situations may or may not result in injury. They include "near-misses." As defined by the National Coordinating Group in Fire Entrapment Investigation and Review Guidelines.

Narrative

Introduction

On October 21, 1996, at approximately 1035 hours, arcing electrical power lines located by the Ventura Freeway at Los Virgenes Road in Calabasas started a fire in dry grass. An augmented brush assignment was dispatched by the LAC. The first unit on-scene reported a $\frac{1}{4}$ - $\frac{1}{2}$ acre fire burning in medium brush, uphill, and with heavy winds. Rotary and fixed wing air units were used on the initial attack. The fire escaped initial containment efforts and moved to the south toward the ocean. Additional resources were requested and began to arrive in force by early afternoon. At approximately 1800 hours, the fire had burned to Pacific Coast Highway. Later in the evening the winds diminished, but continued to blow throughout the night. The speed of the fire's advance also diminished. However, it mushroomed to the east and west of the areas where it approached the ocean endangering many properties along Pacific Coast Highway neighborhoods.

Corral Canyon

Corral Canyon Road runs north from Pacific Coast Highway from a section of the coast that runs east and west. It is a very narrow two-lane road with many turns that generally follows a ridgeline on the western side of Corral Canyon. It has three areas of structures: several groupings along the coast, a tract of about 113 homes one and one half miles north of the ocean, called Malibu Hills, and a tract of about 80 homes about three miles north of the ocean, called Malibu Bowl.

The fire burned all afternoon and evening on October 21, 1996 on the eastern slopes of Corral Canyon. The fire burned downhill with the wind and made occasional runs back uphill, but remained



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Appendix B: Calabasas Fire

primarily on the eastern slopes. It also made several serious runs in Piuma and Latigo Canyons threatening structures in those areas adjacent to Corral Canyon. Fire equipment was assigned to the areas where the fire was most threatening. Six strike teams under a Division Supervisor, each consisting of five Type 1 Engines and a Leader, were assigned to protect the houses in Corral Canyon should the fire come in that direction. Three Strike Teams were assigned in the Malibu Bowl tract, two were on the road approaching the tract, and one was assigned to the Malibu Hills tract. One of the strike teams in the Malibu Bowl tract was reassigned to Latigo Canyon during the night. All of Corral Canyon was designated as one division within the Incident Command System.

By the next morning, October 22, 1996, the fire had begun to move slowly back up the slope away from the ocean, against the wind. At the Plans briefing at 0600, the Incident Command staff noted that the fire area generally designated as Corral Canyon, and most specifically in the area of the Malibu Bowl portion of Corral Canyon, had a high potential for serious fire behavior. A large contingent of air support was assigned to pretreat the area that had not yet burned in Corral Canyon.

The incident objectives were to slow the fire's approach to the area in the event the wind continued to move the fire toward the upper tracts of homes from the northeast direction. If the wind changed and began to blow from the ocean as predicted, the fire's advance on the floor of the canyon would be slowed by the chemical and water pretreatment.

Late in the morning, at approximately 1100 hours, the northeast wind stopped and many people observed that the smoke from the fire was going almost straight up. A spot fire was observed on the western slope of Corral Canyon below the Malibu Bowl tract. Air units quickly attacked the spot fire. Very steep slopes and large amounts of unburned and dead fuel fed its progress up the canyon. The fire was advancing along the bottom of the canyon, making runs upslope, and spotting ahead of itself as it advanced.

Malibu Hills Tract

The Malibu Hills tract was generally on the opposite side of the western ridge of Corral Canyon and was only briefly threatened by the fire. The Division Supervisor assigned a LFD strike team to structure protection for this tract. Corral Canyon Road was heavily congested with many civilian vehicles, news vehicles, service trucks, and fire apparatus in this area. In addition, vehicles from the Malibu Bowl tract had to traverse this area to move to Pacific Coast Highway. The fire did not damage the Malibu Hills tract.

A pre-attack plan had been prepared and distributed for the tract, which defined a need for 20 fire engines to defend the tract from an approaching fire.

Malibu Bowl Tract

The Malibu Bowl tract overlooks Corral Canyon with a direct view to the ocean. A steeply sloped bowl (80% slope) had to be traversed by traffic along Corral Canyon Road to approach the Malibu Bowl tract. Corral Canyon Road split approximately half way across the bowl with the main road continuing further up-canyon and Newell Road bearing off to the east across the bowl toward houses in the tract. Most of the road across the bowl is midslope approximately 600 feet above the bottom of the bowl. Newell Road to Corral Canyon was the predominant route into and out of the tract for most residents. However, an alternate route was available further up Corral Canyon Road.

The terrain around the Malibu Bowl tract consisted of a very steep slope in the bowl that faced predominantly south to southeast as it went around away from the tract. This bowl had several smaller chimneys within it. The eastern side of the housing tract toward the main Corral Canyon was a gentler slope but still uphill at the tract. The hillside continued beyond the tract with some houses on the top of the hill. Most of the tract was midslope on a hill. The brush clearance varied considerably from very good to poor. The entire bowl was full of medium to heavy brush 4-6 feet deep right up to the side of the road. The native vegetation was not cleared along Corral Canyon Road and Newell Road from the saddle area south of the junction of Corral Canyon Road and Newell Road to the entrapment locations



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of LFD Engine 4, 10, and 17. Vegetation clearance from the access roadways in the Malibu Bowl area did not comply with the County of Los Angeles fire code in several areas. A prefire plan had been prepared and distributed for this tract, which called for a commitment of 20 engines.

The protection of the Malibu Bowl tract was set up in late afternoon of October 21, 1996. The plan was developed on the basis that the fire, as it approached the position of the fire fighters, would be driven by a wind from the northeast and would progress across the bottom of the canyon floor. It would move toward the houses located on the east side of the tract. A strike team was set up along the eastern edge of the tract to protect the houses that were determined to be most vulnerable to a fire approaching from that direction. A second and a third strike team were set up at various locations in the tract to protect in case of spot fires in the heavily wooded tract. One of these strike teams was reassigned to another division of the incident during the night. Only 10 engines were left in place, when the fire approached the next day.

One of the two strike teams was in place along the outer edge of the tract and had assigned engine companies specific sectors and houses to protect. GLN Engine 24 was assigned 2050 Newell, Burbank (BRK) Engine 16 was assigned 2004 and 2008 Newell, Pasadena (PAS) Engine 36 was assigned 1966 Newell, BRK Engine 14 was assigned to houses at the end of Newell, and PAS Engine 31 was assigned in reserve. The home at 2006 Newell was determined to be indefensible as it was further down midslope, in a stand of trees with no brush clearance, and personnel had no way of establishing a safe escape route or safety zone.

The structure at 2050 Newell, which was assigned to GLN Engine 24, was on a point at the top of a ridge. It directly overlooked the large bowl area to its south toward the ocean. Two 1½" hoselines were placed around the house with one nozzle located on the patio to the rear of the house and the other, one level below the patio on a point of land. Escape routes were identified following the hoselines and a safety zone was established at the street. The approximate distance from the nozzle to the safety zone was 230 feet up a moderately sloped dirt and gravel path. A relatively safe area was reached at about 170 feet. The engine was placed on the street next to the driveway entrance and near a hydrant. Water pressure was about 200 pounds and volume seemed adequate. The structures at 2004 and 2008 were assigned to BRK Engine 16. LAC fire suppression hand crews had cleared the brush for a width of 10-15 feet below these structures. Several hoselines were placed next to the houses and the brush was pretreated with water from the area cleared by the hand crews. The apparatus was placed between the two addresses in a driveway.

The other Strike Team in the tract was LAC Strike Team 1103 that had dispersed throughout the remainder of the tract to be able to respond to where the fire threatened most. One of the engines was at 1966 Newell and the remainders were at the top of the tract near Corral Canyon Road.

Communications

The Communications Plan for the Incident called for Command to be on LAC Command 3 and the Division to utilize Tactical NIFC Channel Three (168.050). Communications between the Division and the Strike Teams was on LAC Tactical 1. Camp Crews were operating on the crew net, Command 7 Direct. Each strike team was operating internally on their own channels (GLN on Red 5 Direct, LFD on their 22 or 23, LAC on Tactical 1). Communications occurred on Tactical 1 and Command 7 Direct. Neither LFD nor GLN were monitoring these frequencies at the company level and were not familiar with the Communications Plan for the incident. At the company level, both GLN and LFD units were not familiar with the Communications Plan for the incident.

Approaching Fire

Fire fighters assigned to protect the houses in the tract watched the fire all morning from various vantage points. They observed the fire as it spotted south of the Malibu Bowl tract and prepared themselves to control the fire with their preplanned strategies. As the fire approached the tract coming up Corral Canyon from the south, the fire fighters staffed their hoselines.



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The entire bowl area approaching the Malibu Bowl tract was a potential hazard. Many news, civilian, and fire vehicles were located on the road in this location and they were endangered throughout the time the fire approached the road.

The south facing hillside in the bowl had been preheated by the sun, was full of brush including sage and sumac, intermixed with die back, and was very steep, an 80% slope. The hazards of each of these factors individually were recognized, but the combination, along with the tremendous intensity of the fire was not recognized by the companies facing the fire. At 1225 hours, the fire was reported by the Helicopter Coordinator to be active in the base of the bowl area and building in intensity.

Strike Team 1202A Operations

The GLN Strike Team Leader assigned to the protection of the houses on the edge of the tract, and therefore, the first to defend against the fire, requested assistance as the fire approached. The Captain of GLN Engine 24 called for another company to support his position. He was advised by his Strike Team Leader that no other companies were immediately available.

The fire approached the Malibu Bowl tract from the east, running upslope on the east aspect of Corral Canyon towards 2004, 2006 and 2008 Newell Road. These structures were protected by BRK Engine 16 and PAS Engine 31. Hoselines were extended and the native vegetation was wet down between the structures and the advancing flame front. This tactic was not effective in stopping or slowing the approaching fire front. In the same time frame, GLN Engine 24 was attempting to apply a hose stream on the eucalyptus trees from a location above the structure located at 2006 Newell Road. This tactic was ineffective due to the long reach required and the winds generated by the fire. A LAC Fire Crew Superintendent had walked out to the ridge near 2006 Newell Road to observe the advancing fire. He was contacted by radio from his lookout, which was positioned in the saddle area on Corral Canyon Road to the southwest. The lookout told him to get out; the fire was coming hard and fast. The Superintendent fired out in front of the advancing fire trying to buy time and space for the fire fighters and the structures. He escaped to the east passing Engine 16 and Engine 31 fire fighters. He ordered them to leave their position. This position was overrun by fire as they left. The Fire Crew Superintendent was not aware of Engine 24's personnel position on the hill above. BRK Engine 16 and PAS Engine 31 staffed hoselines and, along with an engine deck gun, successfully protected the houses at 2004 and 2008 Newell. The house further out on the point at 2006, which had been previously identified as indefensible, was engulfed in flames shortly after the fire reached the eucalyptus trees.

PAS Engine 36 was next engaged at 1966 Newell. The house they were protecting had excellent brush clearance. However, the personnel of the company chose to take refuge in the swimming pool to avoid the heat of the fire. They were successful in protecting their assigned structures. BRK Engine 14 was also protecting a structure where the advancing fire was knocked down by a helicopter before it reached the structure.

GLN Engine 24 was putting water on the brush and hillside below their position on the point. This was consistent with their plan from the previous day. They had planned to protect the house from a fire, which approached their location from the east. As the fire swept into the eucalyptus trees above the house at 2006 Newell and began to engulf the house, it was still primarily outside of the bowl area below Engine 24's location. There was, however, smoke beginning to come out of the center of the bottom of the bowl area indicating the fire had spread into the area below Engine 24 and was now imperiling everyone else that was above the bowl. Engine 24 personnel continued to operate the 1½" hoseline on the fire. They had some indication the fire was active below them because they could hear it, but could not see its activity through the thick brush about 40 to 50 feet below their location. The fire then began to spot in various points in the bowl including a large area across the bowl from Engine 24 and several small spots below the house. Engine 24's Captain then felt a blast of heat followed by a rain of embers on their position. He ordered his personnel to abandon their hoseline and to run up the primary designated escape route. He left following one fire fighter. The other fire fighter held his position for a few more seconds to cover the escape route, which then closed behind the Captain and



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first fire fighter. He dropped the nozzle and followed them through the smoke and fire up the escape route. They did not consider deploying their fire shelters.

The Captain, along with the fire fighter who had stayed with the nozzle, emerged from the smoke and heat at the top of the escape route near the house. The other fire fighter emerged from the smoke between 15 and 20 seconds later. He obviously was seriously burned: All three of Engine 24's personnel then retreated to the safety of the street.

The engineer of Engine 24 continued to pump his apparatus throughout the event. He was protected by two walls and a distance of about 15 feet to the edge of the bowl. As the fire rolled over him, he staffed his personal protection hoseline and knocked down fire in the bushes and trees next to his position.

Of the two possible escape routes that had been predesignated, one had become unsafe because of the unanticipated intensity and speed of the fire. The fire first came at Engine 24 from the east side cutting off the shorter escape route (which was anticipated), then up the middle and overhead making the route up the stairs to the safety of the house untenable. The third and designated primary escape route was clear for the first person, but became hazardous as the second and third persons ran up its path. It was not anticipated that the fire would come this direction with the speed and intensity that it did after cutting off the other escape routes.

Strike Team 1103A Operations

LAC Strike Team 1103A was also assigned to the Malibu Bowl tract and was working with the GLN Strike Team Leader to coordinate protection for the houses in the tract. LAC Engine 3 from Strike Team 1103A was located near 1966 Newell and assisted in the protection of houses in that area as the fire approached. When the GLN Strike Team Leader requested help at 1225 hours, Strike Team 1103A Leader sent LAC Engine 25 to assist Engine 24. From a higher area of the tract, Engine 25 traveled down Corral Canyon Road, traveled across Newell Road on a midslope road to assist Engine 24. Engine 25 encountered civilian vehicles at Corral Canyon Road and Newell Road and the Captain directed the vehicles out of the area. The company proceeded across Newell Road and reached the other side near Engine 24 just as the fire jumped the road at the intersection of Corral Canyon Road and Newell Road. His direction to the civilians probably saved their lives.

As Engine 25 entered the intersection of Newell Road and Fairside Way, they encountered more civilian traffic, which blocked the road. The Captain attempted to move the traffic out of the way so that his engine and the ones now stacking up behind him could get to safety and assist in the protection of the threatened houses. He eventually got the car blocking the road to move and his engine moved through, followed by LFD Engine 17. The crew of Engine 25 went to work to extinguish fires in the area and assist injured fire fighters.

LAC Engine 96 was also directed by Strike Team 1103A Leader to assist at BRK Engine 16's location. They came down Fairside Way and attempted to set up at Newell Road and Fairside Way, but were driven back up Fairside Way by the heat of the fire. They set up to protect houses in the area above Newell Road and on Fairside Way and extended lines around houses above their location. A civilian vehicle partially parked on their supply line, however, they had sufficient water to control the fire spread in their area.

The two other engines in Strike Team 1103A successfully protected houses in the upper areas of the tract by deploying hoselines and using Class A foam.

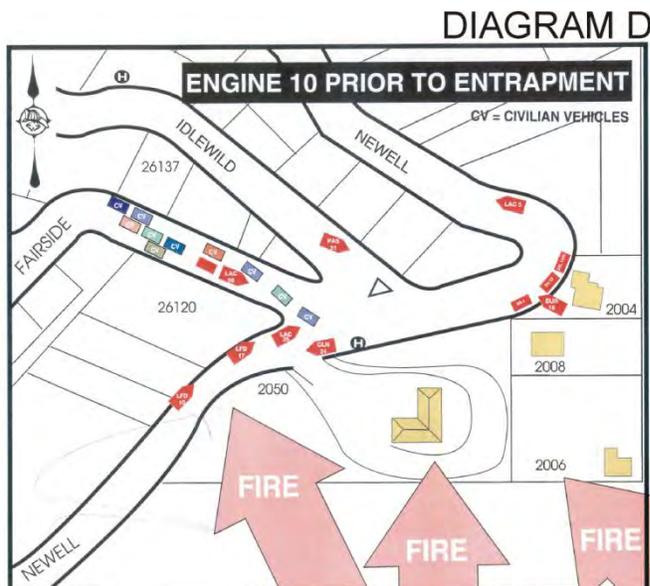
Strike Team 1001A Operations

LFD Strike Team 1001A was returning from the Incident Staging area to their assignment protecting homes in the Malibu Hills tract when they observed a large column of smoke and were requested by another LFD Strike Team Leader to respond to the Malibu Bowl tract. As they arrived at the edge of the bowl opposite the Malibu Bowl tract, Strike Team Leader 1001A was directed by the Division

Supervisor to proceed across Newell Road with half the Strike Team to assist with structure protection in the tract. The other half was assigned to keep the fire from jumping Corral Canyon Road.

The 1001A Strike Team Leader did not consider the exposure of the road or observe the fire conditions below it prior to sending his companies across. Both the 1002A Strike Team Leader and the 1075A Strike Team Leader, who were located in the area of the start of the bowl, had previously reviewed the safety of the situation and knew the potential hazards of the road.

Three of the companies from Strike Team 1001A started up Corral Canyon Road to Newell Road. The first company, LFD Engine 17, was delayed by LAC Engine 25 who, as previously stated, was moving civilians and civilian automobiles from the intersection so they could make the turn Engine 17 started across Newell close behind Engine 25. They stopped at the opposite end of Newell just behind Engine 25 who had been blocked by another civilian vehicle. They notified Engine 25 of their presence by use of the air horn, but Engine 25 was blocked and could not move. The fire then blew up over their Engine with an explosive force. The Engine 17 Captain held his brush jacket against his window to cut down on the radiated heat. The Captain-side fire fighter climbed over the engine compartment for relief from the intense heat of the fire, which by then was engulfing the road behind them and impinging on the rear of their apparatus. The Engine 17 Captain saw in his side mirror that LFD Engine 10 behind them was being overrun by the fire. LAC Engine 25 moved ahead again and Engine 17 moved out of direct fire contact past GLN Engine 24. As soon as they were able to make it to safety, LFD Engine 17 moved as quickly as possible to pull a line back to rescue the personnel of Engine 10 behind them (See Diagram D). The second 1001A Strike Team engine to start across the bowl road was LFD Engine 10. Engine 10 followed about 50-75 feet behind Engine 17, due to smoke and poor visibility.



The engineer from Engine 10 was dressed in his blue work shirt and brush pants and had not taken an opportunity to put on his safety equipment. The rest of the company was dressed in full safety equipment. Engine 10 got through the intersection of Corral Canyon Road and Newell Road quickly and was moving across the Newell Road section of the road when it was hit by the main body of the fire. The engineer attempted to keep the apparatus as close to the base of the cut bank as possible but eventually was forced to come to a stop because Engine 17 had stopped in front of them. After the apparatus was stopped, the vehicle engine stalled from ingesting the heavy smoke. The Captain-side fire fighter on Engine 10 jumped over the engine compartment and attempted to deploy his fire shelter. However, he lost the shelter in the smoke and heat and was unable to find it again. The driver-side fire fighter

successfully opened his shelter in his jump seat. The engineer tried to deploy his shelter, but could not open it because of the extreme heat on his ungloved hands. He joined the fire fighter in the jump seat area under the partially deployed shelter and was additionally covered by the body of the other fire fighter who then pulled the shelter over the three of them. The Captain slid over to the driver's seat and attempted to restart the engine. He was unable to do so. He then exited the cab on the engineer's side and joined the remainder of his crew under the shelter. He was only able to get his upper body under the shelter. He radioed from under the shelter that they were being overrun and that he had burned personnel. He also requested an air ambulance, and water drops on his position. During this



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time, he was able to calm his personnel. The Captain again returned to the driver's seat and attempted to restart the engine.

Flames were wrapping around the vehicle windshield. It would still not start, so he returned to his personnel under the shelter. Engine 17 personnel arrived with a hoseline after an estimated three minutes of entrapment. The Engine 10 engineer received serious burns. The Captain-side fire fighter received minor burns. The other fire fighter and the Captain were in heavily layered personal protective equipment, used a fire shelter as a shield, and received only minor injuries. The Captain suffered smoke inhalation.

The third engine in Strike Team 1001A which was on its way to Newell Road was LFD Engine 4. Engine 4 proceeded to the Corral Canyon and Newell Road intersection and stopped next to a hydrant as they missed the order from Strike Team Leader 1001A. The fire then overran the intersection and Engine 4 attempted to escape further up Corral Canyon, but stalled almost immediately due to extreme heat and smoke conditions. The engine restarted and Engine 4 was able to escape up Corral Canyon. Three members of the company were later treated for smoke inhalation.

The fourth and fifth engines in the Strike Team were LFD Engines 20 and 21. Both these engines were positioning to keep the fire from jumping Corral Canyon Road when the fire jumped over the road ahead of them with reported 200-foot flame lengths. They both retreated to the saddle entrance of the bowl road with their Strike Team Leader.

Strike Teams 1002A, 1003A, and 1075A Operations

Strike Teams 1002A and 1075A were located in the saddle area where Corral Canyon Road opens to become a midslope road over a bowl. Culver City Strike Team 1075A, with engines from Culver City, Santa Monica, and Beverly Hills was assigned to support a Camp Crew that was doing a minor firing operation. LFD Strike Team 1003A was assigned structure protection at the Malibu Hills tract and eventually was involved with the medical treatment of the injured fire fighters and coordination of the helispot. LFD Strike Team 1002A was assigned to protect structures in the Malibu Bowl tract and was preparing to move to the houses when the fire blew across the road cutting off their access to the tract. They eventually participated in the medical treatment of the injured fire fighters.

Medical Treatment and Evacuation

When the fire fighters from Engine 24 reached their Safety Zone, they were met by the Branch Director who was surveying the area. The Branch Director treated the most seriously burned fire fighter in his car and transported him to Strike Team 1002A's location across the Bowl for further medical treatment. He then continued to arrange for an emergency helispot along Corral Canyon Road near the Malibu Hills tract. The Branch Director requested an Air Squad directly through the Helicopter Coordinator.

The area Safety Officer then arrived at Engine 24's location and recognized the burns to the second fire fighter on Engine 24. The Safety Officer transported the second GLN fire fighter to the emergency helispot.

