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Southern California Firestorm 2003

Report for the Wildland Fire Lessons Learned Center

For:
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This report was prepared by two private consulting firms with the input of federal agency employees assisting the Wildland Fire Lessons Learned Center.

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Contents

Introduction

During the last week of October and the first week of November, 2003, thirteen wildfires occurred throughout Southern California. These wildfires created a disaster on such a scale that they may redefine the concept of the wildland urban interface.

On November 7, a six-person information collection team from the Wildland Fire Lessons Learned Center (LLC) assembled in Southern California and spent a week interviewing 107 people from 43 different fire and ICS positions, representing at least 12 different city, county, state, and federal agencies. The team sought to capture the experiences of those who fought these fires, capture the important lessons learned by them, and learn how these events affected the firefighting strategy, tactics, techniques, and decision making of those involved.

"Firestorm 2003," as the media is calling it, was unprecedented in scope and impact. The statistics to date are staggering: 12,000 firefighters, 750,000 acres burned, billions of dollars in damage, approximately $120 million in suppression costs, 4000 homes destroyed, 22 human lives lost.

These events put people in new territory. The enormity of the situation pushed people into positions that the system and the rules were simply not prepared to handle and forced significant mental shifts in the thinking of those involved. Out of 107 interviewees, almost all used words like "conflagration" and "catastrophic" as they tried to describe what they had seen.

There is always a temptation in these kinds of incidents to blame the notorious Santa Ana winds or to rationalize the actions of those involved as once-in-a-lifetime experiences. Those interviewed, however, believed events of this magnitude will continue to occur, and not only in Southern California. In fact, the Santa Ana winds rarely exceeded 30 to 40 mph during these events. Many photos of the fires show flames and smoke standing straight up despite the winds.

Other conditions contributing to these extreme fires are common throughout the western United States: extended drought, widespread tree mortality resulting from insect infestation, high fuel loads, and the continuing expansion of the wildland urban interface. As one Type 1 Incident Commander put it, "This fire season is not abnormal, but the *new* normal." Respondents feel the lessons offered by those who participated are worth studying.

The LLC Information Collection Team's objective was not to list all the things that went wrong. While Incident Management Teams managed the complexity of multiple difficult incidents, the demand on the system simply exceeded its design parameters. Large systemic policy, coordination, and equipment failures were documented and need attention. Many of these are already being reviewed and investigated, and there will no doubt be policy and budgetary challenges that will impact all agencies at all decision-making levels.

But what if we had to do it all over again tomorrow?

This report identifies large unresolved issues, but its primary purpose is to report how people overcame challenges when the demands of the fire situation exceeded the capacity of the rules and the system to provide answers. Repeatedly, the LLC Information Collection Team heard leaders—from engine foremen to incident commanders—say that during these fires they were

faced with some of the most difficult decisions in their careers. So what worked? How did leaders cope and find ways to mitigate the risks and adapt their thinking and tactics successfully?

The interviews reveal that people at every level and in every functional area of every agency found ways to succeed in spite of the overwhelming events. Firefighters described exercising initiative in the absence of communication and during the chaos before unified command could be effectively established.

Leaders spoke about adapting doctrine to create innovative solutions to new tactical problems. Respondents recounted how they had to adapt a rulebook that was no longer relevant and use sound judgment and experience to mitigate risk and remain effective.

Most of the firefighters interviewed said they were just doing their jobs. That may be true, but even this cursory examination of the events in Southern California made the members of the LLC team appreciate the achievement involved in being able to make that simple statement.

The representatives that met with the LLC team were open and selfless with their stories. Many described feeling compelled to relate their experiences in order to generate a frank discussion among the wildland firefighting community—to promote learning and help resolve important foundational issues.

It is important to note that this is not a complete history of the events or decision-making during these fires, nor was it within the LLC Information Collection Team's charter to do so. The LLC team's methodology included selecting and interviewing the broadest sampling of representatives from as many agencies possible—from different fires and at different levels and functional areas of their organizations.

This report focuses on the themes of common concern to all, rather than issues unique to one agency, and on those things that people at all levels can take away and begin applying immediately.

Project Scope

This section outlines the details of the team, objectives, focus areas, and interviews.