The personnel from Engine 10 were rescued by the crews of Engine 17, Engine 20, and Engine 33 who had come to their aid. As they approached Engine 17's location, they were able to commandeer a civilian vehicle, which they used for transportation to the emergency helispot. The LFD Strike Team Leaders arranged directly through LFD Operations Control Division (OCD) for LFD Fire 1 to evacuate their injured fire fighters. This was a very hazardous operation because of the continued presence of fixed wing aircraft and heavy helicopters that were involved in firefighting activities in the area near the emergency helispot.

All injured personnel from GLN Engine 24 and LFD Engine 10 were transported by LFD Fire 1 and LAC Air Squad 8 to UCLA Medical Center for immediate treatment. Four were subsequently transferred to Sherman Oaks Burn Center for more specific treatment for their burns. It is estimated



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that all the injured fire fighters were at UCLA Medical Center within 50 minutes from the time of the injuries.

Findings

The findings listed in this report are supported by interviews, witness statements, physical evidence, standard forms, and other information that are held in the Calabasas Entrapment Analysis File.

Environmental

- The fuel below the entrapment area consisted of Blue Sage and California Sage. The fire burned in a Northern Forest Fire Laboratory (NFFL) Model 4 fuel type (brush)
- Below the entrapment area, the slopes were 75%-80%.
- Temperatures at the entrapment site were 72°F.
- Relative humidity at the entrapment site was 14%.
- Spot weather forecasts indicated that north winds would decrease during the day and might be replaced by onshore winds in the afternoon near the coast.
- The area involved in the incident partially burned in the 1982 Dayton Canyon Fire.
- Live fuel moistures were extremely low and below the 15-year average for live fuel moistures in the Malibu area.
- The slope below GLN Engine 24's location was primarily a south aspect. The slope below LFD Engine 10 and 17's entrapment site was primarily a southeast aspect.
- There were three "chimneys" within the bowl area.
- Brush clearance (both ornamental and native) around structures in the Malibu Bowl area was not in full compliance with the County of Los Angeles fire code.
- Brush clearance along access roadways did not comply with the County of Los Angeles fire codes.
- Access roadways in the Malibu Bowl area do not comply with current County of Los Angeles minimum requirements (existing nonconforming).

Management

- The incident began on October 21, 1996 at 1035 hours, near the 101 Freeway east of Las Virgenes Road.
- LAC Incident Management Team 3 was in command of the fire.
- Division Z encompassed Corral Canyon from Pacific Coast Highway to Mesa Peak Motorway, a distance of approximately 5 miles.
- The IAP indicated Division Z had five Type 1 Engine Strike Teams.
- In addition, Division Z also had Strike Team 1202A assigned to the Malibu Bowl area, one L.A. County long crew and a dozer team. One field observer and one safety officer had just arrived in the Malibu Bowl area at the time the fire became active.
- Day Division Z Supervisor assumed command of Division Z from night Division Z at approximately 0830, October 22, 1996.
- Branch II arrived at BRK Engine 16's location just before the entrapment. Day Operations had observed the Malibu Bowl area 30 minutes before entrapment.
- GLN Engine 24's Captain had approximately one hour of rest after he stopped observing the fire on October 22, 1996.
- GLN Engine 24's Captain had also worked a 24-hour shift on the 20th of October and had performed emergency work during sleep hours.



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- GLN Engine 24's Captain had two years' experience as a USFS Engine fire fighter.
- The fire was not visible directly below GLN Engine 24's position.
- GLN Engine 24's Captain was aware of the fire's approximate location, directly below them.
- GLN Engine 24's Captain had observed from 26120 Fairside Road, the fire's build up in the Bowl.
- There was a written medical evacuation plan, ICS Form 206, Page H-52.
- The medical evacuation plan was not followed in regards to the notification procedure.
- Medical evacuation was accomplished in a timely manner.
- Dedicated lookouts were not assigned in Division Z.
- GLN Engine 24's Captain identified two safety zones and two escape routes.
- GLN Engine 24's Captain performed a PPE safety inspection just before the entrapment.
- GLN Engine 24's crew complied with GLN PPE requirements. Engine 24's crew was wearing approved wildland PPE.
- County of Los Angeles Fire Department Wildland Pre-Attack Information Plans indicated a need for 20 Engines in the Malibu Bowl housing tract. Only two strike teams (10 fire engines) of Type 1 Engines (1103A and 1202A) were in place in the Malibu Bowl before the entrapments occurred.
- County of Los Angeles Fire Department Wildland Pre-Attack Information Plans indicated 20 Engines for the Malibu Hills housing tract also in Division Z.
- Calabasas Incident resource order requested Chief Officers for Overhead.

Controls

Organizational System

- The span of control for the Operation's Chief, Branch II Director & Division Z Supervisor was within ICS guidelines.
- The large geographic size of Division Z made operations difficult. The assignment of six engine strike teams (30 fire engines) and two hand crews were at the limit of the span of control guidelines. In the operational period following the entrapments, this area was divided into two divisions.

City of Glendale Fire Department

- Strike Team 1202A consisted of five Type 1 Engines and a Battalion Chief vehicle.
- There were four members assigned to GLN Engine 24.
- Strike Teams 1103A and 1202A were deployed in the Malibu Bowl area.
- Strike Team 1202A's span of control was within the ICS guidelines.
- The fire in the bottom of the canyon was not visible to GLN Engine 24's crew.
- Approximately 45 minutes passed until the most critically burned fire fighter arrived at UCLA Medical Center.

Los Angeles City, Fire Department

- Three LFD Strike Teams of Type 1 Engines were assigned to Division Z.
- Strike Team 1001A consisted of five Type 1 Engines and a Battalion Chief vehicle.
- Strike Team 1002A was on Corral Canyon Road approximately 1800 feet south of the entrapment area.



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Incident Command and Control Issues

- There was no mandatory evacuation of the Malibu Bowl residential area on October 22, 1996. Civilian access to the Malibu Hills and Malibu Bowl areas was restricted to residents of the area only.
- There was no control of civilian vehicles on Corral Canyon Road between the Malibu Hills residential area and the Malibu Bowl residential area. Residents, media, and utility crews were allowed unrestricted access to this area.
- When fire activity increased in the Malibu Bowl area, a number of civilians who had been in their houses for several hours, attempted to evacuate the area. This movement of civilian vehicles hindered fire-fighting operations once the fire became reactive.
- Several civilian onlookers were parked at Corral Can Road and Newell Road. These civilians were directed out of the area by LAC Engine 25 approximately 2 minutes was entrapped at that general location.

Communications

- The radio communications plan for the first day of the Calabasas Incident was listed in the first Incident Action Plan. The tactical channel was LAC Tac 1 (154.430).
- The radio communication plan for the October 22, 1996, 0600-1800 hours operational period (second day) changed the Division Z tactical channel to VHF Bendix-King Channel 3 (168.050). This new communication plan was listed in the IAP distributed during the morning Operations Briefing. This change in the tactical channel caused some confusion among LFD personnel who were issued loaner hand held radios.
- Division Z tactical radio traffic appears to have continued on LAC Tac 1 after 0600 hours on October 22, 1996. This was not consistent with the communication plan in the IAP that designated NIFC 168.050 as the correct tactical channel for the day.
- Communication on the tactical channel in use before the entrapment was not a problem. After the aggressive run uphill by the fire, the communications system was overloaded. Many radio messages were not acknowledged.
- Strike Team 1202A Leader was unaware the tactical channel had changed from White 1 (154.430) to VHF Bendix-King Channel 3 (168.050) at 0600 hours on October 22, 1996.
- At the time of the entrapments, LAC Command frequency Blue-3 was essentially out-of-service, due to an open microphone.
- There was confusion among LFD Strike Team Leaders on how to use the hand held radios issued to them by LAC.
- LFD Strike Team 1001A and 1002A were each using different 800 MHZ channels (22 and 23). The Strike Team Leaders could not easily communicate with each other by radio when the entrapments occurred.
- GLN Engine 24 had both UHF and VHF hand held radios available. At the time of the entrapment, GLN Engine 24's Captain carried only the UHF radio that monitored a GLN TAC frequency.
- Interference from radio stations transmitting from Mexico became a problem on October 23, 1996 when additional radio repeaters were installed in the general area of the Calabasas Incident. This interference was not a factor in the entrapments.

Personnel

City of Glendale Fire Department Personnel

Engine 24 Member 1, Age 38: minor burn
 Member 2, Age 46: no injuries



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Member 3, Age 52: major burns

Member 4, Age 42: moderate burns

- Three members of GLN Engine 24 were entrapped while escaping to their safety zone.
- All personnel had training in shelter deployment. However, no training was conducted in deploying fire shelters in simulated wind conditions and dynamic deployment in the 1996 calendar year.
- This was the first entrapment situation for all members of Strike Team 1202A.
- Members of Strike Team 1202A had been assigned to the Calabasas Incident for approximately 24 hours, at the time of entrapment.
- The uninjured members of Strike Team 1202A remained on duty after the entrapment and were demobilized at approximately 2100 hours on October 22, 1996.
- Engine 24 Captain had 16 years job seniority, 5 years in rank, and 2 years as a USFS Engine fire fighter.
- The Strike Team Leader of Strike Team 1202A had been a Battalion Chief for twenty months. This was his first assignment as a Strike Team Leader at a wildland incident.
- Strike Team Leader 1202A had completed Strike Team Leader training offered by the Burbank Fire Department in September 1996.
- Scientific analysis of PPE belonging to the critically burned fire fighter revealed. "The best fit of the observed data and burn patterns indicates brief flame contact off the ground with a longer exposure on the ground."

Los Angeles City Fire Department Personnel

Engine 10 Member 5, Age 38: smoke inhalation

Member 6, Age 42: burns

Member 7, Age 29: burns

Member 8, Age 30: smoke inhalation

Engine 4 Member 9, Age 41: smoke inhalation

Member 10, Age 43: smoke inhalation

Member 11, Age 26: smoke inhalation

Member 12, Age 31: no injuries

- Four members of LFD Engine 17 were entrapped on their apparatus, but not injured.
- All LFD personnel on Strike Team 1001A had not been trained in the deployment of fire shelters under simulated wind conditions and dynamic deployment in the 1996 calendar year.
- Two members of Strike Team 1001A had previous wildland firefighting experience with a hand crew for the U.S. Forest Service or County of Los Angeles Fire Department. These two members were the only members on Strike Team 1001 to immediately recognize the danger when they drove north of the "saddle" area on Corral Canyon Road.
- Members of Strike Team 1001A had been assigned to the Calabasas Incident for approximately 27 hours at the time of the entrapment.
- The uninjured members of Strike Team 1001A remained on duty after the entrapment and were relieved at approximately 1000 hours on October 23, 1996.
- The Engine Captains in Strike Team 1001A had from 1½-13½ years seniority in their rank.
- The Strike Team Leader of Strike Team 1001A has been a Battalion Chief for eighteen months. He was not assigned to a wildland area. This was his fourth assignment as a Strike Team Leader, at a wildland incident.



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- Strike Team 1001A Leader had completed Division Supervisor training offered by the U.S. Forest Service, in 1995.

Other Command Positions

- The County of Los Angeles Fire Department, Los Angeles City Fire Department, Glendale Fire Department, and California Department of Forestry and Fire Protection have no experience-based requirement for overhead positions in wildland fires.

Equipment

City of Glendale Fire Department

- All members were wearing full wildland personal protective equipment as specified in GLN Training Bulletins.
- Fire shelters carried by Engine 24 personnel complied with USFS specifications.
- None of the Engine 24 personnel deployed their fire shelters.
- Analysis of PPE belonging to the critically burned fire fighter concluded: "Overall, the Nomex and other protective clothing and equipment, all functioned within their designed limitations and helped to reduce burn injury."

Los Angeles City Fire Department

- Not all members of Strike Team 1001A were wearing their personal protective equipment.
- Some members of Strike Team 1001A wore a mix of wildland and structure fire personal protective equipment.
- Three members of LFD Engine 10 attempted to deploy their fire shelters. Only one was successful at opening the shelter.
- All members of Strike Team 1001A had fire shelters available for their use.
- One fire fighter on LFD Engine 10 utilized his fire shelter as a shield. Ultimately all members of LFD Engine 10 took refuge under this fire shelter.
- The engineer on LFD Engine 10 attempted to deploy his fire shelter, but was unsuccessful. This fire shelter was later used by personnel from LFD Engine 17 to shield the engineer from LFD Engine 10, as he was escorted on Newell Road.
- One fire fighter on LFD Engine 10 attempted to deploy his fire shelter, but had it accidentally knocked from his hands.
- The Captain on LFD Engine 10 was unable to find his fire shelter, as he prepared to exit the cab.
- Many members of Strike Team 1001A wore firefighting hoods instead of their helmet shrouds. Personal protective equipment functioned within designed limits.
- The apparatus on Strike Team 1001A were a mix of fully enclosed and partially enclosed Type 1 Engines. Engines 17, 10, and 4 were partially enclosed apparatus. Engines 20 and 21 were fully enclosed apparatus.
- LFD Engine 10 sustained approximately \$30,000 damage because of the entrapment. The cab area was not breached and the vehicle was road worthy
- LFD Engine 17 sustained approximately \$5,000 damage because of the entrapment. The damage was confined primarily to the equipment on the right rear of the apparatus.
- A Strike Team Leader was operating in a vehicle with a right front window broken and missing. This allowed heat, smoke, and embers to enter the vehicle. Repair was available through Ground Support Unit.



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Appendix B: Calabasas Fire

Injuries

The six members of GLN Engine 24 and LFD Engine 10 were injured at approximately 1244 hours on October 22, 1996. These two separate incidents occurred within the same event. The initial medical treatment and transportation of the injured members is summarized below.

GLN Engine 24 Injuries

- GLN Engine 24 members were given first care when they exited north of 2050 Newell Road, near PAS Engine 31. This area was chosen because it provided a safe haven to administer care to the more seriously burned fire fighter. All of the personal protective gear from the critically burned GLN fire fighter was removed at this location and saline solution was poured over him by members of GLN Engine 24. The other less seriously burned GLN fire fighter was neither treated nor transported at this time, because his injuries were not immediately apparent to those around him.
- Branch II Director and his fire fighter/paramedic driver transported the critically burned GLN fire fighter off the hill, to a cut out parking area, approximately one-quarter mile south of the Corral Canyon Road and Newell Road intersection. LFD EMTs and paramedics removed his remaining clothing, applied additional saline, and wrapped him in sheets. He was placed back in Branch H's sedan and transported to Corral Canyon Road and Seabreeze Drive for air evacuation. En route, a LFD paramedic rode with him, took his vitals, and administered oxygen. At the helispot, LFD paramedic Engine 47 was standing by and initiated paramedic intervention. LFD paramedics attempted to establish base station contact several times, but were unsuccessful. Several attempts by cellular phone also failed, and UCLA Medical Center was finally contacted by LFD Dispatch Center and advised to stand by to receive the burned fire fighters. The critically burned GLN fire fighter was loaded into LFD Helicopter Number 1 (Fire 1) with the paramedics from LFD paramedic Engine 47 and transported to UCLA Medical Center. The critically burned GLN fire fighter was stabilized at UCLA and then transferred to Sherman Oaks Burn Center.
- At the time the critically burned GLN fire fighter was being treated on Corral Canyon, four injured LFD fire fighters were being prepared for transportation to the helispot for evacuation by helicopter. While the four LFD members were being treated at Newell Road and Fairside Road, a LAC Safety Officer (Safety 8) found the second injured GLN fire fighter and put him in his Safety Officer's van. The LAC Safety Officer gave the injured fire fighter some saline and a towel to help cool the burn. The LAC Safety Officer left the area of Newell Road and Fairside Road just before the civilian van with the LFD fire fighters. The LAC Safety Officer transported the second injured GLN fire fighter to the helispot at Corral Canyon Road and Sea Breeze Road, where an I.V. was established, oxygen administered and he was prepared for helicopter transport to UCLA Medical Center. The second injured GLN fire fighter was placed on LAC paramedic Air Squad 8, with the two remaining LFD fire fighters. All three injured members arrived at UCLA Medical Center by 1336 hours. The two GLN and one LFD fire fighters were eventually transferred to Sherman Oaks-Grossman Burn Center later the same day.

LFD Engine 10 Injuries

- Burns immediately occurred as soon as the Engine 10 engineer exited the cab to deploy a shelter. Other members covered the engineer with their bodies and shielded the engineer with a partially deployed shelter. Water was applied to burns during the entrapment. All four members huddled together in the jump seat under the shelter. From the entrapment site, they were assisted by other fire fighters to a safe area at the intersection of Newell Road and Fairside Road. They were treated with saline solution and wrapped in sheets.
- From this location, they were led to a civilian owned van and loaded for transportation down the hill. The van owner had given permission to use the van for this purpose. Two LFD paramedics from LFD Engine 33 arrived and rode to the helicopter-landing site with the four injured fire fighters. At the landing site, they were triaged and given additional paramedic treatment. The two most



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seriously burned LFD members were loaded into LFD Fire 1, along with the critically burned GLN fire fighter, and then transported to UCLA Medical Center.

Prehospital Care Trauma Protocols

The decision was made to transport the critically burned GLN fire fighter to UCLA Medical Center due to his seriously compromised airway. The second group of victims on Air Squad 8 was transported to UCLA Medical Center to maintain continuity of care as the UCLA Medical Center Emergency Room could handle all six members. UCLA Medical Center was contacted by the flight paramedics, before arrival of both air ambulances.

The Medical Plan in the IAP for this operational period (0600-1800 hours, October 22, 1996), indicated UCLA Medical Center as the closest trauma center. County of Los Angeles prehospital care trauma protocols were followed in ensuring the care of the personnel injured during this incident.

Medical Evacuation and Emergency Medical Service Operations

(Times are approximate)

- 1244 Radio transmission heard on TAC 1, Strike Team 1001A Leader requesting an Air Ambulance.
- 1246 LAC Air Squad 8 self-dispatches from Camp 8, after overhearing radio transmission.
- 1251 LAC Air Squad 8 lands on a clearing west of dedicated helispot (71-A) in Malibu Bowl area. Made contact with LAC Engine 27. LAC Air Squad 8 attempted to contact LFD Fire 1 with no success. LFD helicopter Fire 1 dispatched to Corral Canyon Road and Sea breeze for helicopter transport.
- 1300 LAC Air Squad 8 lifted off and followed LFD Fire 1 down Corral Canyon Road and saw LFD Fire 1 land at a helispot near Sea Breeze and Corral Canyon road.
- 1310 LFD Fire 1 left helispot with three victims. LAC Air Squad 8 landed and began loading additional victims.
- 1323 LFD Fire 1 landed at UCLA Medical Center and shut down.
- 1325 LAC Air Squad 8 left helispot for UCLA Medical Center.
- 1327 LAC Air Squad 8 contacted UCLA Medical Center and was ordered to transport all victims to that facility.
- 1336 LAC Air Squad 8 landed at UCLA Medical Center and shut down.
- 1541 LAC Air Squad 8 lifted off to transfer one GLN fire fighter to Sherman Oaks Burn Center.
- 1550 LAC Air Squad 8 arrived at Sherman Oaks Burn Center.
- 1623 LFD Fire 1 transferred one GLN fire fighter and one LFD fire fighter to Sherman Oaks Burn Center.
- 1624 LAC Air Squad 8 lifted off to return nurse to UCLA Medical Center.

Injuries and Personal Protective Equipment

Note: Refer to diagrams and photos for each member.

GLN Member 1

- GLN Member 1 wore brush pants over work pants, brush jacket over a short sleeve T-shirt, helmet with earflaps down, goggles and gloves. GLN Member 1 was able to escape complete entrapment by running 170 feet in less than 30 seconds with fire impinging from the left side and from behind. Injury sustained was a small second-degree spot on the left side of neck. GLN Member 1 did not feel the need to deploy his shelter.

GLN Member 2

- GLN Member 2 was not entrapped.



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Appendix B: Calabasas Fire

GLN Member 3

- GLN Member 3 wore brush pants over work pants, brush jacket over a long sleeve T-shirt, helmet with earflaps up, firefighting hood around neck, goggles, bandana, and gloves.
- GLN Member 3 was able to exit the entrapment area (170 feet in less than 40 seconds) but sustained burns to 70% of the body. GLN Member 3 did not deploy shelter.
- GLN Member 3's cotton bandana burned through. Cotton chars at 475°F and auto ignites at 750°F. Nomex chars at 824°F and auto ignites at 1300°F. A long sleeve T-shirt under a brush jacket with substantial flame impingement on GLN Member 3 failed to prevent serious burns. Double layering from head to toe, reduced the severity of the members burns.

GLN Member 4

- GLN Member 4 wore brush pants over work pants, brush jacket over a long sleeve T-shirt, helmet over a firefighting hood, goggles, and gloves. GLN Member 4 ran 170 feet in less than 30 seconds with flame and heat impinging on the left side and heat impinging on the left side and from the rear. Injuries sustained were second- and third-degree burns to left elbow, left ear, and left side of face. GLN Member 4 did not deploy shelter. If the firefighting hood was not placed on GLN Member 4, a substantial increase in facial and ear burns would have occurred.

LFD Member 5

- LFD Member 5 wore turnout pants over work pants, brush jacket over work shirt, long sleeve T-shirt and a short sleeve T-shirt, helmet over a firefighting hood, goggles, and eyeglasses.
- LFD Member 5 was able to exit the cab, check on crew, re-enter cab to start engine, return to crew under shelter, and exit shelter to check the environment. LFD Member 5 used body to protect the crew while sharing the shelter. No injuries were sustained. LFD Member 5 was able to continue functioning during the entrapment due to layering and use of some structure firefighting clothing.

LFD Member 6

- LFD Member 6 wore brush pants over work pants and a short sleeve T-shirt. LFD Member 6 could not deploy a shelter due to instantaneous burns upon exiting cab. LFD Member 6 huddled with other crewmembers under a single shelter in a jump seat. LFD Member 6 sustained second- and third-degree burns to both arms below the short sleeve line. LFD Member 6 also received second-degree burns to spots on the neck and back.

LFD Member 7

- LFD Member 7 wore brush pants over work pants, brush jacket over a long sleeve T-shirt over two short sleeve T-shirts, helmet with shroud over firefighting hood. LFD Member 7 retreated to unexposed jump seat, shielded other members with his own body under a single shelter. LFD Member 7 sustained 2nd and third-degree burns to upper back, left elbow, forehead, and ears.

LFD Member 8

- LFD Member 8 wore brush pants over work pants, brush jacket over work shirt over long sleeve T-shirt and short sleeve T-shirt, helmet with shroud, eyeglasses, and gloves. LFD Member 8 opened a fire shelter and partially deployed it. LFD Member 8 stayed in jump seat while other crewmembers huddled on top under one shelter. LFD Member 8 sustained minor smoke inhalation. Long sleeve T-shirts provided additional protection for LFD Members 5, 7, and 8 during their entrapment.

LFD Members 9, 10, and 11

- LFD Members 9, 10, and 11 were placed off duty with smoke inhalation injuries. At the time their injuries were incurred, they were not wearing respiratory protection. These injuries occurred during structure and rescue operations immediately after the entrapment. There are no photographs of LFD members 9, 10, and 11's PPE included in this report.



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Appendix B: Cedar Fire

Cedar Fire

California Department of Forestry and Fire Protection
Investigation Summaries of Serious CDF Injuries, Illnesses, Accidents, and Near Miss Incidents
Engine Crew Entrapment, Fatality, and Burn Injuries - October 29, 2003

A Board of Review has not approved this Summary Report. It is intended as a safety and training tool, an aid to preventing future occurrences, and to inform interested parties. Because it is published on a short time frame, the information contained herein is subject to revision as further investigation is conducted and additional information is developed.

Summary

The Cedar Fire was reported on Saturday, October 25, 2003, at approximately 5:37 P.M. The fire, burning under a Santa Ana wind condition eventually consumed 280,278 acres and destroyed 2,232 structures, 22 commercial buildings, and 566 outbuildings, damaging another 53 structures and 10 outbuildings. There was one fire fighter fatality, 13 civilian fatalities and 107 injuries. The fire was under Unified Command with the United States Forest Service, the California Department of Forestry and Fire Protection, and local government.

On October 29, 2003 four personnel from Engine Company 6162 (E6162) of the Novato Fire Protection District, as part of Strike Team XAL2005A, were overrun by fire while defending a residential structure located on Orchard Lane in the community of Wynola, in rural San Diego County.

The fire made a wind-driven run through heavy brush directly toward their position, covering a distance of approximately one-half mile in just less than two minutes. One crewmember died at the scene and the three others were provided treatment and then airlifted to the University of San Diego Burn Center.

Conditions

The accident site was located on a ridge near the origin of the San Diego River drainage. Slopes at the accident site range between 12-20%. The elevation at the accident site is approximately 3800 feet, 400 feet above the bottom of the drainage.

The Palmer Drought Index shows a preliminary reading of -2.88. The fuel models in the immediately area of the accident site were Fuel Model 4-brush (with at least 90% crown closure) and Fuel Model 1-grass. Live fuel moisture values were below critical levels.

At the time of the accident, a strong onshore pressure gradient had developed with sustained winds of 17 mph and a gust of 31 mph out of the west. At 2:30 P.M. at the accident site, the temperature was 70 degrees and the relative humidity was 30%.

As all the fire environment factors of fuel, wind, and topography came into alignment, there was a sustained run from the southwest directly to the accident site as a running crown fire. Flame lengths were calculated to be in excess of 78 feet, fire line intensities in excess of 73,989 BTU/ft/sec, and rates of spread in excess of 16 miles per hour (for the maximum wind speed recorded at 31 mph). It took the fire a little under 2 minutes to go from the bottom of the slope to the top, a distance of .46 miles. All fuels, both dead and live were totally consumed below the accident site.

Road Conditions: The access to the accident site is a curving ten-foot wide, 490-foot long cement driveway proceeding uphill to the residence. The driveway is overgrown with brush and requires trimming to allow ingress. At the ridge top, the driveway makes a sharp 90 degree curve to the south that finally orients in line with the ridge along the west side of the house.

Make/Model of Equipment: E6162 is a series 2000 International similar to a CDF Model 14. It is outfitted with a 4-person cab, 500-gallon tank, and 500 gallon-per-minute (GPM) pump. The engine is 8 feet 8 inches wide, 24 feet long, and 9 feet 4 inches tall.



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Appendix B: Cedar Fire

Sequence of Events

By 11:00 A.M. on October 29, 2003, the Cedar Fire had crossed Highway 78 spreading along the ridge on the west side of the San Diego River drainage. The fire was making short runs (averaging less than 100 yards) in the grass, brush, and oak trees.

Helicopters were making bucket drops in an effort to keep the fire on the west side of the San Diego River drainage.

The fire on the west side of the drainage moved up canyon and gained elevation.

Under the influence of a west wind, higher up in the drainage, the spread to the northeast, burning the property at 902 Orchard Lane. (See Fire Spread Map) Spot fires are observed in the area and both helicopters and ground resources are moved to the area of Orchard Lane. This includes ST2005A, with E6162, which has a four-person crew including a Captain, two Engineers (who will be referred to as Engineer #1 and Engineer #2), and a Fire Fighter.

At about 12:15 P.M., the Strike Team Leader for 2005A, after reviewing conditions, assigns E6162 to the residence at 920 Orchard Lane (the site of the accident). No engines are assigned to 902 or 930 Orchard Lane. A Captain and an Engineer, in a utility vehicle, arrive at 902 Orchard Lane and begin to fire out around the residence.

While the Captain from E6162 walks ahead to evaluate, E6162 backs up the driveway as overhanging brush is cleared by the crew of E6162. (See Accident Site Sketch) The Captain returns to the engine and expresses some concern about the conditions. The Captain and Fire Fighter return to the residence and determine, based on a large cleared area to the southwest side of the property, that the location is defensible.

The cleared area provides for a view to the west and northwest, tall brush, drifting smoke restricts the view to the southwest, and no fire activity is visible. They observe smoke from the fire to the north, near 902 Orchard Lane, which is flanking towards them, and determine it to be the greatest threat. Small runs of fire are taking place across the canyon on the west side of the drainage.

The crew observes an up-canyon and up-slope wind, at about 7-10 mph, on a line from where Highway 78 crosses the San Diego River towards the location of 902 Orchard Lane, a natural saddle. The crew develops and implements a plan that includes brushing and firing below the house; identifying the house and/or engine as a refuge and placing an axe at the back door; using a residential ladder on the house; laying out 1½" hose lines for engine protection all in an attempt to defend the structure.

The Captain advises the crew of a fire fighter firing out in the area north of the garage. Engineer #1 observes fire on the ground near the garage, and begins strip firing from that location. The Captain throws fuses down the slope into the heavy brush below the area strip burned. This results in a partial burn.

At about 12:25 P.M. the Captain and Engineer, in the utility vehicle, arrive at 930 Orchard Lane. They begin firing around the structures from south to north along the west side of the structures. The Captain instructs the Engineer to take the line of fire to the next house to the north, which is 920 Orchard Lane. The Engineer begins to lay fire towards the north in 15-foot brush with dry grass underneath. Active burning conditions result from this firing and the Engineer does not continue north. Fire from the firing operation makes a run east towards the driveway, where a helicopter bucket drop slows it down.

At about 12:35 P.M. the Strike Team Leader for 2005A arrives at the location of E6162 and reviews their progress and plans. The sky is clear overhead and the winds are moderate. About five minutes after the Strike Team Leader leaves the scene, the crew of E6162 observes an increase in the fire activity below them.



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Appendix B: Cedar Fire

Near where Highway 78 crosses the San Diego River, the fire begins an up-canyon, upslope run in heavy brush and oak fuels. Wind driven, the fire makes a continuous run directly at 920 Orchard Lane, covering a distance of about one-half mile in less than two minutes.

As the fire intensity below them increases, the crew retreats to the passenger side of the engine. The Fire Fighter staffs a 1½" hose line at the front bumper, while Engineer #2 staffs a similar hose line near the rear bumper. Engineer #1 is standing at the rear duals. The Captain is believed to be towards the rear of the engine with the only portable radio.

Members of the crew notice a significant wind increase at this time. A flaming front is observed blowing across the driveway in the direction of the garage. Very active fire is observed below them with flame lengths of 40'-50'. Due to intense heat, the Captain orders the crew to move to the shelter of the residence.

Bushes along the patio behind the crew are burning. The Fire Fighter drops his line and runs in the direction of the raised patio. Upon leaving the protection of the engine, he experiences severe thermal conditions. The Fire Fighter leaps past the burning bushes and onto the patio, followed by Engineer #1 who runs to the steps, stumbles and falls to his knees at the top of the steps, recovers, and continues to retreat behind the rear of the house, following the Fire Fighter. Engineer #2 puts on a hose pack stored in the rear compartment of the engine.

Arriving at the rear door, (approximately 170' from the engine) the Fire Fighter and Engineer #1 use the axe to force entry into the residence. Realizing that no one else is following them, they decide to return and look for the Captain and Engineer #2. At about this time, a radio call is heard indicating a fire fighter is down. Fire burns the charged hose lines (at the rear of the engine) causing the tank to be pumped dry.

The Fire Fighter and Engineer #1 return to the south end of the house. As they near the southeast corner, they observe solid flame blowing sideways across the patio. They then see the Captain stagger around the corner out of the flames. He appears to be dazed.

The Captain tells them that Engineer #2 has fallen and states they need to go back for him, the Captain then turns to go back after the fallen engineer. Engineer #1 and the Fire Fighter determine the patio area is untenable. The three retreat back into the residence. Inside they discuss a plan to search for Engineer #2.

After a moment, they open the front door to check the front of the house. Intense heat surges in and the door is closed. After a few minutes, a second attempt is made to try the front door. Engineer #1 exits to search for the missing Engineer followed by the Fire Fighter who turns back when he is hit by a burst of heat.

Engineer #1 moves towards the front bumper line taking small shallow breaths. Engineer #1 observes the body of Engineer #2 on the patio and continues to the bumper line, advancing it towards the body of the down Engineer. Engineer #1 gets a 10-15 second burst of water before the tank is dry.

An increase in heat forces Engineer #1 to take shelter inside the engine. Engineer #1 considers deploying the extra fire shelters stored in the cab. Concerned that the Fire Fighter and Captain may come searching for him, Engineer #1, taking a single breath runs to the front door and rejoins the other two.

The burning structure forces the three to make their way to the engine. The Firefighter disconnects the two protection lines. Engineer #1 drives the engine down the driveway to the east. Heavy dark smoke obscures the view and Engineer #1 feels his way, using the feel of the tires dropping off the edge of the pavement to make corrections. At one location, the engine is stopped to avoid running off the driveway. Concern about being overrun again convinces them of the need to continue. The Captain transmits a "fire fighter down" message. The crew continues south on Orchard Lane to a location just short of Highway 78.

The three exit the engine and advise a Hot Shot crew that they have been burned. The Hot Shot crew provides medical assistance prior to the three being flown to a hospital burn unit in San Diego for treatment.

Injuries

The Fire Fighter had minor inhalation injuries to the respiratory tract and first degree burns on the face (under the goggles), and small patches of first-degree burns on the back between the shoulder blades.

Engineer #1 received second-degree burns on the tip of the nose and a two-inch by three-inch area on the back. First-degree burns were also sustained on all knuckles of both hands and an additional two-inch by three-inch area on the back.

The Captain received second-degree burns affecting approximately 28% of the body including the face, ears, arms, elbows, and legs as well as sustaining a respiratory inhalation injury.

Engineer #2 died while running for the house and received extensive burns over most of the body.

Damage

Plastic lens covers on all four sides of E6162 melted or showed heat damage. The vinyl hose bed cover for the driver's side pre-connect and both rear hose bed covers melted. There was no obvious heat damage to the paint and the engine was driven away from the accident site.

The wood-frame stucco house at 920 Orchard Lane had a rolled paper and tar roof, and a large wooden deck attached to the north end of the house. The house burned to the ground after the surviving crewmembers left the scene.

Safety Issues for Review

Ten Standard Fire Orders Applicable

- #1. Keep informed on fire weather conditions and forecasts. This needs to be an on-going activity based on all available information. This includes fire weather watches and red flag warnings.
- #2. Know what your fire is doing at all times. This should include the main body of the fire and any fingers and hotspots. If there is any firing taking place in the area, this fire activity needs to be monitored also.
- #3. Base all actions on current and expected behavior of the fire. It is important to consider not only the current and expected behavior, but consideration should be given to the unexpected or possible worst-case scenario.
- #5. Post lookouts when there is possible danger. The presence of a posted, dedicated lookout assigned to the division or area of greatest concern/threat would have allowed for an observation of the fire in the drainage.
- #6. Be alert. Keep calm. Think clearly. Act decisively. Command presence during times of stress is imperative. The leadership demonstrated during this event directly saved lives.
- #7. Maintain prompt communication with your forces, your supervisor and adjoining forces. This needs to be accomplished at all levels within the operation, including the crew level, strike team / task force level, the division / branch level and the operational level. If air resources are moved into and out of an area this needs to be communicated.
- #9. Maintain control of your forces at all times. When positioning, or repositioning resources during a fluid fire environment, it is critical to ensure that all resources are accounted for, and to the greatest extent possible, know the location of their adjoining forces and the tactics being employed.
- #10. Fight fire aggressively, having provided for safety first. Aggressive actions generally place fire fighters in close proximity to the fire's edge. Safety mitigations must be part of the immediate plan. In this case, safety of the crew was demonstrated by aggressive actions taken at the



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Appendix B: Cedar Fire

structure to create a more favorable position, which included a safety zone. When reacting to extreme fire behavior accompanied by a rapidly spreading fire, the safety plan needs to be continually evaluated and updated. It appears that all of the necessary Personal Protective Clothing and Equipment was being worn correctly.

18 Watch Out Situations Applicable

- #4. You are in an area where you are unfamiliar with local factors influencing fire behavior. Out of area / region crews need to be briefed on local conditions and fire behavior prior to going onto the fireline.
- #5. You are uniformed on strategy, tactics, and hazards. All tactics being implemented both within and adjacent to the assigned division need to be known and communicated to all. This is especially true of firing operations.
- #11. You are in heavy cover with unburned fuel between you and the fire. The inability to estimate fire spread in heavy fuels is often cited as a causal agent in fire line injuries / deaths and is directly related to Situation #12.
- #12. You cannot see main fire and you are not in communication with anyone who can. The lack of knowledge about exactly where the leading edge of the fire is and what it is doing, places those that cannot acquire that information at considerable risk.
- #15. You notice that the wind begins to blow, increase or change direction. While often noticed, if not noticed and communicated in time, any required change in the predetermined safety plan may not allow for the plan to be communicated and implemented.
- #17. You are away from a burned area where terrain and/or cover make travel to safety zones difficult and slow. The ability to reach a safety zone, as opposed to an area of refuge, needs to be carefully scrutinized, allowing for a reasonable time frame under the worst-case situation.

Common Denominators Applicable

When there is an unexpected shift in wind direction or speed. The unexpected shift in direction and rapid increase in the speed of the wind were a direct contribution to this accident.

Fires run uphill surprisingly fast in chimneys, gullies, and on steep slopes. This fire responded to an upslope / up-canyon influence as it spotted across the highway and into the upper tributary of a major drainage. The accident site was located on a high ridge and at the top of a significant chimney.

LCES

Lookouts - Lookouts dedicated to that role need to be identified and have proper communication ability. The Lookout location, and time they will be in place, needs to be known by all crews assigned to that division / location. The use of aerial reconnaissance and aerial lookouts needs to be used when it is the only viable lookout that can adequately perform the function.

Communications - As prompt radio communication begins to degrade, regardless of the reason, the propensity to rely on face-to-face communication requires that everyone realize the increased time it will take to ensure all who need to know specific information have in fact received it. Lookouts need to have a clear understanding of desired "trigger points" and to whom and how they will be communicated.

Although not a common occurrence, on this incident the loss of a repeater (destroyed by fire) further complicated radio communications. Command staff must ensure that any and all significant weather information is broadcast to all levels of the incident organization.

The use of VHF and 800 MHz radio frequencies and the potential for lack of communication on the incident, specifically at the division level must be recognized by all personnel. The assignment of multiple tactical frequencies within a division (air resources, structure group, and division tactical channel) must be known, and/or monitored for critical radio traffic.



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Appendix B: Cedar Fire

Escape Routes - Escape routes that are identified at any given moment, need to be constantly evaluated and re-evaluated. The utilization of vehicles / structures as refuge and/or Safety Zones needs to be clearly discussed and assigned accordingly. Creating additional defensible space around structures must be included in the re-evaluation of the number, type, and location of escape routes. Escape routes for both vehicular and foot traffic need to remain viable throughout the operation and during the worst-case scenario.

Safety Zones - Safety zones need to be identified and/or established and communicated to all who may have to use them. Their size and location needs to be based on both current and expected fire behavior. While safety zones may be adequate for what is expected, they need to be applied to the burning conditions present to ensure they are adequate.

The difference between safety zones and refuge areas needs to be clearly understood by all who may use them. The pros and cons of each and the desired sequence of use also need to be communicated. Safety Zones should allow for the required level of safety from as many angles as possible.

Incidental Issues for Review

1. Emphasize the need to establish a dedicated "Lookout" position into the ICS organization.
2. Need to review the 10 Standard Orders, 18 Watch Out Situations, and LCES for specific applicability to wildland/interface operations.
3. Need to address interoperability of communication systems within the fire service community; specifically the 800 MHz versus the VHF frequencies.
4. Need to develop systematic process to inform out-of-area/region resources with local conditions affecting the fire environment.
5. Need to evaluate structure defense philosophies, strategies, and tactics and incorporate into standardized training, technology, and procedures.
6. Approximately 1.5 miles southwest of the entrapment site, 11 fire fighters were killed in a firestorm on the Inaja Fire. (See Orchard Lane Vicinity Map) The Inaja Fire started November 25, 1956, under strong Santa Ana winds, the fatalities occurred when the winds turned to the west.



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Appendix B: Esperanza Fire

Esperanza Fire

California Department of Forestry and Fire Protection
Investigation Summaries of Serious CDF Injuries, Illnesses, Accidents, and Near Miss Incidents
Fire Fighter Burn Over, Five Fatalities - October 26, 2006

Summary

On October 26, 2006, five USFS firefighters were entrapped while engaged in structure protection operations on the Esperanza Fire in Riverside County, California. Three firefighters were killed at the scene, one died en route to the hospital and the fifth died on 10/31/06. All deaths were the result of burns received at the incident.

Conditions

Topography - The fire was located in the San Jacinto Mountains in Riverside County. The burn over site was located on a prominent knob in a bowl, near the top of an “un-named” drainage. This drainage is located west of the Twin Pines Drainage and runs from the desert floor in a northeast alignment with a rapid elevation increase to 3240’ above sea level.

Fuel Type - Area fuels were predominately continuous heavy Chaparral/Manzanita best described as Fire Behavior Fuel Model 4.

Weather - A Red Flag Warning was in effect at the time due to “Santa Ana” wind conditions. Weather conditions were taken from the Beaumont RAWS.

Date	Time	Temperature	Relative Humidity	Wind Speed	Gusts	Direction
10/26	0110	60° F	5%	8	21	ENE
10/26	0310	60° F	6%	8	20	ENE
10/26	0510	59° F	6%	10	23	ENE
10/26	0610	60° F	7%	13	26	E
10/26	0710	57° F	8%	13	31	E
10/26	0810	59° F	10%	15	ND	E
10/26	0910	62° F	10%	16	33	E

Fire Behavior

Forecasted weather and the seasonally dry vegetation conditions categorized the fire with a high probability for large development. The fire produced a rapid rate of spread with extreme fire behavior conditions with wind dominancy. These conditions displayed increased spotting potential with flame lengths of up to 90 feet. A rate of spread of 20 mph was observed on level terrain. Wind and slope alignment produced a greater rate of spread to 40 mph, which caused temperatures to exceed 1220 degrees Fahrenheit ahead of the fire front.

The fire was in full alignment with wind and slope at the time of the burn over. The fire drastically increased in velocity due to the converging of forecasted winds out of the northeast and terrain effects. The fire environment dominated the atmosphere with area ignition conditions surrounding the fatality site. A convection column of up to 18,000 feet high occurred.

Location of Burn Over

(See attached detail map for visual representation)

Sequence of Events

On Thursday October 26, 2006, at approximately 0111 hours, a fire was intentionally set on Esperanza Road at the bottom of a slope near the town of Cabazon, California in State Responsibility



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Appendix B: Esperanza Fire

Area (SRA). It quickly spread southwest uphill toward State Highway 243 and the rural residential community of Twin Pines.

Initial attack fire apparatus were dispatched from the California Department of Forestry and Fire Protection (CDF). At approximately 0123 hours, CDF/Riverside County Fire Medic Engine 24 arrives at the scene. Engine 24 assumes Esperanza Incident Command (IC) and reports that the fire is approximately 10 acres with a rapid rate of spread and is well established on the hillside. The IC advises the Perris Emergency Command Center (ECC) that the fire might have entered the United States Forest Service (USFS) direct fire protection area. At 0130 hours, Perris IC requests five Type III Engines from the USFS. At approximately 0132 hours, the first arriving CDF Battalion Chief arrives and assumes command. At approximately 0307 hours, Esperanza IC is transferred to a CDF Division Chief. The IC reports that the fire is 500 acres plus and has reached the top of Cabazon Peak.

Between 0330 - 0402 hours, BDF Engines 51, 54, 56, 52 and 57 assemble at the Incident Command Post. The engines are instructed to respond to the Twin Pines area for structure protection. At approximately 0515 hours, BDF Engines 52 and 57 arrived at Hwy 243 and Twin Pines Road and assigned to Branch II (Position held by a CDF Battalion Chief). They were given the assignment of evacuations and structure protection in the Gorgonio View Road and Wonderview Road area. BDF E57 and E52 access Wonderview Road directly from Twin Pines Road. At approximately 0550 hours, BDF E52 arrived at a residential structure and identified an elderly woman that needed to be evacuated and are committed. BDF Engine 57 drove down Wonderview Road and turned right on Venison Road. BDF E57 stopped at 49550 Venison to check on a residential structure under construction, referred to as the "Tile Roof House." The home was found to be empty. BDF E57 left the "Tile Roof House" and drove back to Wonderview Road until reaching the "T" intersection of Wonderview Road and Gorgonio View Road. BDF E57 then turns right and arrives at 15400 Gorgonio View Road. As the branch director drives south on Gorgonio View from Wonderview Road, he makes contact with BDF Engines 51, 54, 56 and March Brush 10 at a mobile home referred to as the "Double Wide".

At approximately 0620 hours, the Branch Director meets with BDF E57 at 15400 Gorgonio View Road and discusses their plan, state of the weather, topographical features, locations of other resources, and safety zone.

At an unknown point in time after the Branch Director left 15400 Gorgonio View Road, BDF E57's crew deploys firefighting equipment. They deploy a portable pump at the swimming pool located to the west of the main residential structure and attach a 1½" hoseline which is laid out to the east side of the residence. A 1½" hoseline was attached to a rear discharge of BDF E57.