Team Composition

Team Leader

- Dave Christenson, Wildland Fire Lessons Learned Center

Team Members

- Tim Duck, BLM, Parashant National Monument, St. George, UT
- Kim Round, USFS, San Juan Public Lands Center, Durango, CO
- Jeanne Gural, USFS, San Bernardino National Forest and San Dimas Technology & Development Center, CA
- Michael DeGrosky, The Guidance Group, Washburn, WI

- Mark Smith, Mission-Centered Solutions, Parker, CO

Objective

An Information Collection Team (ICT) comprised of federal agency employees and two private sector consultants collected wildland urban interface lessons learned and best practices by interviewing numerous overhead and field personnel over a six day period. The team traveled throughout Southern California to conduct interviews with agency administrators, incident management teams, operations overhead personnel, and structural protection resources from a variety of agencies.

Focus Areas

Interviews were based on the following focus areas:

- Describe the best success in the urban interface you were involved with on your incident (tactics, techniques, or procedures).
- What was the most significant thing you learned regarding urban interface on your incident? Please explain.
- What was the biggest urban interface challenge you faced on the incident? Describe how you overcame this challenge.
- Describe any lessons learned on the incident regarding structural protection, evacuations, command and control, or unified command if applicable.
- How did the fire behavior affect your strategy and decisions on the incident?
- Please comment on the work/rest guidelines in regard to this incident.
- Were there any unresolved urban interface issues you faced? What is your recommendation for resolution?

Interviewees

Total number: 107 interviewed, representing 12 different city, county, state and federal agencies and private citizens who participated in thirteen fires.

Positions held by interviewees:

Air Tactical Group Supervisor
Air Tanker Base Manager
Air Tanker Pilot/Co-Pilot
Area Commander
Assistant Air Tanker Base Manager
Assistant Chief
Battalion Chief (structural and wildland)
Branch Director
Camp Superintendent
Company Officers (Station Captains)
Crew Coordinator
Crew Leader Type 1
Crew Leader Type 2
Deputy Incident Commander Type 1
Dispatcher
Dispatch Supervisor
District Ranger
Division Chief
Division Supervisor
Emergency Medical Technician
Emergency Operations Center Coordinator
Engine Driver/Operator (structural and wildland)
Engineer (structural and wildland)
Engine Captain
Fuels Technician
Forester
Fire Fighter
Fire Management Officer (District and Forest levels)
Incident Commander Type 1
Incident Commander Type 2
Incident Commander Type 3
Interagency Hotshot Crew Superintendent
Law Enforcement Officer
Logistics Section Chief Type 1
Operations Section Chief Type 1
Operations Section Chief Type 2
Paramedic
Planning Section Chief
Prevention Technician
Public Information Officer
Radio Operator
Rehabilitation Group Supervisor
Safety Officer Type 1
Strike Team Leaders
Structure Group Supervisor

Fire Behavior and Fuels

This section outlines lessons learned regarding fire behavior as described by interviewees.

Extreme Fire Behavior

> *I've seen a once-in-a-lifetime fire three times now.*
> **- 30 year Engine Company Captain**

Respondents felt it was important to communicate to the wildland community that the Southern California fires were much more than typical wind-driven events. The Santa Ana influence was typical, with winds rarely stronger that 30 to 40 mph. The extreme fire behavior during this event resulted from a convergence of extended drought, fuel conditions, hot and dry weather, and wind.

Similar fire-prone landscapes that set preconditions for extreme wildland fire can be found across the western U.S:

- rangelands and forests with high or overloaded fuel conditions
- extensive areas of tree mortality resulting from insect infestations
- extensive areas affected by persistent drought

- increasing human encroachment into fire-prone environments and relentless expansion of the wildland-urban interface (WUI)

After extending into the urban environment, these fires often split into multiple heads and spread along paths defined by the available fuel sources. Fires spread over and around barrier after barrier. Wind conditions contributed to extremely unpredictable fire behavior and erratic changes in fire direction and spread. On one fire, the flaming front extended 45 miles throughout the city.

The fires moved far more quickly than anyone had anticipated or prepared for. One fire grew from 500 to 31,000 acres in four hours. Sudden wind shifts and huge fire whirls threw embers and flaming debris far ahead of the main fire. Wildland fires nearing urban areas spotted ½ to ¾ of a mile past the interface and into the urban environment. One pilot reported encountered a 4' x 8' flaming sheet of plywood and rocks at an altitude of 1,500 feet.

The majority of respondents indicated that they did not recognize early on the need to significantly adapt strategy to the extreme fire behavior. The felt they pursued perimeter control strategies too long before shifting their thinking defensively and enacting appropriate tactics until the weather provided an opportunity to go back on the offensive. All indicated that when this mental shift occurred, they were more successful in saving neighborhoods. All indicated that if faced with a similar situation in the future, they would initially adopt a protect-and-defend strategy.