At approximately 0640 hours, the Branch Director contacts the Operations Section Chief (Position held by a CDF Battalion Chief) and the Twin Pines Structure Group leader to advise them of extreme fire spread upslope toward Twin Pines Ranch Road. He advises them to start evacuations at Poppet Flats.

At approximately 0700 hours, the fire burns up the Twin Pines Drainage and crosses HWY 243 south of Twin Pines Ranch Road and is described by the Branch Director as having very extreme fire behavior with multiple spot fires. At approximately 0710 hours, the fire also established within the "unnamed" drainage below 15400 Gorgonio View Road. Slope and wind alignment in conjunction with multiple spot fires which resulted in an area ignition event. These conditions developed a head fire run to the Northwest and to the ridgeline. The winds exceeded 50 mph during this event. The speed and intensity of this fire run overwhelmed the crew of BDF E57.

At approximately 0745 hours, a search for the crew of BDF E57 began.

At approximately 0800 hours, emergency medical treatment was rendered to the survivors.

Injuries

Three firefighters perished at the scene. One firefighter died en-route to the hospital and the fifth died on 10/31/06 from the injuries.



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Appendix B: Esperanza Fire

Damage

A 2001 USDA Forest Service Fire Engine Type III Model 62 was completely destroyed by the passing fire front.

Safety Issues for Review

- Lookouts, Communication, Escape Routes, Safety Zones
- 10 Standard Firefighting Orders
- 18 Situations That Shout Watch Out

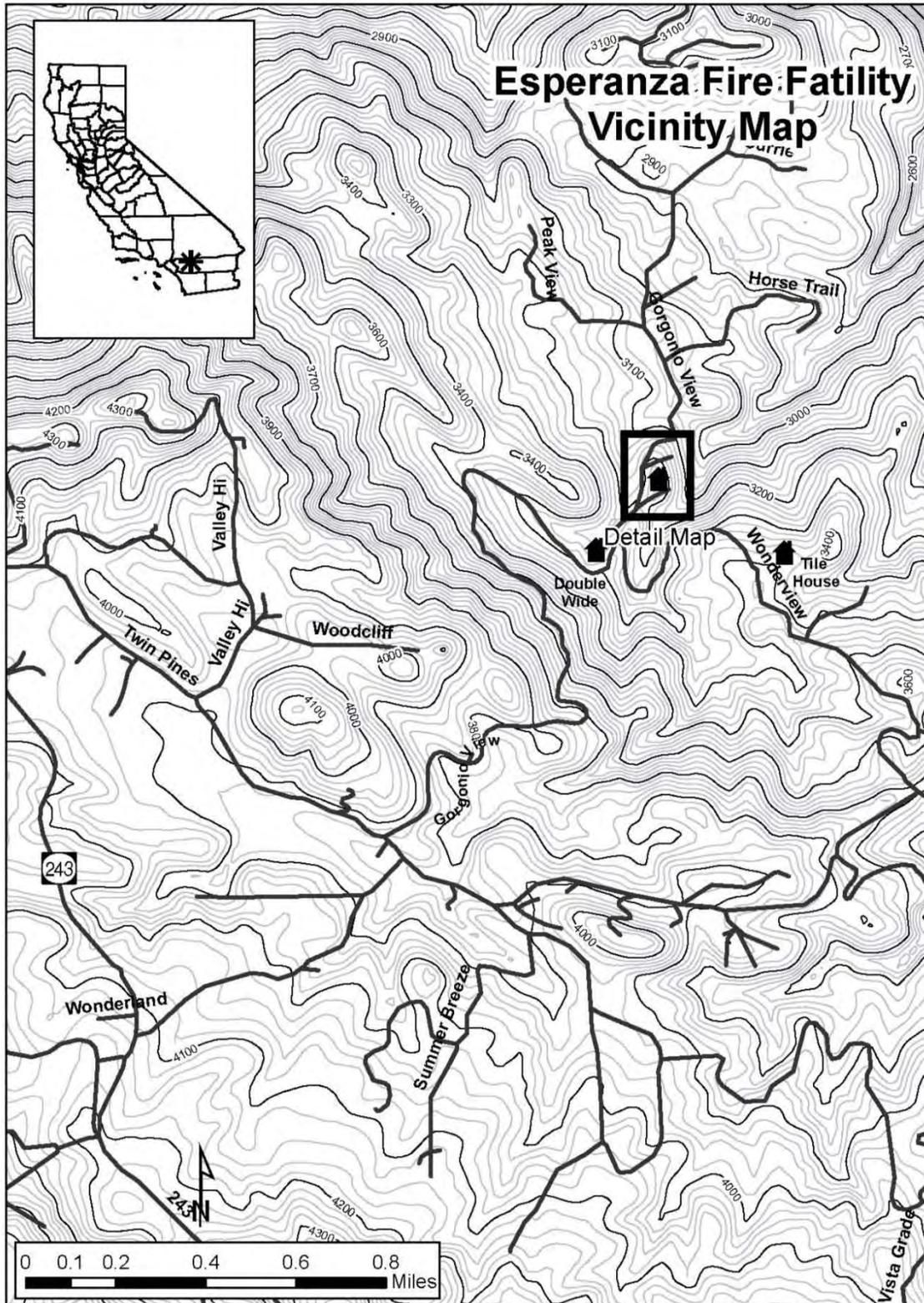
Incidental Issues for Review

- Review structure protection triage procedures
- Ensure all personnel are briefed on fire weather watches and red flag warnings
- Review structure protection tactics
- Complete a risk versus gain analysis while in a wildland urban interface operation

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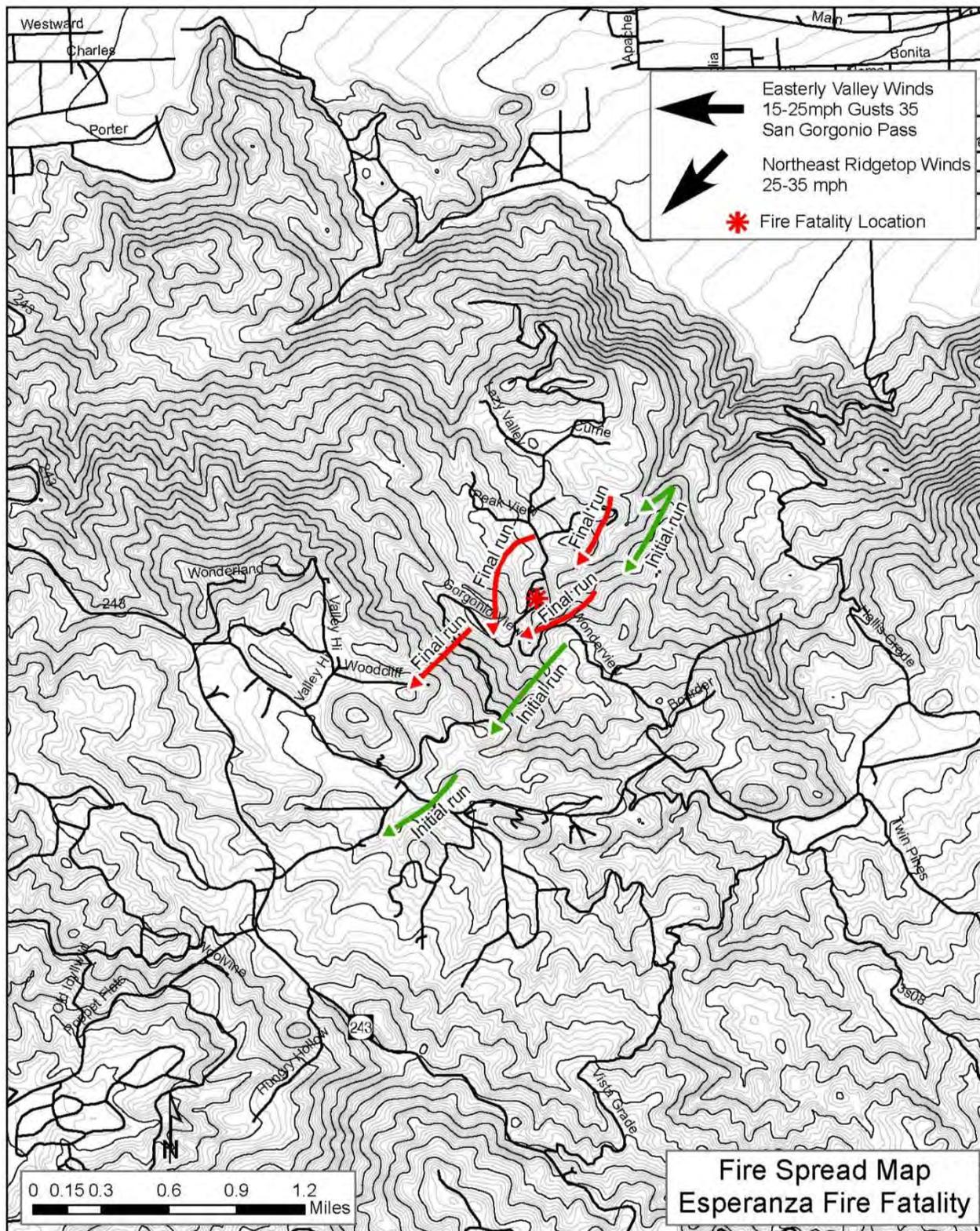
Appendix B: Esperanza Fire



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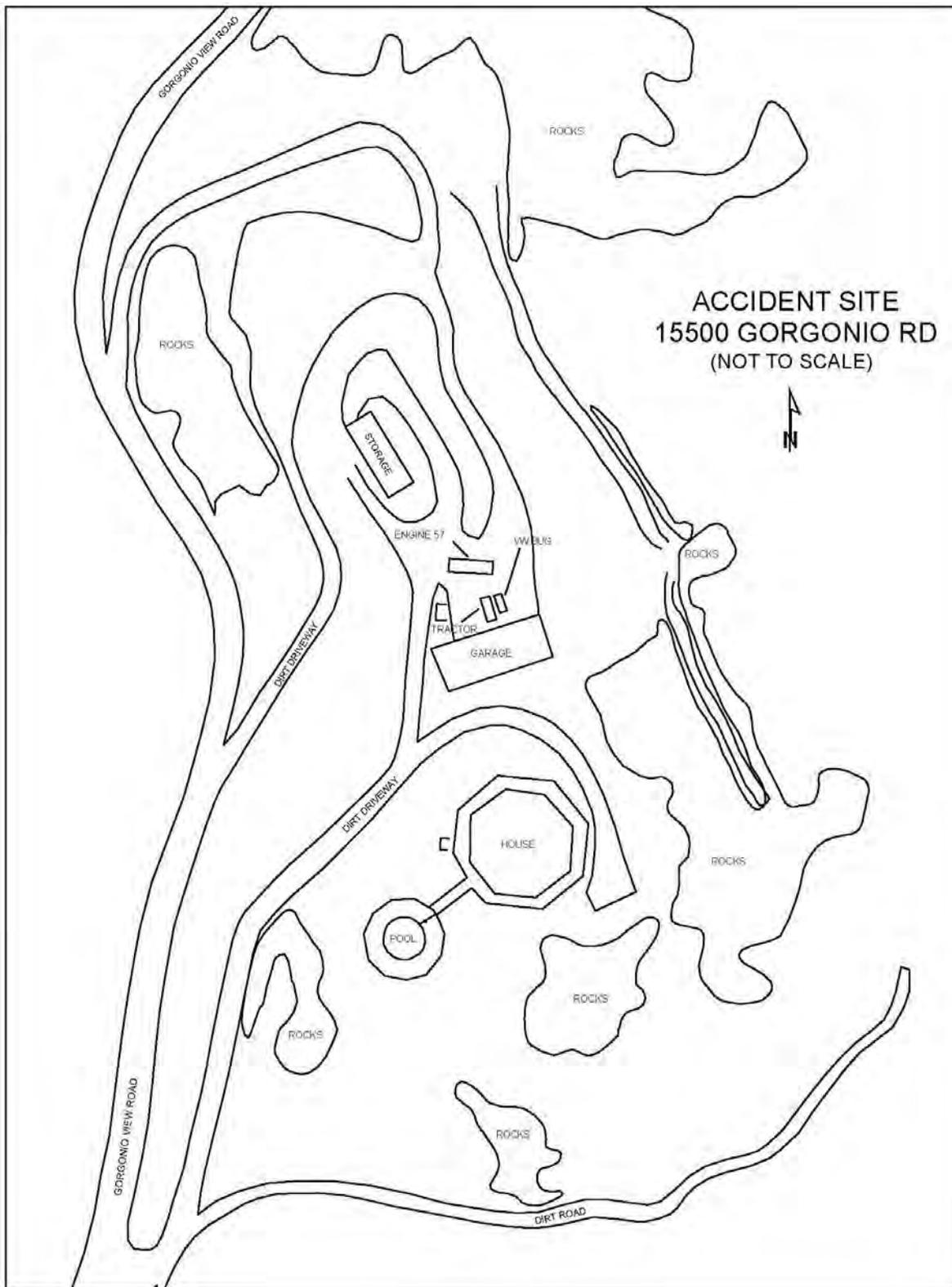
Appendix B: Esperanza Fire



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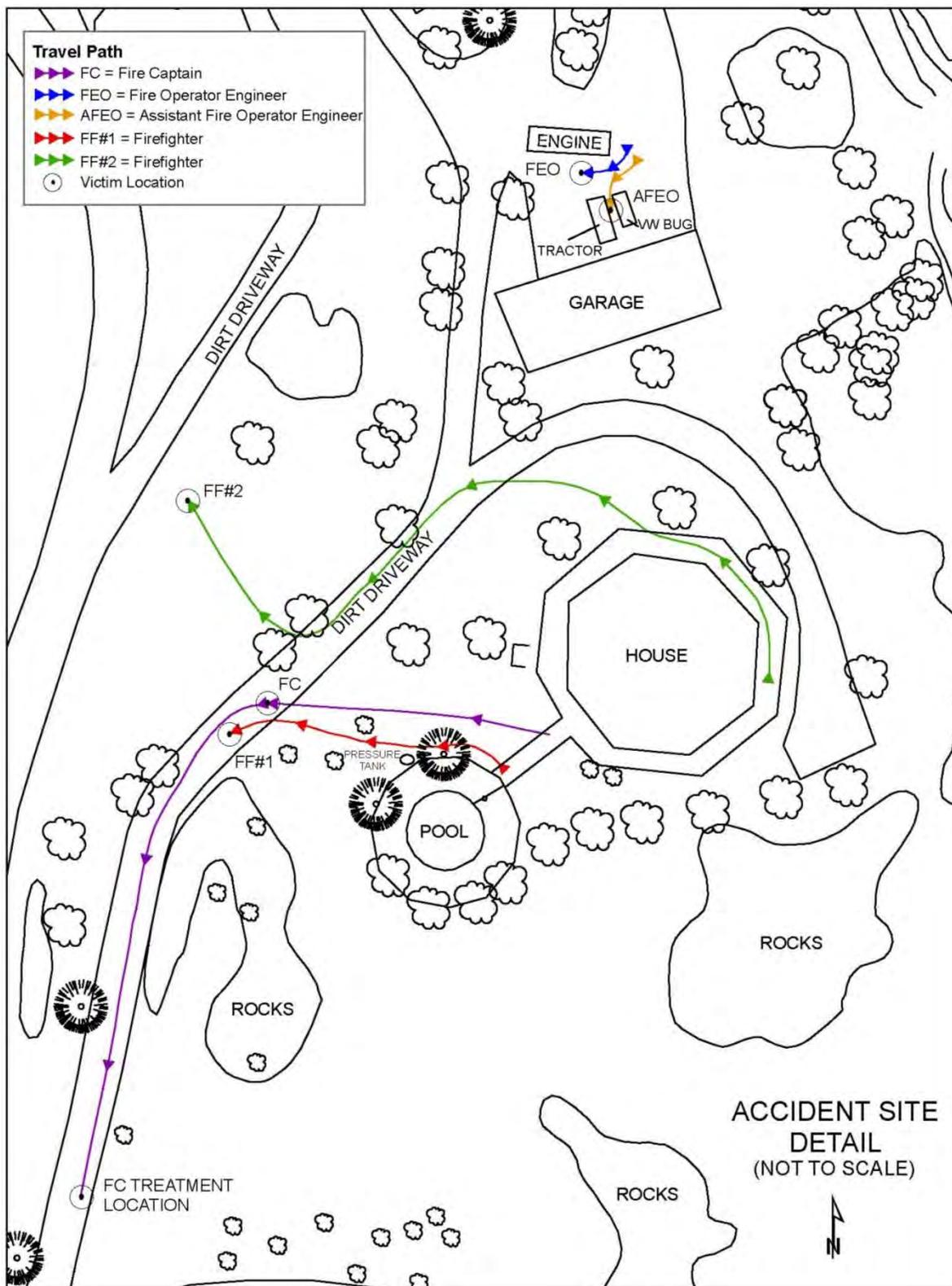
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Appendix B: Esperanza Fire



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Appendix B: Jesusita Fire

Jesusita Fire

California Department of Forestry and Fire Protection
Investigation Summaries of Serious CDF Injuries, Illnesses, Accidents, and Near Miss Incidents
Firefighter Burn Injuries with Engine Burnover, and Additional Related Near Miss Incidents - May 6, 2009

A Board of Review has not approved this Summary Report. It is intended as a safety and training tool, an aid to preventing future occurrences, and to inform interested parties. Because it is published on a short time frame, the information contained herein is subject to revision as further investigation is conducted and additional information is developed.

Summary

On the afternoon of Wednesday, May 6, 2009, several engine companies assigned to structure protection on the Jesusita Fire, North of the City of Santa Barbara, experienced extreme fire behavior related to the surfacing of strong down slope (sundowner) winds typical of the area. This sudden increase in fire behavior resulted in the burn over of a Ventura County engine company, causing burns and smoke inhalation to the engine crewmembers, and major damage to the fire engine.

During this same fire behavior event, several other engine companies and overhead personnel were required to take refuge in structures and apparatus. This event resulted in significant damage to one Type I engine, minor damage to three Type I engines, destroyed two light duty vehicles, and minor injuries to fire personnel.

Conditions

Fire Apparatus - The fire apparatus assigned to the Jesusita Incident directly involved with the serious accident (burnover) and near miss incidents are described in each event narrative.

Personnel - Abbreviations used to describe the firefighting personnel are as follows:

STEN	Strike Team Leader – Engines
STEN(T)	Strike Team Leader Trainee – Engines
ST	Strike Team
BC	Battalion Chief
FC	Fire Captain
FAE	Fire Apparatus Engineer or Apparatus Operator
FF	Firefighter

Location - North of the City of Santa Barbara in the urban interface border with the Los Padres National Forest in the area of Mission Canyon.

Fuel Type - Fuels in the area were a true Model (4) chaparral - Sumac, Scrub Oak, Manzanita, Toyon, Chamise, Lemonade Berry, Ceanothus, and Sage. Annual grasses with a contingent of Buckwheat played a significant role in spotting receptivity, especially in the urban interface. The heavy concentration of ornamental vegetation acted as a ladder fuel element. Ornamental species included Italian Cypress, Oleander, Juniper, Palm, Pepper, and a high concentration of Eucalyptus. Structures and personal property became supplementary fuel sources when ignited. A significant dead component existed in the fuel bed due to decreased seasonal precipitation and long term regional drought.

Fuel Loading - Canopy heights in the Model (4) fuels were estimated in the 8 to 12 foot range that supports fuel loading of approximately 15 tons per acre. This fuel bed had not been impacted by fire since the Coyote Fire of 1964, resulting in heavy fuel loading and high fireline intensities. Again, the high volume of structures within the vegetation contributed greatly to the overall fuel load and subsequent fire intensity and spread.

Fuel Continuity - Fuels in the chaparral layer were classified as continuous and dense; though fire behavior was generally pushed into the extreme category by the wind event. When the fire entered the



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Appendix B: Jesusita Fire



interface, widespread spotting was observed in the less continuous annual grasses that propagated into heavier fuel beds.

Live Fuel Moisture - Live fuel moistures taken from regionally based measuring stations confirm that the observed and climatological based estimates of live fuel moistures were approximately 100 percent, accelerated in their traditional curing timeline by recent record high temperatures, and drastically lower seasonal precipitation levels.

Dead Fuel Moisture - Fine dead fuel moisture in the 1-hour time lag category was calculated at between 2 and 4 percent on the day of the extreme fire behavior event. This exceptionally dry fuel bed was calculated at between 90 and 100 percent receptive to fire from an ignition source.

Weather Observations of May 6, 2009

Time	Temperature	Relative Humidity	Wind Speed	Wind Direction
1200	87° F	36	4-10 Gust 13	SW
1300	95° F	18	5-10 Gust 12	N/NW
1400	98° F	14	4-10 Gust 21	N/NE
1500	98° F	17	10-17 Gust 43	NE
1600	96° F	19	17-20 Gust 39	NW

Precipitation Year	Normal	Seasonal to Date
2009	17.00 inches	10.00 inches

(Weather obtained from field observations, representation RAWS, and recognized weather networks.)

Topography

Topography in the fire area was characterized by a principal ridge approximately 4000 feet in elevation with a generally south facing aspect. In the fire area the prevailing drainages run from the northeast to the southwest. Homes are placed in every aspect and level within the landscape between 500 and 1100 feet in elevation. Slope steepness runs from approximately 12 percent on the lower slopes to 57 percent in the higher canyons along the forest border.

Fire Behavior

On the morning of May 6, 2009, fire behavior was classified as backing. However, the intensity of this backing fire was considerable, with nearly complete consumption of the chaparral fuel bed at the 1500-foot elevation. By 12:00 PM, the fire was reacting to the effects of an upslope wind component and increased solar radiation. Short fire runs from small scale spotting were being recorded. The fire was readily burning through retardant treated fuels. By 2:00 PM the predicted offshore wind stream began to interact with established up canyon winds resulting in an erratic, gusty wind flow. By 3:30 PM the downslope wind component, locally known as a "sundowner," was in full control with large scale spotting now being observed. This "sundowner" phenomenon is the product of a strong pressure gradient where stable air inland pushes downward. Often, the subsiding air funnels downslope through canyons and passes with great velocity. Propelled by this wind pattern, fire spread was principally accomplished through spotting, often up to ½ mile ahead of the main body of fire. Each new spot then took full advantage of favorable topography and caused the fire to extend in multiple directions.

Sequence of Events

On Tuesday, May 5, 2009, at 1:45 PM, a wildland fire was reported burning in the foothills north of the City of Santa Barbara along the "Jesusita" hiking trail within the Los Padres National Forest – Santa Barbara Ranger District. Los Padres National Forest (LPF), Santa Barbara County Fire Department



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Appendix B: Jesusita Fire

(SBC), and Santa Barbara City Fire Department (STB) initiated a coordinated wildland fire dispatch of fire suppression resources to the incident.

The first arriving SBC Division Chief reported a fire burning in heavy brush along the Jesusita Trail, approximately 1 mile above the Lauro Canyon reservoir, within the Direct Protection Area of the LPF. Access into the fire area was limited by the mid slope location of the fire. By 2:30 PM, Unified Command was established with the three agencies. Potential existed for the fire to move into State Responsibility Area (SRA), as well as the urban interface area, and a Type 1 Incident Command Team was selected to manage this incident due to the anticipated complexities of incident management. A CAL FIRE Incident Command Team (ICT) was ordered based on the predicted weather and potential for fire spread down slope off the Forest, into SRA, and urbanized areas of Santa Barbara.

On Wednesday, May 6, 2009, an extended attack command structure (Type 3 Incident Command Organization per Interagency Standards for Fire and Aviation Standards – “Red Book”) conducted the operational briefing. This briefing covered incident objectives, weather, division assignments, communication plan, and a safety message. Weather predictions were discussed during the morning briefing for the potential of downslope “Sundowner” winds for the late afternoon and evening hours. The incident was planned to transition to CAL FIRE ICT-4 at 6:00 PM.

The fire was estimated at 400 acres, and later reduced in size to 200 acres after more accurate mapping. Fire spread was topography and fuel driven, and the predicted winds had not yet surfaced. The incident strategy for perimeter control included direct attack using Fire Crews, Type 3 engines, and aircraft. The fire was divided into two branches; Branch I (East portion), and Branch II (West portion). Branch I control operations were direct attack starting in the Spyglass area in Mission Canyon working to the West. Branch II control operations were direct attack from the origin along the Jesusita trail working to the East. Both Branches had significant challenges with limited access to the fire line and the mid slope location of the fire.

The Structure Protection Branch coordinated fire suppression resources among the residential areas. Three Structure Groups were developed: Tunnel Structure Group for the Tunnel Road area, San Roque Structure Group for the San Roque Canyon area, and Mission Structure Group for the Mission Canyon Road area. Control operations for all structure groups within the Structure Branch were to prepare and triage structures that could be threatened by an advancing fire. Access challenges existed for all Structure Groups due to the narrow roads, ornamental and native vegetation, and the arrangement of the homes among the canyons and ridges. An evacuation order was in place for the Northern portions of Mission and San Roque Canyons.

A Staging Area was set up at the Incident Base at Earl Warren Show Grounds. There was a considerable amount of fire suppression resources staged due to the possibility of fire progression downslope due to the forecasted “Sundowner” winds. Resources continued to arrive at staging throughout the day.

At approximately 2:20 PM, the fire was slightly over 200 acres, and the windy conditions at the higher elevations grounded the fixed wing aircraft. The fire continued to become more active as Northwest “Sundowner” winds began to surface, and a high intensity backing fire started to push down slope toward structures in the Mission Canyon Area. Branch I disengaged perimeter control resources and removed them from the upper sections of Mission Canyon due to this increase in winds and fire behavior. Branch II also disengaged the perimeter control resources and moved them back to a safe location. Both Branches were now experiencing stronger winds and increased activity.

Structure Branch recognized the increased fire activity, and was coordinating resource movements within the Tunnel Group and Mission Group for structure protection. At 3:39 PM, Branch I reported significant fire activity and that the fire had moved down slope and was in the vicinity of the water tank at the end of Tunnel Road. Winds were reported to be between 20 and 30 miles per hour from the Northwest. At 3:46 PM, the Operations Section Chief reported substantial fire activity in the upper Spyglass Ridge Road and Mission Canyon area. In addition, the winds had increased to velocities that grounded rotary wing aircraft. At 3:50 PM hours Branch I reported the fire was burning above and



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Appendix B: Jesusita Fire

below homes and resources in Mission Canyon and advised Structure Branch to pull the resources out of Mission Canyon.

At 3:52 PM, Tunnel Structure Group requested additional strike teams of engines for structure protection as the fire was spotting ¼ mile in front of the main fire front that was headed down slope. At approximately 4:00 PM, the fire front moved into the residential areas of upper Mission Canyon. Spot fires ahead of the fire front became established in the drainages above Lauro Reservoir, and caused multiple uphill fire runs from all directions into the residential areas of Mission Canyon. Engine companies assigned to Mission and Tunnel Structure Groups became engaged in structure protection operations.

Radio reports of firefighters trapped in structures, taking refuge in structures, or taking refuge in their engine were being reported. At 4:08 PM, the first report of injured firefighters was received. The Operations Section Chief and Structure Branch Director directed resources into the Mission Canyon area to assist with structure protection. Narrow roads, extreme fire behavior, downed power lines, and heavy smoke conditions precluded fire suppression resources from exiting the area, as well as hampering resources from entering into the area to assist. Residents who remained in their homes within the evacuation area sought refuge with various engine companies in various locations. Multiple homes were burning adding to the heavy smoke and extreme temperatures. Some water systems within the residential area lost volume and pressure.

Strike Team Leaders and Engine Companies were bringing injured personnel to Santa Barbara County Fire Station 15 (located at Mission Canyon Road and Foothill Road) for initial treatment, or were taking them directly to the hospital outside of the knowledge of the incident. Residents that sought refuge with engine companies were escorted out of the area.

At 4:52 PM, the Operations Section Chief gathered intelligence on the burnover and firefighter injuries to brief the Incident Commander. The Agency Administrators were advised of the burnover and firefighter injuries, and a CAL FIRE Serious Accident Review Team (SART) was requested at 6:00 PM.

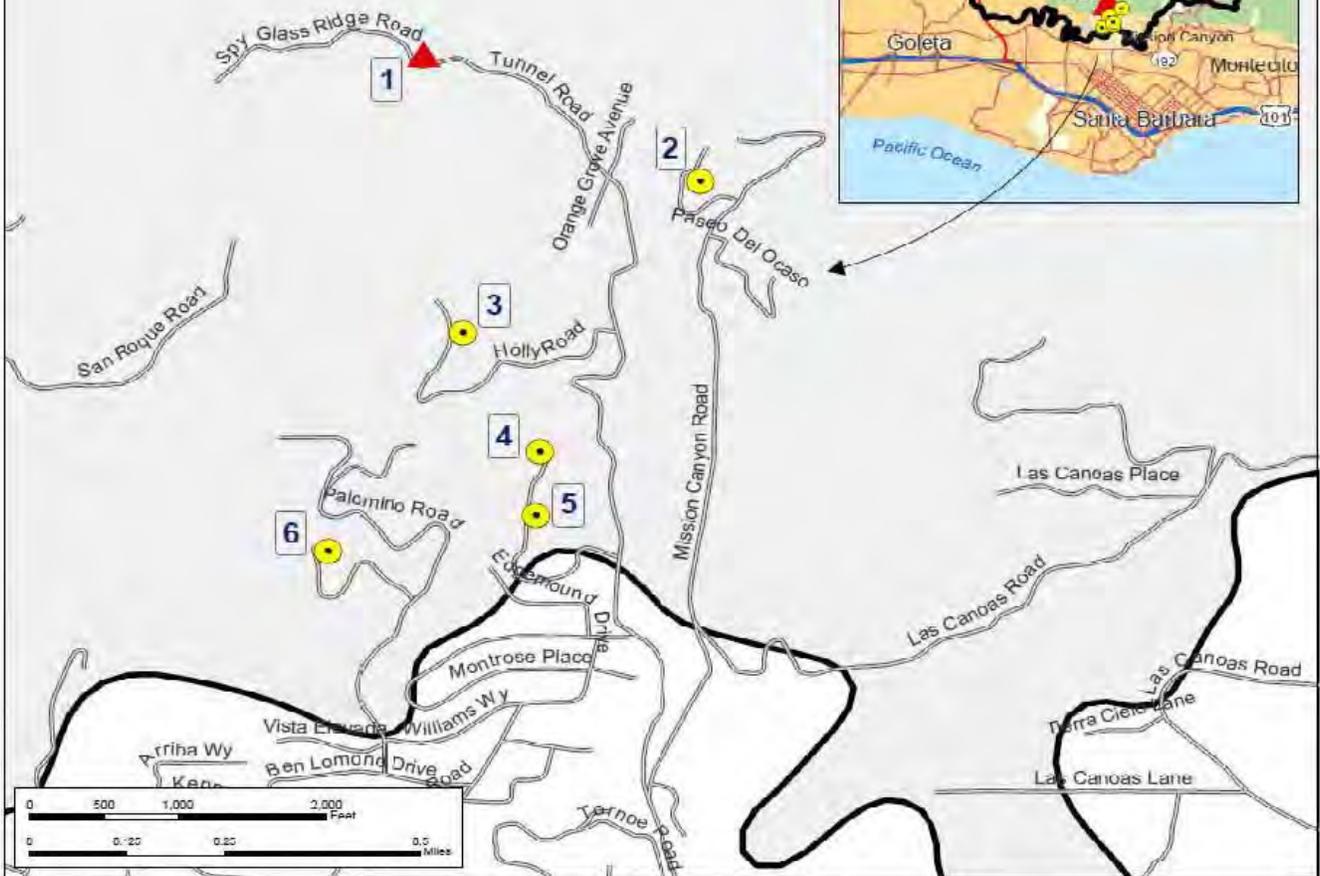
Vicinity Map

Jesusita Accident Review CA-CSR-000031

- ▲ Serious Accident Site
- Near-Miss Site

Incident	Address	Type
1	1495 Spyglass Ridge Rd	Serious Accident Site
2	1433 Mission Canyon	Near-miss Site
3	2850 Holly Rd	Near-miss Site
4	1165 Tunnel Rd, G	Near-miss Site
5	1185 Tunnel Rd, E	Near-miss Site
6	1125 Palomino Rd	Near-miss Site

Fire Perimeter: Valid as of 5/17/2009

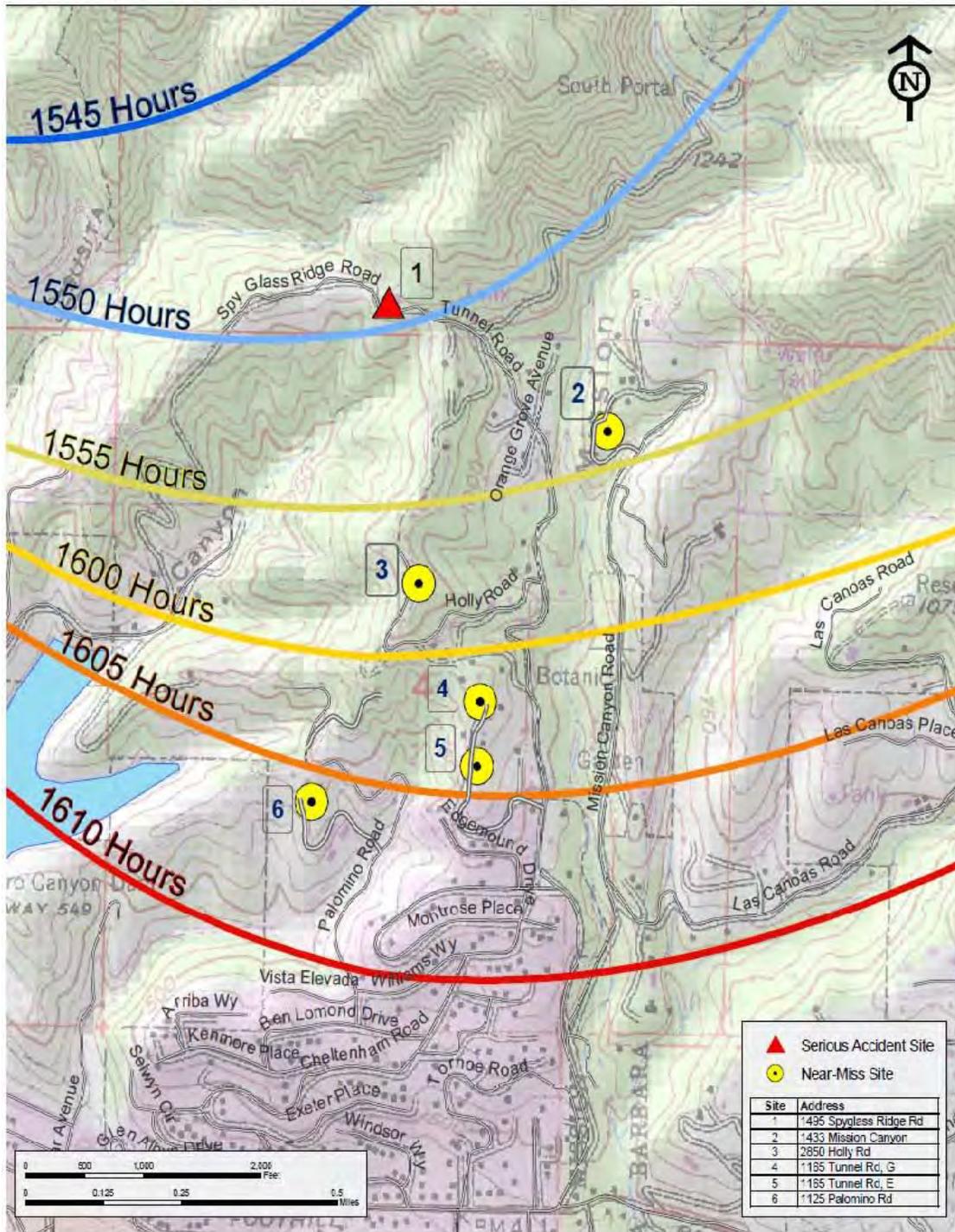


Kennedy, 5/17/2005

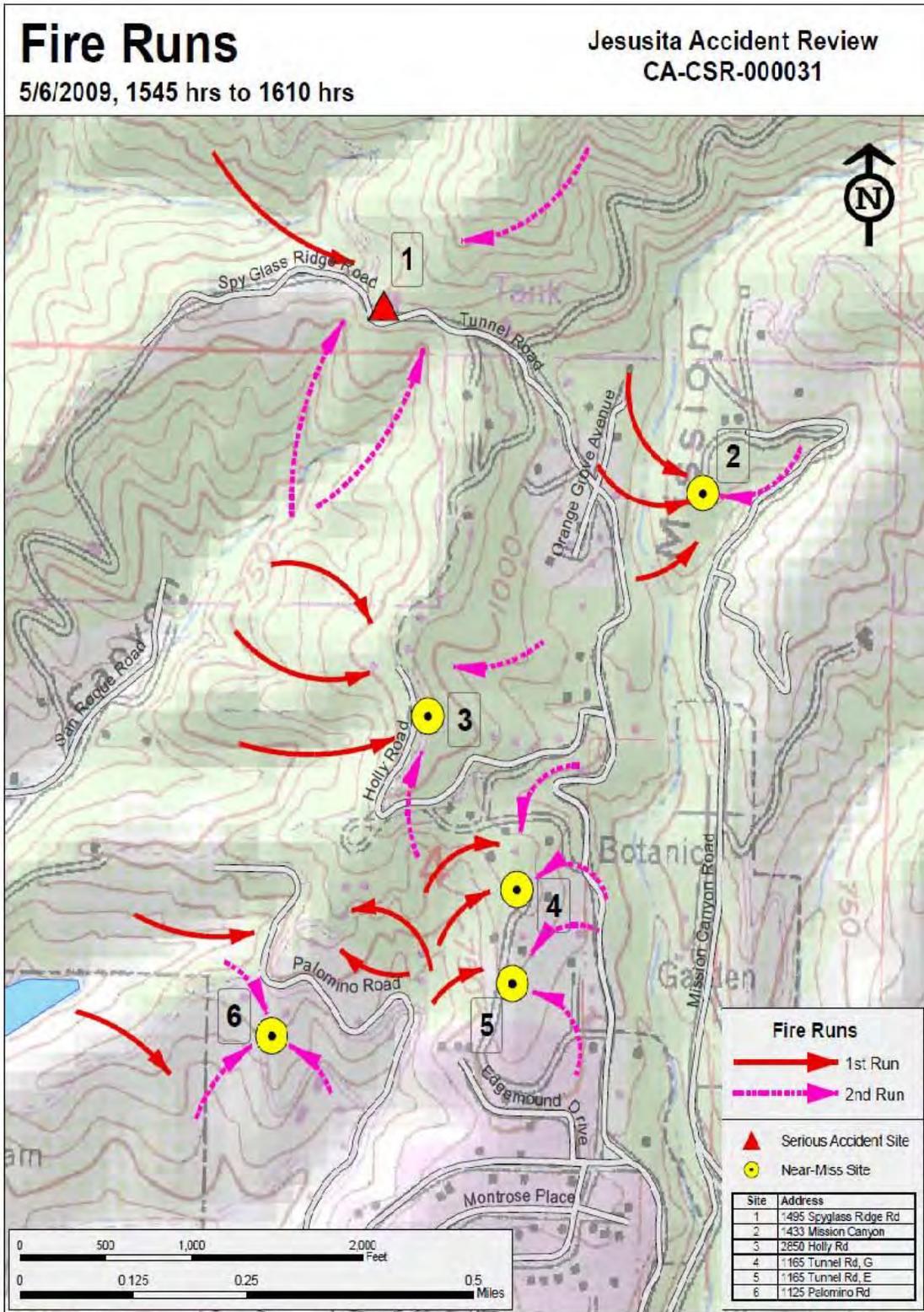
Incident Progression

Jesuita Accident Review
CA-CSR-000031

5/6/2009, 1545 hrs to 1610 hrs



Kennedy, 5/17/2009



Kennedy, S/17/2009



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Appendix B: Jesusita Fire

Detailed Sequence of Events for Each Burnover or Near Miss Incident

Spyglass Ridge Road

Equipment and Personnel - Ventura County Department (VNC)

VNC Engine 54 (E-54) is a 2007 American LaFrance Type I fire Engine. E-54 was staffed with a Fire Captain, a Fire Apparatus Engineer, and one Firefighter during the burnover.

VNC Engine 30 (E-30) is a 2004 American LaFrance Type I Fire Engine. E-30 was staffed with a Fire Captain, a Fire Apparatus Engineer, and one Firefighter. (See 1495 Spyglass Ridge Road Map)

Ventura County Fire Department (VNC) Engine Strike Team (ST) 1580A was assigned to the Tunnel Structure Group of the Structure Protection Branch. The strike team moved to the Santa Barbara Mission where an additional safety briefing was conducted by the Tunnel Structure Group Supervisor.

At approximately 9:00 am, VNC ST-1580A was positioned in the Spyglass Ridge Road residential area. A tailgate safety briefing was conducted, and the cul-de-sac at the end of Spyglass Ridge Road was identified as the Safety Zone. The fire was located on the ridge above (North of) their location. Fire behavior was of low intensity as the fire backed downhill against the wind, and was burning in a continuous fuel bed of mature chamise.

Throughout the day the engine crews from VNC ST-1580A performed structure preparation; moved combustible items away from the structures; cleaned out rain gutters; and applied aluminum foil to vent openings. VNC E-54 performed these tasks at their assigned location of 1495 Spyglass Ridge Road. Two hose lines were pre-positioned around the main house. VNC E-54 prepositioned two hoselines. A 100' 1 1/2" hose was placed along the West side of the main house, and a 100' 1 3/4" was placed at the bottom of the driveway near the Northwest corner of the main house. Both hose lines were connected to a gated wye for connection to the water supply when needed. Three Self-Contained Breathing Apparatus (SCBA) were also prepositioned inside the living room of the main house. At approximately 2:01 P.M., VNC E-42, located at the adjacent residence to the West, observed and documented a shift in the wind direction and speed. The winds changed from upslope South-Southwest to across the slope from the Northwest. Fire activity began to increase on the ridge above their position. The Northwest wind continued to increase, and the fire began to move downslope toward Spyglass Ridge Road.

At approximately 3:35 P.M., FC-54 noticed a spot fire above the location of E-54. At the same time, FF-54 pointed out another spot fire near the Southeast corner of the main house. A 200' 1 3/4" hose line was then connected from E-54 to the gated wye to charge the pre-positioned hose lines. FC-54 then radioed STEN 1580A and advised that another fire engine was needed. E-30 moved to assist, and backed in next to E-54.

At approximately 4:00 p.m. the fire made extreme advances towards the Spyglass Ridge Road area. Numerous spot fires caused a condition similar to area ignition around 1495 Spyglass Ridge Road. FC-54 told FF-54 to protect the rear of the main structure. After several minutes of firefighting, FC-54 took FF-54 into the structure, entering through the back door on the Southwest side to wait for the fire to pass. While inside the structure, FF-54 removed his web gear and fire shelter and donned his SCBA. FC-54 also donned his SCBA over his web gear and fire shelter.

As the fire intensity increased, FC-54 radioed STEN-1580A and advised that the FC-54 and FF-54 were in the structure and needed immediate aircraft support. The main house began to burn, and FC-54 and FF-54 moved to various rooms in the house as the fire progressed through the structure. FAE-54 had remained at E-54, and used the engine protection line to protect the engine from the advancing fire.

FAE-54 was trying to make radio communication with FC-54 and FF-54 but no contact was made. FAE-54 again radioed FC-54 and advised him E-54 was out of water. As the fire advanced towards E-30 location, E-30 dropped their hoselines, donned their SCBAs, and took refuge in the cab. E-30 was



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WUI Command Operations for the Company Officer



Appendix B: Jesusita Fire

out of water, and FC-30 told FAE-54 to get in the cab of E-30. With concerns for E-54's crew, he reluctantly jumped into the cab of E-30. With FAE-54 now inside the cab with E-30's crew, they attempted to drive down the driveway to safety but were halted by a wall of flames. E-30 waited for a break in the flaming front then drove down the driveway dragging all their hose and nozzles.

With the majority of the main house burning, FF-54 crouched down and removed the fire shelter belonging to FC-54 and prepared to use it as a heat shield while exiting the structure. Before the fire shelter could be fully opened, the sliding glass door shattered, and a rush of heat entered the room. FC-54 made the decision to leave without using the fire shelter.

As FC-54 and FF-54 exited the structure, FC-54 instantly felt his skin burning. FF-54 fell to the ground as FC-54 ran up the driveway towards E-54. FC-54 thought that FF-54 was attempting to deploy the fire shelter at that location. FC-54 yelled at FF-54 to continue to the fire engine. FC-54 arrived at the fire engine and climbed into the back seat on the passenger side still wearing his SCBA. FC-54 could not locate FF-54 and his low air warning device was sounding on his SCBA.

FC-54 radioed to STEN-1580A and told him that he had returned to the location of E-54. STEN-1580A radioed back and told him that he would come and get him. FF-54 then radioed that he was also back at E-54. STEN-1580A arrived at E-54 and the STEN (T)-1580A placed FF-54 and FC-54 into the rear seat of the vehicle. STEN-1580A drove the injured FC-54 and FF-54 to the residence located at 2845 Spyglass Ridge Road where Paramedic Engine 32 initiated treatment. Both victims were assessed by the Paramedic and a medevac helicopter was requested due to their extensive burn injuries, but could not make access due to the conditions.

Branch I arrived, and was preparing to transport FF-54 along with the Paramedic when a paramedic ambulance escorted by a law enforcement officer arrived. The paramedic ambulance with the injured FC-54 and FF-54, assisted by a FF-Paramedic from ME-32, transported both patients to Cottage Hospital for evaluation. They were subsequently flown to Grossman Burn Center. STEN (T)-1580A was transported by Branch I to Santa Barbara County Fire Station #15 for smoke inhalation injuries. A paramedic ambulance transported STEN (T)-1580A to Cottage Hospital for initial evaluation, and was subsequently flown to Grossman Burn Center. FAE-54 sought treatment for smoke inhalation on May 9, 2009. All structures at 1495 Spyglass Ridge Road were destroyed.

Injuries

VNC Strike Team Leader-Trainee (STEN-T) Fire Captain

- Smoke inhalation

VNC Engine 54 Fire Captain (FC-54):

- 1st and 2nd degree burns to both ears, sideburn areas, and forehead.
- 1st and 2nd degree burns to both arms, from the wrist to just above the elbow.
- 1st and 2nd degree burns to the back of right hand
- 1st and 2nd degree burns to left calf

VNC Engine 54 Fire Apparatus Engineer (FAE-54)

- Smoke inhalation

VNC Engine 54 Firefighter (FF-54)

- 1st and 2nd degree burns to forehead
- 1st and 2nd degree burns to left side of neck
- 2nd and 3rd degree burns left ear
- 3½ inch laceration to right side of neck below jaw
- 2nd and 3rd degree burns to both shoulders and upper back
- 1st, 2nd, and 3rd degree burns to triceps area of both arms
- 2nd and 3rd degree burns to palm of right hand (includes palm side of all fingers)

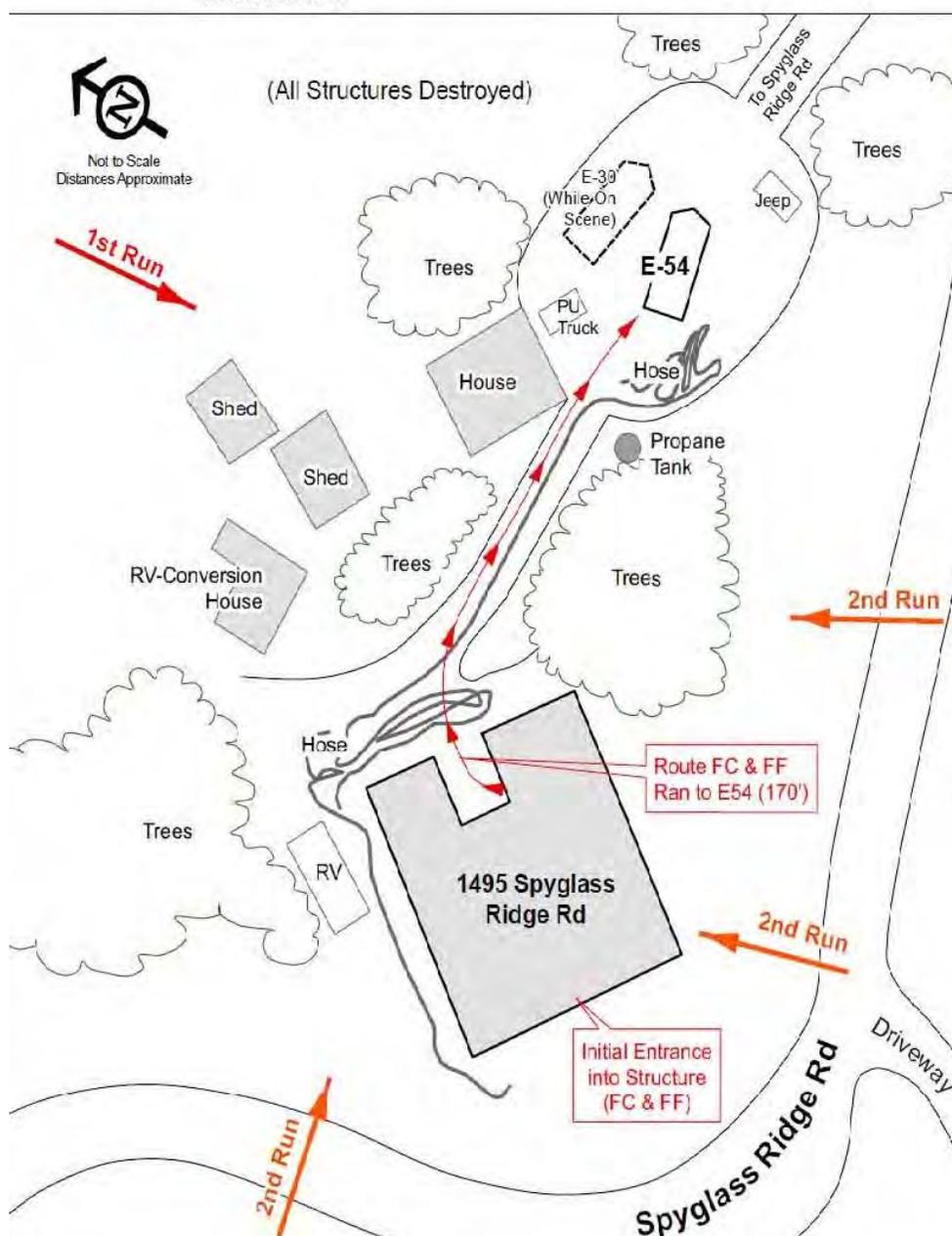
Damages

- VNC E-54 had severe fire damage to the front and left side of the apparatus. The hose bed had major damage from the cribbing and hose that caught fire. The apparatus had a transmission leak along the left frame rail, but was physically driven off the mountain.
- VNC E-30 received minor exterior heat/fire damage.

1495 Spyglass Ridge Rd

Jesuita Accident Review
CA-CSR-000031

Accident Site





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WUI Command Operations for the Company Officer



Appendix B: Jesusita Fire

Mission Canyon Road

Equipment and Personnel - Los Angeles County Fire Department (LAC)

LAC Engine 149 (E-149) is a 1995 KME Type I Fire Engine. E-149 was staffed by a Captain, a Fire Apparatus Engineer, and two Firefighters. See 1433 Mission Canyon Map attached

On Wednesday May 6, 2009 Los Angeles County Fire Department (LAC) ST-1241A was assigned to the Mission Structure Group. The entire strike team was briefed by STEN-1241A, and staged in the Botanical Gardens in Mission Canyon. STEN-1241A performed a reconnaissance of upper Mission Canyon Road and deployed the engines to protect structures in the northern end of Mission Canyon Road. STEN-1241A provided a safety briefing identifying the structures and a graded lot below 1433 Mission Canyon Road as safety zones. E-149 was assigned the structure located at 1433 Mission Canyon Road, backed into the driveway, and deployed two 1" reel-lines to the entrance of the driveway and front of the house.

At approximately 3:00 PM the wind transitioned from an upslope southerly direction to a down canyon northerly direction and increased substantially. The head fire made a run down the Mission Canyon Drainage toward 1433 Mission Canyon Road. Spot fires developed around the structure. At approximately 3:40 PM conditions deteriorated more than anticipated. At approximately 3:55 PM, due to strong winds, intense heat and poor visibility, FC-149 called for the crew to retreat into the structure. Accountability was conducted and STEN-1241A was notified via radio.

The engine crew entered the structure twice to avoid heat and once to get out of the smoke. One firefighter suffered heat related symptoms and moderate respiratory distress. He was transported to Cottage Hospital by STEN-1241A, kept overnight for observation and released the next day. The engine sustained damage to a hose reel and ladder protectors. The house received minor damage.

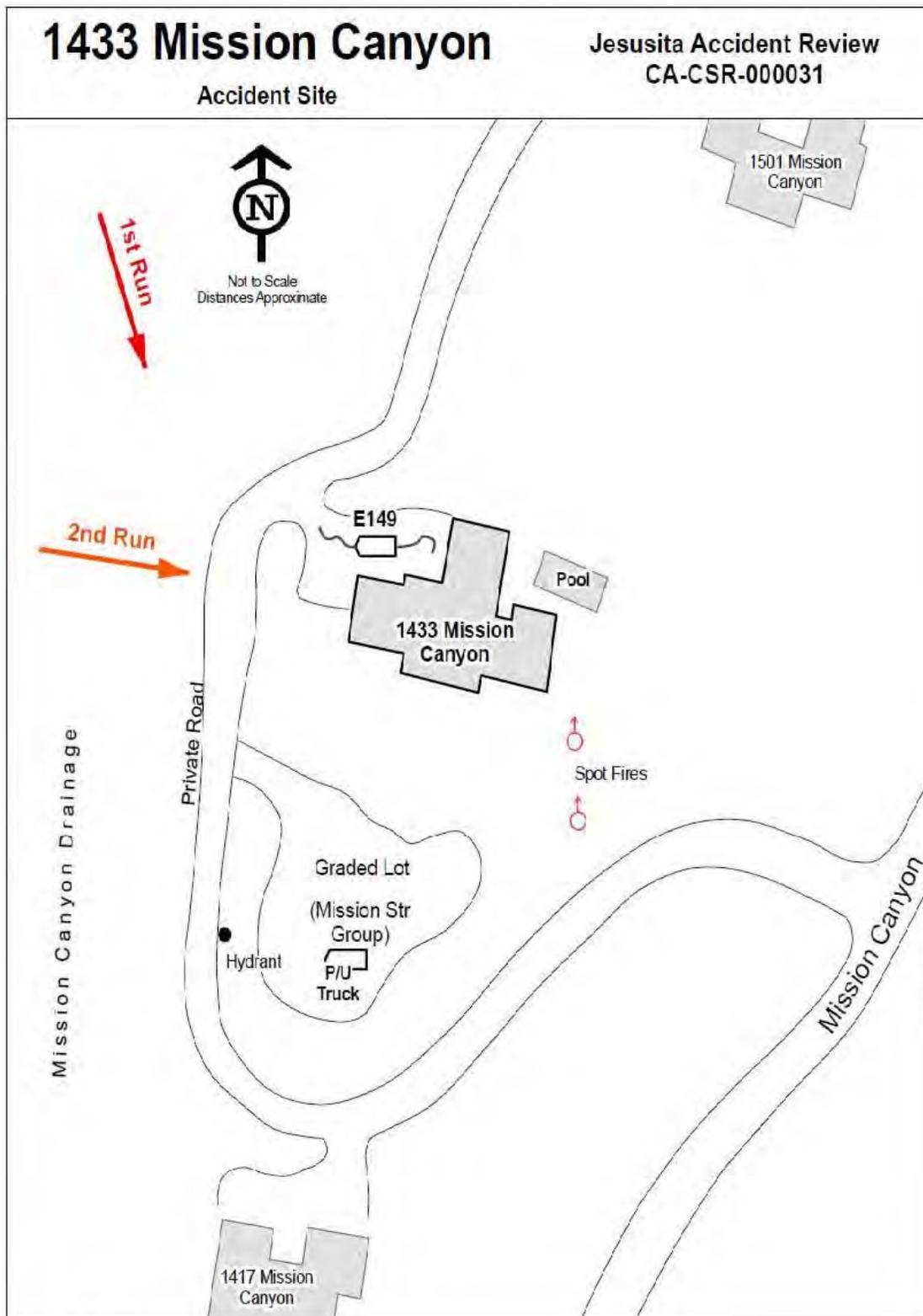
Injuries

LAC Engine 149 Firefighter (FF-149)

- Heat exhaustion and smoke inhalation

Damage

- LAC E-149 had the ladder cover with heat/fire damage.





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Appendix B: Jesusita Fire

Holly Road

Equipment and Personnel - Los Angeles City Fire Department (LFD)

LFD Battalion 18 (B-18) is a 2007 Chevy Suburban. B-18 was staffed with a Battalion Chief and a Firefighter-Staff Assistant.

LFD Utility 33 (U-33) is a 2003 Ford Crew-cab two-wheel-drive pick-up truck. Utility 33 was staffed by a Battalion Chief. (See 2850 Holly Rd Map attached)

On Wednesday, May 6, 2009, Los Angeles Fire Department (LFD) ST-1001A was assigned to Tunnel Structure Group. STEN-1001A was given a tour of the area by the Tunnel Structure Group Supervisor, and at 11:00 AM returned to brief the crews and give out assignments. Engines were in place at their locations at approximately 11:30 A.M. E-14 was assigned as a roving engine for ST-1001A and was the lookout for Holly Road.

At approximately 2:50 P.M., the winds began to increase and turn down slope. At approximately 3:00 P.M., the winds were periodically gusting at an estimated 40 to 60 miles per hour according to the crew of E-14 at the top of Holly Road. E14 requested more engines for assistance on Holly Road because of the large amount of unprotected structures and change in weather.

At approximately 3:45 P.M., led by B-18 and U-33, E-35 drove up Holly Road to the turnaround at 2910. E-35 noticed a spot fire in the north drainage beyond 2911 Holly Road. Shortly after that, the ridge area surrounding Holly Road where E-14, E-35, STEN-1001A, STEN(T)-1001A and their staff assistant was located experienced multiple spot fires, which led to extreme fire behavior resulting in multiple fire fronts moving through the area. During the same time the hydrant system in the area lost water.

STEN-1001A immediately gave the order to take refuge. STEN-1001A, STEN(T)-1001A, FAE-14, one firefighter from E-14, FAE-35, and 5 civilians took refuge in the residence at 2910 Holly Road. FC-35 and two Firefighters from E-35 took refuge in the structure located at 2911 Holly Road as their escape route was blocked. FC-14 and one firefighter from E-14 took refuge in the structure located at 2931 Holly Road. They decided the structure would not withstand the fire, and moved to 2921 Holly Road. They took refuge for approximately 15-20 minutes, and when conditions permitted, made their way to 2910 Holly Road with the other personnel.

The Staff Assistant originally took refuge in a structure at 2850 Holly Road and moved to the garage after the front window gave way and the fire moved into the house. The staff assistant moved to the home at 2910 Holly Road when conditions permitted. Eight fire personnel took refuge at 2910 Holly Road and remained there with the five civilians for approximately 20 additional minutes. Structure PPE and 5 SCBAs were brought inside 2910 Holly Road as a precaution when the windows cracked due to the fire. The three fire personnel from E-35 took refuge in the home at 2911 for the entire fire siege.

During the entrapment, accountability reports were made via a LFD tactical frequency with all the engine crews involved with STEN-1001A. The Crews of E-14 and E-35 resumed firefighting operations after the fire had passed and located additional water sources. LFD Command Vehicle B-18 and U-33 were parked in the driveway at 2850 Holly Road and were destroyed by fire. STEN-1001A experienced debris in both eyes, and was treated and released at a local hospital. Structures at 2931 Holly Road, 2921 Holly Road, and 2850 Holly Road were destroyed.

Injuries

Strike Team Leader (STEN) Battalion Chief

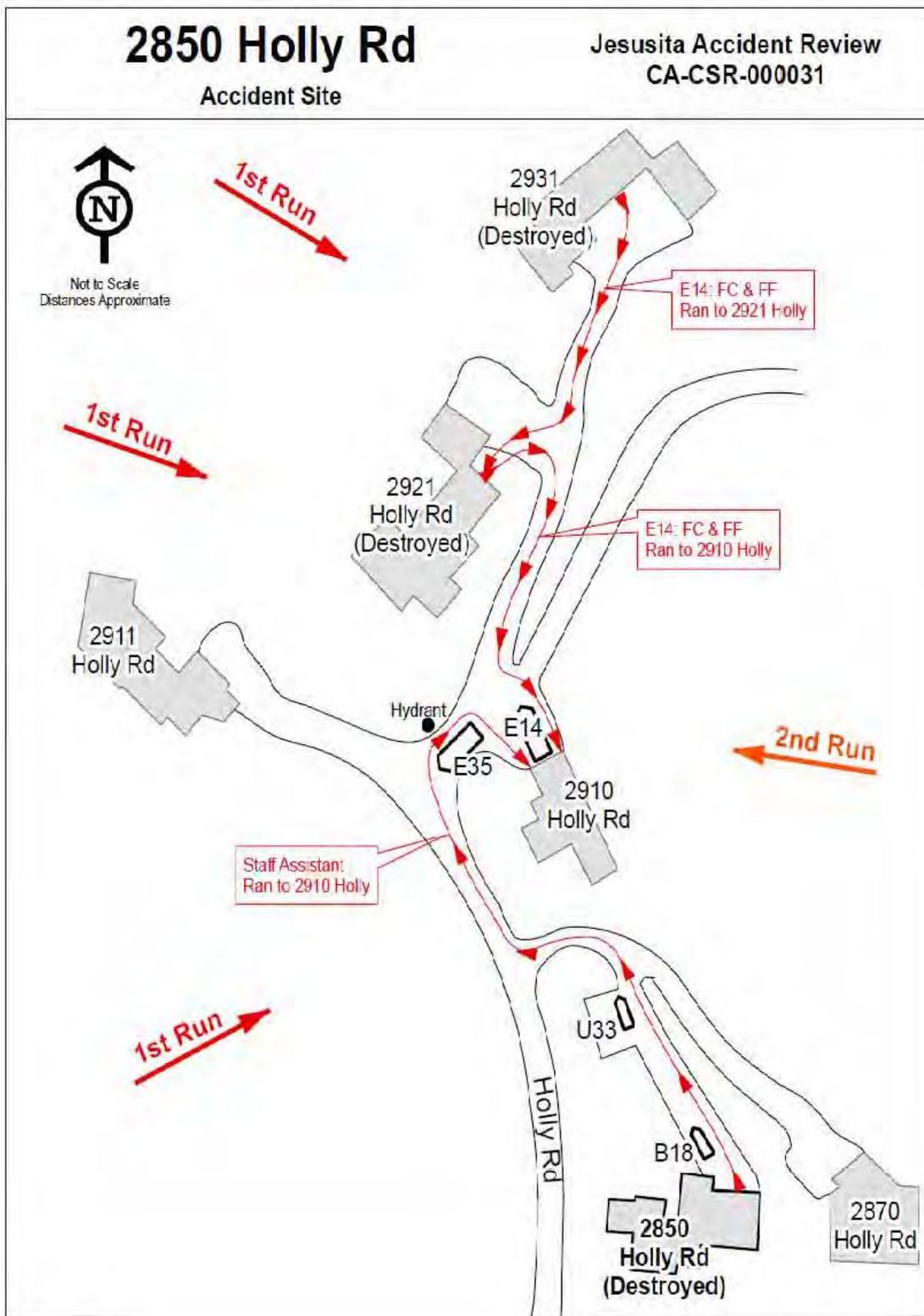
- Severe eye irritation

Damages

- LFD B-18 was completely destroyed.
- LFD Utility 33 was completely destroyed.

COMMAND 1C

WUI Command Operations for the Company Officer



Kennedy 5/17/2005



COMMAND 1C

WUI Command Operations for the Company Officer



Appendix B: Jesusita Fire

Tunnel Road

Equipment and Personnel - Santa Paula City Fire Department (SPA)

SPA Engine 81 (E-81) is a 2001 Ferrara Type I Fire Engine. E-81 was staffed by a Captain, a Fire Apparatus Engineer, and one Firefighter.

Equipment and Personnel - Ventura City Fire Department (VEN)

VEN Medic Engine 5 (ME-5) is a 2000 Seagrave Type I Fire Engine. ME-5 was staffed by a Captain, a Fire Apparatus Engineer, and two Firefighters. (See 1165 Tunnel Road E and G attached)

On May 6 at approximately 7:30 AM, Ventura County Operational Area (XVE) ST-1550A was assigned to the Tunnel Structure Group. Santa Paula City Engine E-81 performed structure triage at 1165 Tunnel Road #E. At approximately 4:00 P.M., E-81 experienced heavy spotting from the East and West. FC-81 gave the order to apply Class A foam directly to E-81 for protection from the extreme heat. FC-81 directed self-contained breathing apparatus from E-81 to be placed by the side entrance of 1165 Tunnel Road #E. After 2 to 3 minutes FC-81 gave the order to take refuge in the residence. After entering the residence the decision was made to move E-81. The FAE-81 and FF-81 each donned a SCBA and repositioned E-81. When the fire front passed the crew from E-81 met with Ventura City Engine ME-5, and XVE STEN-1550A to debrief. No firefighters were injured.

The engine received minor damage to the left rear upper equipment compartment while being repositioned. The crew from E-81 returned to firefighting duties and completed their shift. No injuries resulted. Minor Damage occurred to the wall at 1165 Tunnel Road #E from the contact with E81.

Medic Engine 5 (ME-5), also part of XVE ST-1550A, performed structure triage at 1165 Tunnel Road #G. At approximately 4:00 P.M., ME-5 also experienced numerous spot fires from all directions. FC-5 gave the order to don SCBA, and continue firefighting. After the crew went through one and a half bottles of air, the crew from ME-5 experienced zero visibility and extreme heat. FC-5 gave the order to take refuge in ME-5. When inside ME-5, FC-5 gave the order to remove fire shelters from their cases. FC-5 opened his fire shelter and placed it on the dash board of the engine to deploy as a heat shield if needed. Radio contact was made with XVE STEN-1550A, and told of their situation. FC-5 gave the order to move to the location of E-81 where they were briefed by XVE STEN-1550A. All firefighters were uninjured and resumed their firefighting duties.

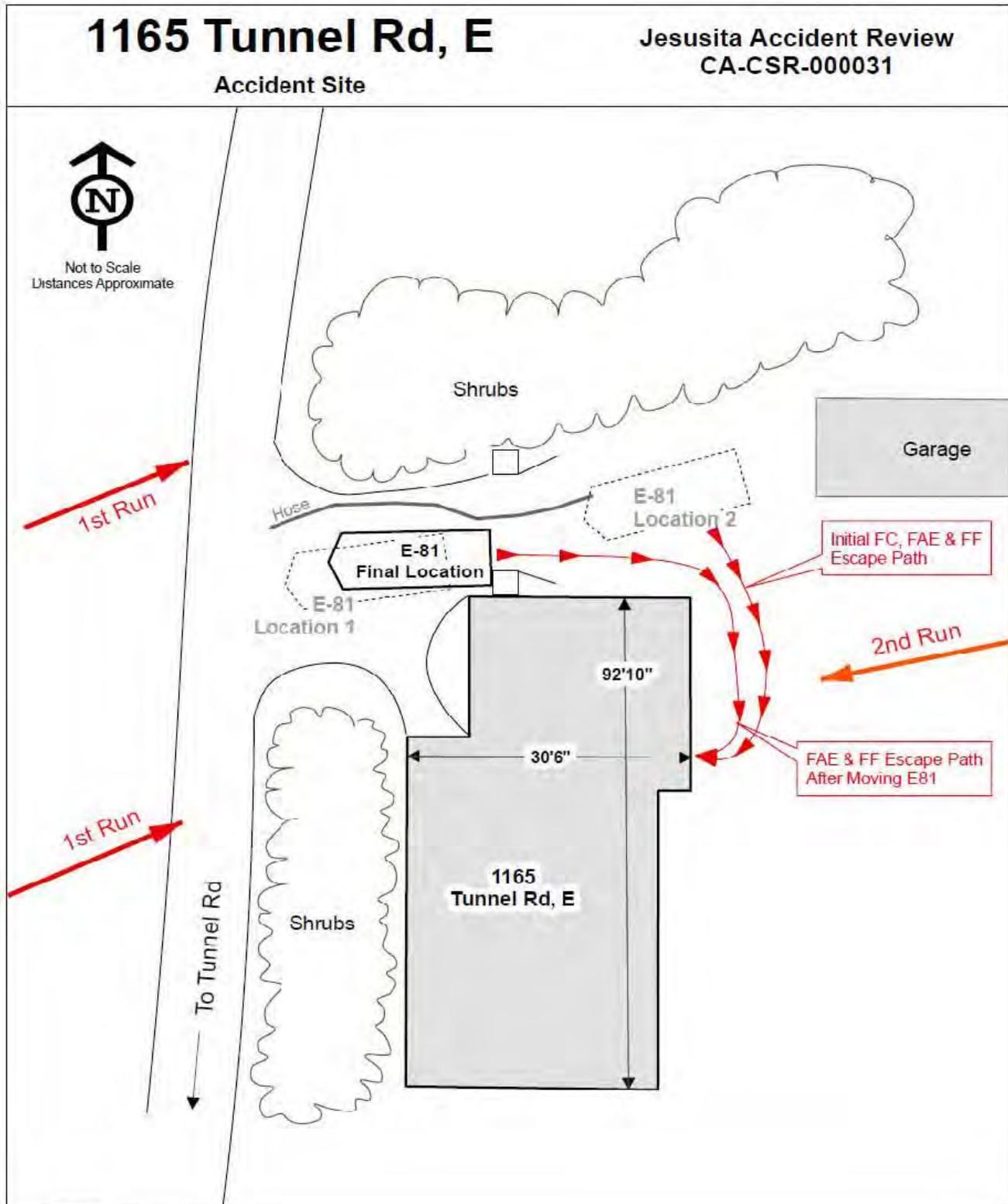
Out buildings were destroyed at 1165 Tunnel Road #G. The main structure received minor damage. All structures were destroyed at 1165 Tunnel Road # A and 1255 Tunnel Road.

Injuries

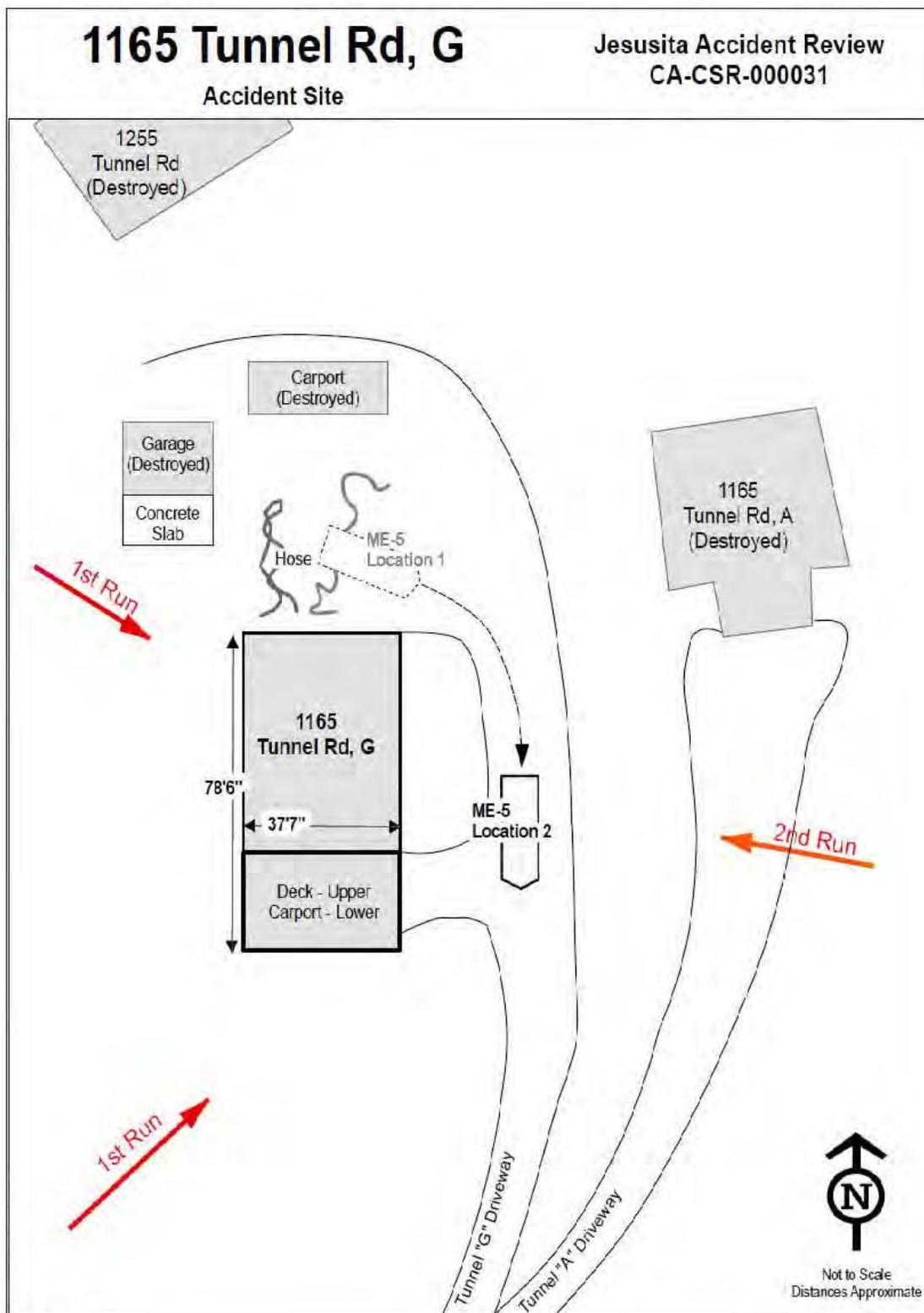
None Reported

Damage

SPA E-81 received damage to the left rear upper compartment door and the body had scraping damage consistent with striking a concrete wall. The chrome bezel around the left rear stop, turn signal and back up light assemblies had scrape damage. The engine did not have an ember screen installed in the motor air intake system.



Kennedy, 0/1 /12/03



Kennedy, 5/17/2003



COMMAND 1C

WUI Command Operations for the Company Officer



Appendix B: Jesusita Fire

1125 Palomino Road

Equipment and Personnel - Los Angeles County Fire Department (LAC)

LAC Engine 70 (E-70) is a 2007 KME Type I Fire Engine. E-70 was staffed by a Captain, a Fire Apparatus Engineer, and two Firefighters. (See 1125 Palomino Road Map attached)

On May 6, 2009, Los Angeles Fire Department (LFD) ST 1002A was assigned to protect structures on Palomino Road. After receiving the morning briefing and instructions from LFD STEN-1002A, the strike team arrived on Palomino Road at approximately 10:00 AM.

LFD STEN-1002A scouted the area, developed a plan, and began to prepare the homes for the fire front. LFD E-98 was positioned facing the direction of egress along Palomino Road directly in front of 1121 Palomino Road. Firefighters deployed two hose lines. One line was identified to protect the home at 1125 Palomino Road and the other line would be used to protect the structure at 1121 Palomino Road. Firefighters removed combustible items away from the structures and established a water source from a supply line pumped from another engine hooked to a hydrant located approximately 300 feet down the road.

LAC ST-1240A was off shift from the previous night and called back to duty from the Incident Base when additional resources were requested. LAC ST-1240A was then assigned to Tunnel Structure Group and arrived at Palomino Road at approximately 3:25 PM. After receiving instructions from LAC STEN-1240A, LAC E-125 and LAC E-70 drove up the lower spur of Palomino Road to protect structures. They were unaware of other engines located on Palomino Road.

Both LAC E-125 and LAC E-70 drove up lower Palomino Road and observed spot fires in the drainage below as they drove around the bend. LAC E-125 went to the end of Palomino Road and backed into the driveway of 1125 Palomino Road, LAC E-70 drove past LAC E-125 and stopped to allow LAC E-125 to clear the driveway. LAC E-125 pulled out of the driveway and proceeded back down Palomino Road.

LAC E-70 backed into the driveway at 1125 Palomino Road in an attempt to turn around. The fire activity increased and LAC E-70 was unable to make the turn and stopped. Firefighters attempted to deploy hose lines to protect their engine. LFD FC-98 observed LAC E-70's position getting hit by the fire front. LFD E-98 and his two firefighters placed E-98's second hose line into operation to protect LAC E-70. Conditions deteriorated, and LFD FC-98 gave instructions for everyone to take refuge in the structure located at 1125 Palomino Road. LAC FAE-98 remained at the engine while the remainder of the crew sought refuge. The crew from LAC E-70, along with two firefighters from LFD E-98, took refuge in the garage. LFD FC-98 took shelter in the main part of the structure. LFD FC-98 directed the crews to move from the garage to his location farther into the house.

LAC FC-70 and LFD FC-98 contacted their respective STEN's by radio as to having had to shelter in the structure. A few minutes later LAC STEN-1240A radioed LAC FC-70 that he was outside the building and it was safe to come out. The crew from LFD E-98 went back to their engine and continued fighting fire. The crew from LAC E-70 returned to the engine and found it had stopped running. The engine was re-started driven to base camp, and was placed out of service in Ground Support.

LAC FAE-70 suffered heat exhaustion, was transported to the hospital via ambulance, treated, and released. LAC E-70 received moderate damage. The structure at 1125 Palomino Road was destroyed.

Injuries

Engine 70 Fire Apparatus Engineer (FAE-70)

- Heat exhaustion

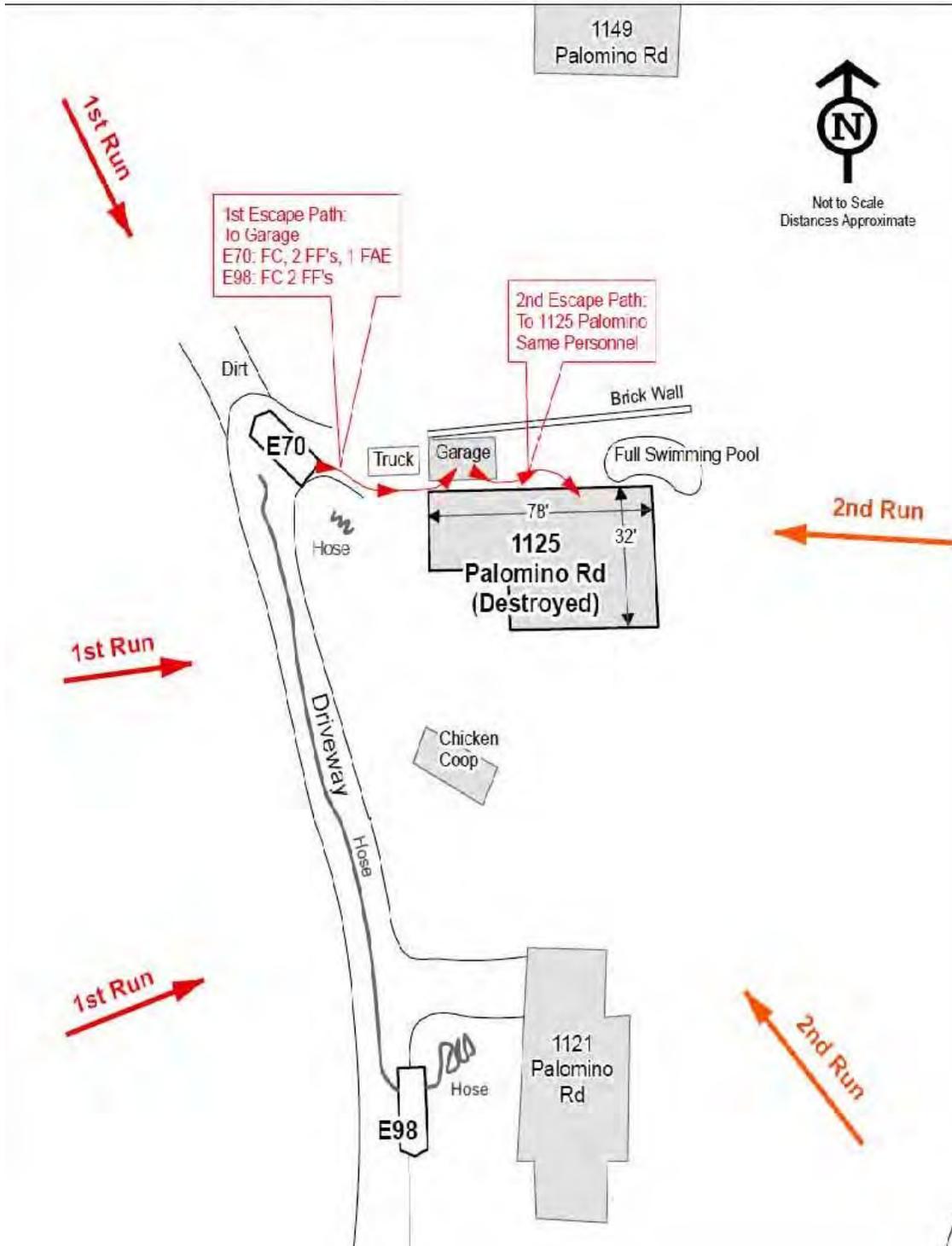
Damage

LAC E-70 had moderate fire damage to the complete front side of the vehicle, including cracks to both front windshields and the cab mounted light bar destroyed. Left side tires were damaged. The motor had stalled on the incident, and the crew discovered the air cleaner had burned. The engine was equipped with an ember screen on the motor air intake.

1125 Palomino Rd

Jesuita Accident Review
CA-CSR-000031

Accident Site



Safety Issues for Review

Personal Protective Equipment

- Proper utilization of ALL personal protective equipment prior to engaging in fire suppression

Fireline Safety Policy (Agency Specific)

Ten Standard Firefighting Orders

- Base all actions on current and expected fire behavior
- Identify escape routes and safety zones and make them known
- Maintain prompt communications with your forces, your supervisor, and adjoining forces
- Fight fire aggressively having provided for safety first

Eighteen Situations that Shout Watch Out

- Safety Zones and escape routes not identified
- Attempting frontal assault on a fire
- Unburned fuel between you and the fire
- Weather is becoming hotter and drier
- Wind increases and/or changes direction
- Getting frequent spot fires across the line
- Terrain and fuels make escape to safety zones difficult

Common Denominators of Near Fatal or Fatal Fires

- On relatively small fire or deceptively quiet area of a large fire
- When there is an unexpected shift in wind direction or in speed
- When fire responds to topographic conditions and runs uphill

Wildland-Urban Watch Outs (NWCG Incident Response Pocket Guide)

- Poor access and narrow one-way roads
- Wooden construction and wood shake roofs
- Power lines, propane tanks, and hazardous materials threats
- Inadequate water supply
- Natural fuels 30 feet or closer to structure
- Structures in chimneys, box canyons, narrow canyons, or on steep slopes (30% or greater)
- Extreme fire behavior
- Strong winds
- Evacuation of public (panic)

Engine Protection Hoseline Policy (Agency Specific)

Lookouts, Communications, Escape Routes, and Safety Zones (LCES)

Establish appropriate LCES mitigations for current and expected fire behavior. Be alert for changing conditions and adjust both tactics and LCES measures to meet new levels of risk.

Lookouts - Lookouts must be dedicated to their task and familiar with the responsibilities of this position.

Communications - All assigned resources must be familiar with the incident's communication plan and have radio capability for the listed frequencies.

Escape Routes - Escape routes are easily compromised in structure defense by remaining at the structure beyond what would be considered safe in wildland fire operations.

Safety Zones - Structures should not be relied on as safety zones. They are “survival zones” and should be used only as a last resort. If no adequate safety zones exist, decision points should be set for leaving the area.

Incidental Issues for Review

Situational Awareness

Maintaining situational awareness is essential due to the numerous factors that can quickly compromise the safety of everyone involved. Critical information concerning recognized hazards, unexpected weather changes, significant events, etc. needs to be communicated to all resources as well as the Planning Section.

Spot Fires

Spot fires create multiple fire fronts and firefighters protecting structures are often surrounded by flames, showered by burning embers, and are subjected to dense smoke.

Use of Breathing Apparatus

Usage of breathing apparatus to conduct structure protection during a wildland fire, or to remain in an untenable environment, is a situation that requires further evaluation. When conditions are degraded to this extent, a structure should be considered indefensible and resources moved to a safe area. Personnel involved in structure protection must not use breathing apparatus to justify taking greater risks, but rather as a last-resort “survival tool” in case of entrapment.

Mobility

Mobility is one of the most important tactics employed in structure defense. Consider actions in the deployment of firefighting equipment that will allow for rapid response to the changing fire environment as well as maintaining the ability to escape to a safety zone. Avoid having engines anchored to hydrants.

Briefing

Assure that all resources receive a quality briefing prior to engagement. Include local factors affecting fire behavior.

Reporting of Injuries

All injuries need to be reported to the incident for proper treatment and accountability

Ember Protection

All fire equipment should have an ember protection screen mounted inside the air intake to protect the air cleaner.



COMMAND 1C

WUI Command Operations for the Company Officer



Station Fire

County of Los Angeles

Camp 16 Incident: Vehicle Accident and Fatalities - August 30, 2009

This Informational Summary Report is intended as an aid in accident prevention, and to provide factual information from the first 72 hours of the accident review. To that end, it is published and distributed within a short time frame. Information contained within may be subject to revision as further investigation is conducted, and other reports and documents are received.

Summary

On the afternoon of Sunday, August 30, 2009, at approximately 1645 hours, a County of Los Angeles Fire Department, Camp Superintendent (Fire Captain) and Camp Foreman (Fire Fighter Specialist) were involved in a single vehicle accident near Los Angeles County Fire Camp 16 (near Mt. Gleason). Both firefighters died as a result of their injuries.

72 additional personnel were assigned to provide structure protection for Fire Camp 16 and they were forced to use structures, vehicles, and fire shelters for protection from the rapidly approaching fire front. These additional personnel included two Type 1 Engine Companies, one Type 4 Patrol, one Battalion Chief, three Crew Foremen, three California Department of Correction and Rehabilitation employees, and 55 inmate firefighters. Several of the personnel received injuries while trying to access and render aid to the firefighters who were involved in the vehicle accident and during the sheltering events.

Narrative

On Saturday, August 29, the decision was made to evacuate all non-essential personnel from Fire Camp 16 due to the advancing fire front. A plan for defending the camp was developed and briefed to all of the remaining personnel. On Sunday, August 30, 2009 at approximately 1500 hours, personnel gathered at the camp helipad and observed fire to the west of the camp. At approximately 1530 hours, the decision was made to feed the inmate firefighters in anticipation of increased fire activity.

At approximately 1615 hours, the fire conditions around the camp began to deteriorate very rapidly. There was an increase in temperature and wind speed. The decision was made to "shelter in place" the inmate firefighters while the engines and patrol were deployed as per the briefed plan. During this time frame, the Camp Superintendent and Camp Foreman drove to the area of the helipad and began a firing operation that was part of the briefed plan.

At approximately 1630 hours, the dining facility was becoming untenable due to fire involvement. The order was given to the inmate firefighters to prepare fire shelters for deployment.

At this point, there was radio traffic from the Battalion Chief advising all personnel to move to the north of the dining facility where there were better conditions. The personnel moved to the north with some utilizing their shelters to protect themselves. When they arrived at the crew transports, they were directed to enter the transports for additional protection.

At approximately 1715 hours an accounting of all personnel began and it was determined that two personnel were missing. A search of the area was started for the missing individuals and their vehicle.

A short time later the missing vehicle was located approximately 800 feet below the road and it was determined that both the Camp Superintendent and the Camp Foreman had received fatal injuries.

Continued Safety Considerations for Extreme Fire Behavior

- Have adequate resources available to support all emergency operations at all times.
- Maintain current information on fire weather forecasts and expected fire behavior.
- Identify adequate safety zones and escape routes, and update them regularly.
- Maintain Situational Awareness and know what the fire is doing at all times.
- Identify trigger points that allow for adequate time to evacuate after receiving notification by posted lookouts.



COMMAND 1C

WUI Command Operations for the Company Officer



Appendix C: ICS FORMS

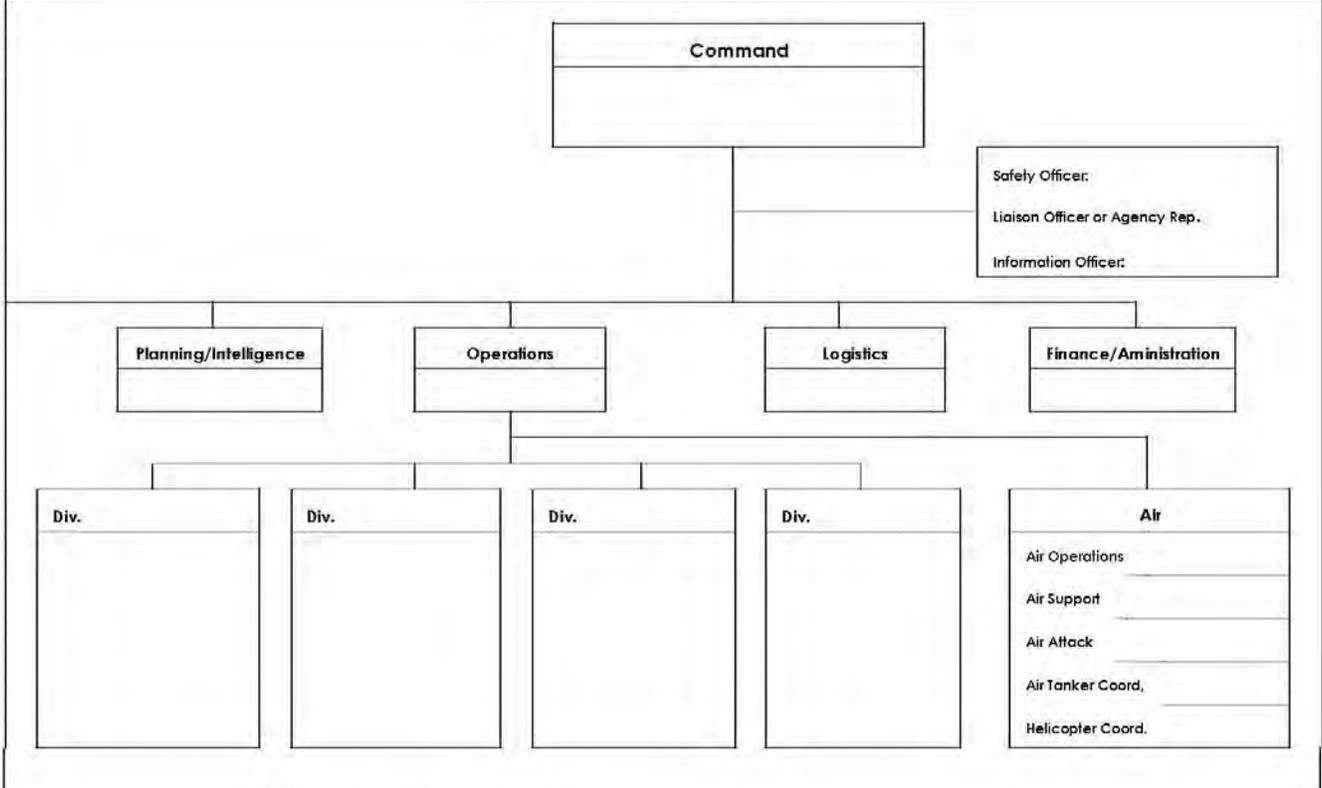
Appendix C: ICS FORMS

Your student manual references the following ICS forms. Your instructor has additional copies when needed for student activities.

INCIDENT BRIEFING	1. Incident Name	2. Date	3. Time
--------------------------	------------------	---------	---------

4. Map Sketch

5. Current Organization



Page 1 of	6. Prepared by (Name and Position)
-----------	------------------------------------

ORGANIZATION ASSIGNMENT LIST		9. Operations Section	
1. Incident Name		Op's Chief	
		Deputy	
2. Date		a. Branch I	
3. Time		Branch Director	
4. Operational Period		Deputy	
Position	Name	Division/Group	
5. Incident Commander and Command Staff		Division/Group	
Incident Commander		Division/Group	
Deputy		Division/Group	
Safety Officer		Staging Area	
Information Officer			
Liaison Officer		b. Branch II	
6. Agency Representative		Branch Director	
Agency	Name	Deputy	
		Division/Group	
		Staging Area	
7. Planning/Intelligence Section		c. Branch III	
Plans/Intel Chief		Branch Director	
Deputy		Deputy	
Resources Unit		Division/Group	
Situation Unit		Division/Group	
Documentation Unit		Division/Group	
Demobilization Unit		Division/Group	
Technical Specialists		Division/Group	
Human Resources		d. Air Operations Branch	
Training		Air Operations Branch Director	
GIS		Air Tactical Supervisor	
		Air Support Supervisor	
		Helicopter Coordinator	
		Air Tanker Coordinator	
8. Logistics Section		10. Finance/Administration Section	
Logistics Chief		Finance/Admin. Chief	
Deputy		Deputy	
Supply Unit		Time Unit	
Facilities Unit		Procurement Unit	
Ground Support Unit		Compensation/Claims Unit	
Communications Unit		Cost Unit	
Medical Unit		Prepared by (Resource Unit Leader)	
Food Unit			

INCIDENT RADIO COMMUNICATIONS PLAN			Incident Name			Date/Time Prepared			Operational Period Date/Time		
Ch #	Function	Channel Name/Trunked Radio System Talkgroup	Assignment	RX Freq N or W	RX Tone/NAC	TX Freq N or W	Tx Tone/NAC	Mode A, D or M	Remarks		
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
Prepared By (Communications Unit)					Incident Location						
					County	State	Latitude	N	Longitude	W	

The convention calls for frequency lists to show four digits after the decimal place, followed by either an "N" or a "W", depending on whether the frequency is narrow or wide band. Mode refers to either "A" or "D" indicating analog or digital (e.g. Project 25) or "M" indicating mixed mode. All channels are shown as if programmed in a control station, mobile or portable radio. Repeater and base stations must be programmed with the Rx and Tx reversed.

MEDICAL PLAN	1. INCIDENT NAME	2. DATE PREPARED	3. TIME PREPARED	4. OPERATIONAL PERIOD		
5. INCIDENT MEDICAL AID STATION						
MEDICAL AID STATIONS	LOCATION			PARA MEDICS?		
				YES		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
6. TRANSPORTATION						
A. AMBULANCE SERVICES						
NAME	ADDRESS	PHONE	PARA MEDICS?			
			YES			
			<input type="checkbox"/>			
			<input type="checkbox"/>			
			<input type="checkbox"/>			
			<input type="checkbox"/>			
			<input type="checkbox"/>			
B. INCIDENT AMBULANCES						
NAME	LOCATION			PARA MEDICS?		
				YES		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
				<input type="checkbox"/>		
7. HOSPITALS						
NAME	ADDRESS	PHONE	TRAVEL TIME	TRAUMA CENTER?	HELIPAD ?	BURN CENTER?
				YES	YES	YES
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
				<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. MEDICAL EMERGENCY PROCEDURES						
9. PREPARED BY (MEDICAL UNIT LEADER)				10. REVIEWED BY (SAFETY OFFICER)		

Incident Demobilization Vehicle Safety Inspection

Vehicle Operator: Complete items above double lines prior to inspection

Incident Name		Order No.	
Vehicle: License No.	Agency		Reg/Unit
Type (Eng., Bus., Sedan)	Odometer Reading		Veh. ID No.

Inspection Items	Pass	Fail	Comments
1. Gauges and lights. See back*			
2. Seat belts. See back *			
3. Glass and mirrors. See back*			
4. Wipers and horn. See back *			
5. Engine compartment. See back			
6. Fuel system. See back *			
7. Steering. See back *			
8. Brakes. See back *			
9. Drive line U-joints. Check play			
10. Springs and shocks. See back			
11. Exhaust system. See back *			
12. Frame. See back *			
13. Tire and wheels. See back *			
14. Coupling devices. *			
Emergency exit (Buses)			
15. Pump Operation			
16. Damage on Incident			
17. Other			

*** Safety Item - Do not Release Until Repaired**

Additional Comments:

HOLD FOR REPAIRS	RELEASE
------------------	---------

Date	Time	Date	Time

Inspector Name (Print)	Operator Name (Print)
Inspector Signature	Operator Signature

This form may be photocopied, but three copies must be completed.
 Distribution: Original to Inspector, copy to vehicle operator, copy to Incident Documentation Unit

INSPECTION ITEMS

(REF: FEDERAL MOTOR CARRIER SAFETY REGULATIONS)

HOLD FOR REPAIRS IF:

1. Gauges & Lights	<ul style="list-style-type: none"> - Speedometer inoperative. (Federal Motor Carrier Safety Regulation (FMCSR 393.82) - All required lighting devices, reflectors and electrical equipment must be properly positioned, colored and working. (FMCSR 393.9) 	8. Brakes	<ul style="list-style-type: none"> - Brake system has any missing, loose, broken, out of adjustment or worn out components. - Brake system has any air or fluid leaks. (FMCSR Appendix G, Sub. B) - Brake system has any other deficiencies as described in FMCSR Appendix G, Sub. B.
2. Seat Belts	<ul style="list-style-type: none"> - Any driver's or right outboard seat belt, missing or inoperative. (FMCSR 393.93) - Passenger carrying have missing or inoperative seat belts in passenger seats, Buses excepted. 	10. Springs & Shocks	<ul style="list-style-type: none"> - Any U-bolt, spring, spring hanger or any other axle positioning part is cracked, broken, loose or missing resulting in any shifting of an axle from its normal position. (FMCSR Appendix G, Sub. B)
3. Glass & Mirrors	<ul style="list-style-type: none"> - Any windshield crack over 1/4" wide. - Any damage 3/4" or greater in diameter. - Any 2 damaged areas are closer than 3" to each other. - Any crack less than 1/4" wide intersects with any other crack. (FMCSR 393.60) - Any crack or discoloration in the windshield area lying within the sweep of the wiper on either side of the windshield (FMCSR Appendix G, Sub. B) - Any required mirror missing. One on each side, firmly attached to the outside of the vehicle, and so located as to reflect to the driver a view of the highway to the rear along both sides of the vehicle. See Exceptions (FMCSR 393.80) - Any required mirror broken. 	11. Exhaust	<ul style="list-style-type: none"> - Any leaks at any point forward of or directly below the driver and/or sleeper compartment. - Bus exhaust leaks or discharge forward of the rearmost part of the bus in excess of 6' for Gasoline powered or 15" for other than Gasoline powered, or forward of any door or window designed to be opened on other than Gasoline powered bus. (Exception: emergency exit) - Any part of the exhaust system so located as would be likely to result in burning, charring, or damaging the wiring, fuel supply or any combustible part of the vehicle. (FMCSR Appendix G, Sub. B)
4. Wipers & Horn	<ul style="list-style-type: none"> - Wiper blade(s) fail to clean windshield within 1" of windshield sides. (FMCSR 393.78) - Horn, missing, inoperative, or fails to give an adequate and reliable warning signal. (FMCSR 393.81) 	12. Frame	<ul style="list-style-type: none"> - Any cracked, broken, loose or sagging frame member. - Any loose or missing fasteners including those attaching engine, transmission, steering gear, suspension, body or frame to contact the tire or wheel assemblies. - Adjustable axle assemblies with locking pins missing or not engaged. (FMCSR Appendix G, Sub. B)
5. Engine Compartment	<ul style="list-style-type: none"> - Low fluid levels - Loose or leaking battery - Excessive leaks - Cracked or deteriorated belts or hoses. - Any condition of impending or probable failure. 	13. Tires & Tread	<ul style="list-style-type: none"> - Tread depth less than 4/32" on steering axle. - Less than 2/32" on any other axle. - Any body ply or belt material exposed through tread or sidewall. - Any tread or sidewall separation. - Any cut exposing ply or belt material. - Any tire marked "Not for highway use". - A tube-type radial tire without radial tube stem markings. - Any mixing of bias and radial tires on the same axle. - Any tire not properly inflated or overloaded. - Any bus with recapped tires. (FMCSR Appendix G, Sub. B) - Lock or slide rings; any bent, broken, cracked, improperly seated, sprung or mismatched ring(s). - Wheels and rims; any cracked or broken or has elongated bolt holes. - Fasteners (both spoke and disc wheels). Any loose, missing, broken, cracked, stripped or otherwise ineffective fasteners. - Any cracks in welds attaching disc wheel disc to rim. - Any crack in welds attaching tubeless demountable rim to adapter. - Any welded repair on aluminum wheel(s) on a steering axle or any welded repair other than disc to rim attachment on steel disc wheel(s) on steering axle. (FMCSR Appendix G, Sub. B)
6. Fuel System	<ul style="list-style-type: none"> - Visible leak at any point. - Fuel tank cap missing. - Fuel tank not securely attached to vehicle by reason of loose, broken or missing mounting bolts or brackets. (FMCSR Appendix G, Sub. B) 		
7. Steering	<ul style="list-style-type: none"> - Steering wheel does not turn freely, has any spokes cracked, loose spokes or missing parts. - Steering lash not within parameters, see chart, in FMCSR 393.209. - Steering column is not secure - Steering system; any U-joints worn, faulty or repaired by welding. - Steering gear box is loose, cracked or missing mounting bolts. - Pitman arm loose. - Power Steering; any components inoperative. - Any loose, broken or missing parts. Belts frayed, cracked or slipping. - Any fluid leaks, fluid reservoir not full. (FMCSR 393.209) 		

DEMOBILIZATION CHECKOUT		
1. Incident Name/Number	2. Date/Time	3. Demob. No.
4. Unit/Personnel Released		
5. Transportation Type/No.		
6. Actual Release Date/Time	7. Manifest? <input type="checkbox"/> Yes <input type="checkbox"/> No Number	
8. Destination	9. Notified: <input type="checkbox"/> Agency <input type="checkbox"/> Region <input type="checkbox"/> Area <input type="checkbox"/> Dispatch	
	Name: Date:	
10. Unit Leader Responsible for Collecting Performance Rating		
11. Unit/Personnel		
You and your resources have been released subject to sign off from the following: <i>Demob. Unit Leader check the appropriate box</i>		
Logistics Section		
<input type="checkbox"/> Supply Unit		
<input type="checkbox"/> Communications Unit		
<input type="checkbox"/> Facilities Unit		
<input type="checkbox"/> Ground Support Unit		
Planning Section		
<input type="checkbox"/> Documentation Unit		
Finance Section		
<input type="checkbox"/> Time Unit		
Other		
<input type="checkbox"/>		
<input type="checkbox"/>		
12. Remarks		
13. Prepared by (include Date and Time)		
DEMOBILIZATION CHECKOUT		

INCIDENT PERSONNEL PERFORMANCE RATING		<i>INSTRUCTIONS:</i> The immediate job supervisor will prepare this form for each subordinate. It will be delivered to the planning section before the rater leaves the fire. Rating will be reviewed with employee who will sign at the bottom.																			
THIS RATING IS TO BE USED ONLY FOR DETERMINING AN INDIVIDUAL'S PERFORMANCE																					
1. Name						2. Incident Name and Number															
3. Home Unit (<i>address</i>)						4. Location of Incident (<i>address</i>)															
5. Fire Position				6. Date of Assignment From: To:				7. Acres Burned				8. Fuel Type(s)									
9. Evaluation																					
Enter X under appropriate rating number and under proper heading for each category listed. Definition for each rating number follows: 0 - Deficient. Does not meet minimum requirements of the individual element. DEFICIENCIES MUST BE IDENTIFIED IN REMARKS. 1 - Needs to improve. Meets some or most of the requirements of the individual element. IDENTIFY IMPROVEMENT NEEDED IN REMARKS. 2 - Satisfactory. Employee meets all requirements of the individual element. 3 - Superior. Employee consistently exceeds the performance requirements.																					
Rating Factors						Hot Line				Mop-Up				Camp				Other (<i>specify</i>)			
						0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3
Knowledge of the job																					
Ability to obtain performance																					
Attitude																					
Decisions under stress																					
Initiative																					
Consideration for personnel welfare																					
Obtain necessary equipment and supplies																					
Physical ability for the job																					
Safety																					
Other (<i>specify</i>)																					
10. Remarks																					
11. Employee (<i>signature</i>) This rating has been discussed with me														12. Date							
13. Rated By (<i>signature</i>)						14. Home Unit (<i>address</i>)				15. Position on Incident				16. Date							

FIRE APPARATUS INVENTORY AND RECORD **OES F-157 (Rev 7/2000)**

DATE	ASSIGNED DEPARTMENT	LOCATION
ENGINE # OES	LICENSE #	MILEAGE
INCIDENT NAME	REGION	OPERATIONAL AREA

TYPE OF INVENTORY (Check One)

ANNUAL
 FIRE
 TRANSFER

ACCOUNTABLE PROPERTY & EQUIPMENT	BOOK	FOR ENGINES	ACTUAL COUNT	SHORT COUNT	ACCOUNTABLE PROPERTY & EQUIPMENT	BOOK	FOR ENGINES	ACTUAL COUNT	SHORT COUNT
1 Adapter, 1½" IPF to 1½" NSM	1	up to 237			58 OES Operations/Maintenance Bulletins	1			
2 Adapter, 1½" PCF to 1½" NSM	1	up to 237			59 Pike Pole	1			
3 Adapter, 1½" NSF to 1½" PCM	1	up to 237			60 Plug, 2½" Suction	2			
4 Adapter, 1½" NSF to 1½" IPM	1	up to 237			61 Pulaski	1			
5 Adapter, 5" x 2½", DF Hydrant	1				62 Radef Kit	1			
6 Adapter, 5" x 4", DF Hydrant	1				63 Radio, Hand-held	1			
7 Adapter, 5" x 4½", DF Hydrant	1				64 Radio, Mobile, OES #	1	Yes <input type="checkbox"/> No <input type="checkbox"/>		
8 Axe, Pick head	1				65 Reducer, 1½" NSF to 1" IPM	1			
9 Block, Chock (one each 166 to 237)	2	238 and up			66 Reducer, 2½" NSF to 1½" NSM	1			
10 Bracket, Logbook	1	257 and up			67 Reflector Kit, 3 Unit	1			
11 Cans, Fuel	2				68 Rope, ½" x 100'	2			
12 Cap, 2½" Discharge	5				69 Shovel, Long Handle, Round Point	1			
13 Chain, Tow 25', with Grab Hooks	1				70 Siamese, 2½"	1			
14 Clamp, Hose (Hebert)	1				71 Soft Suction Hose, 2½" x 12'	1			
15 Coupling, 2½", DF	2				72 Strainer, Class A Foam	1			
16 Coupling, 2½", DM	2				73 Strainer, 5" Suction Hose	1			
17 Cord, Electrical 12/3 Ga. 100'	2				74 Strap, Hose and Ladder	4			
18 Crank, Hose Reel	1				75 Wrench, Adjustable Hydrant	2	238 and up		
19 Cutter, Bolt, 30"	1				76 Wrench, Suction Hose Spanner	1			
20 Fire Extinguisher, 4# or 5#	1				77 Wrench, Hose Spanner	4			
21 First Aid Kit	1				78 Wrench, Lug with Handle	1			
22 Floto Pump, OES #	1				79 Wye, 2½" NSF x 2 1½" NSM	1			
23 Generator, 3500 Kw	1				US&R INVENTORY				
24 Hammer, Sledge, 8-10 lb.	2				80 Axe, Flathead	1			
25 Hose, 1" x 50', NST	8	up to 252			81 Backboard, with 4 Straps	1			
26 Hose, 1" x 100', NST	4	253 and up			82 Bar, Pinch Point, Pry, 60"	4			
27 Hose 1½" x 35', Truck Protection Line	1	253 and up			83 Bar, Claw, Wrecking, 3'	2			
28 Hose 1½" x 50', NST	8	up to 199			84 Belt, Carpenter	2			
29 Hose 1½" x 50', NST	12	201 and up			85 Blade, Hacksaw, High Speed, Pkg	3			
30 Hose, 1½" x 100', Forestry	8				86 Blanket, Disposable	2			
31 Hose, 2½" x 50', NST	20	up to 165			87 Camming Device	6			
32 Hose, 2½" x 50', NST	24	166 to 256			88 Carabiner, Locking "D", 11 mm	12			
33 Hose, 3" x 50', NST	24	257 and up			89 Chain Saw, with Chain and Tool Kit	1	Yes <input type="checkbox"/> No <input type="checkbox"/>	ID#	
34 Hose, Booster, 1" x 150'	1				90 Chisel, Cold, 1" x 7½"	2			
35 Hose, Hard Suction, 5" x 10'	2				91 Cribbing and Wedge Kit	1			
36 Hose, Soft Suction, 5" x 12'	1				92 Edge Protectors	2			
37 Increaser, 1" IPF to 1½" NSM	1				93 Friction Device, Figure 8 or Brake Bar	2			
38 Intercom Set	1				94 Hacksaw	2			
39 Ladder, 10' Attic	1				95 Handsaw, Crosscut, 26"	2			
40 Ladder, 14' Roof	1				96 Hammer, Framing, 24 oz.	2			
41 Ladder, 24' Extension	1				97 Hammer, Sledge, Short, 3-4 lb.	2			
42 Lantern, Hand, 12 Volt	1				98 Harness, Commercial	2			
43 Logbook with Credit Card	1				99 Jack, Hydraulic with Handle, 8 Ton	2			
44 Mallet, Rubber	1				100 Kernmantle, ½" x 150', Static	2			
45 Manual, Chassis	1				101 Litter and Complete Prerig	1			
46 Manual, Engine	1				102 Marking Kit, Building	1			
47 Manual, Pump	1				103 Nails, 25# each: 16p, 8p, 16p Duplex	1			
48 Manual, Transmission	1				104 Picket, Steel, 1" x 4'	6			
49 McCleod	1				105 Pulley, Rescue, 2" or 4"	3			
50 Mount, Ground, Deluge	1	238 and up			106 Shovel, D Handle, Scoop	1			
51 Nozzle, 1", Combination	2				107 Shovel, Long Handle, Square Point	1			
52 Nozzle, 1½", Combination	4	201 to 252			108 Square, Tri or Speed	2			
53 Nozzle, 1½", Combination	5	253 and up			109 Strap, Pick Off with D or V Rings	2			
54 Nozzle, Deluge Set, 1½, 1½, 1¼, 2	1				110 Tape, Duct	3			
55 Nozzle, 1½", Foam, Air Aspiration	1				111 Tape Measure, 25'	2			
56 Nozzle, 2½", Fog	1				112 Trauma Kit	1			
57 Nozzle, 2½", Shut-off with Tips	2				113 Webbing Kit	1			

NOTE ANY EQUIPMENT DAMAGE. RECAP ALL SPECIAL EQUIPMENT CARRIED THAT IS OWNED BY OES.

CORRECT PER ACTUAL COUNT

OES, FIRE & RESCUE BRANCH SIGNATURE	TITLE		ASSIGNEE SIGNATURE	TITLE
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Distribution: ORIGINAL: OES, Rancho Cordova COPY 1: Assignee COPY 2: OES Field Assistant Chief