Summary of Lessons Learned—Extreme Fire Behavior

- The extreme fire behavior during this event resulted from a convergence of extended drought, fuel conditions, hot and dry weather, and wind. Respondents felt conditions that led to these fires are common in other areas throughout the western U.S.
- The extreme nature of the fire behavior surprised most firefighters. Most did not initially recognize the need to adapt strategy and tactics to the extreme fire behavior. They said adopting an initial protect-and-defend strategy before attempting perimeter control would have been more effective.

Transition to an Urban Conflagration

Normally we go after it. This time it went after us!
- City Battalion Chief

These fires burned beyond the wildland-urban interface into urban environs with little or no wildland fuels. In this environment, fires spread from structure to structure—an urban conflagration.

When fires initially entered urban zones, embers from the main fire ignited spot fires in the urban zones. There, ornamental vegetation, such as palms, ignited producing intense ember showers and more spotting. Winds often carried these ember showers into attic vents and eave spaces of neighboring houses. Consequently, unlike most structures destroyed by wildland fire, these urban houses burned from the inside out.

In some cases, the requirements of urban firefighting and the intense heat generated by multiple structure fires demanded that firefighters abandon traditional “bump and run tactics” in favor of

flowing large quantities of water to involved structures that threatened whole blocks. The criteria for selecting the appropriate tactic are discussed in depth in the Strategy and Tactics section of this report. The extension of fire well into urban settings also required unified command between agencies that do not frequently come into operational contact.

Given the continuation of the conditions contributing to these fires and the persistent expansion of the wildland-urban interface, Respondents believed that similar fire events will occur in the future. Consequently, contingency planning for such fire events becomes increasingly necessary.

Summary of Lessons Learned—Transition to an Urban Conflagration

- Fires crossed the traditional interface into purely urban areas. Structures became another fuel type to carry the fire deeper into cities.
- Ornamental vegetation created an unpredictable and significant fuel source that blew into attic vents and eaves and spread through neighborhoods by torching, crowning, or throwing embers. Structures became involved from ember attack from the inside out rather than flame impingement.
- Firefighters found heat control the primary factor for preventing fire from spreading to other structures once fire entered denser urban areas.
- Respondents believed similar events will happen in the future and reiterated the need to put even more effort into pre-incident planning.

Fire Whirls

What we were expecting to see were fire whirls (4' to 6' tall), what we actually saw were true fire tornadoes. The fire researchers kept telling us what we were seeing was impossible and never seen before. After three days of discussion, the fire researchers started to understand that what they were expecting and what was happening was not jiving.
-Division Supervisor

Respondents reported unusual numbers of fire whirls that ranged from several yards wide up to a ½ mile wide. *Destructive fire whirls,* those causing structural damage unrelated to fire, also were reported.

In addition to appearing suddenly, large fire whirls, characterized by a jet engine noise, took in debris such as large tumbleweeds and bushes from the bottom and ejected flaming debris from top—raining embers and violently showering sparks as much as ¾ of a mile beyond the head of the fire. In one reported case, a fire whirl entered an area that had already burned clean down to three-inch stubble and whirled across several hundred feet of burned area into unburned fuel, carrying fire the whole way and igniting the unburned fuel. Another fire whirl crossed an eight-lane freeway. Small fire whirls merged into larger ones. Some reported fire whirls moving downhill.

Summary of Lessons Learned—Fire Whirls

- Observed fire whirl behavior was both unexpected and extreme in these fires, catching many firefighters by surprise and significantly contributing to spotting up to ¾ mile.
- 180-degree wind shifts proceeded fire whirls by 45 seconds to a minute. These wind shifts became a warning sign/trigger point to some firefighters, allowing time to pull crews out to a safer area.

Wind Shifts

It does not matter how much experience you have, the urban interface fire will surprise you. I never expected the fire to move so fast against the wind and wouldn't have believed it if someone told me about it.
- Municipal Department Fire Chief

Wind shifts produced dangerous fire behavior, including fire whirls. Once recognized, crews developed contingency actions (including moving to safety zones) that they implemented when they detected sudden wind shifts. Strategically, the shifts from the easterly Santa Anas to the prevailing westerly winds offered opportunities to take the initiative and gain ground on perimeter control.

Summary of Lessons Learned—Wind Shifts

- Wind shifts were trigger points indicating the potential for fire whirls and other dangerous fire behavior. Leaders developed contingency plans to implement when wind shifts occurred.
- Larger predicted wind shifts were used to set strategic trigger points to take advantage of wind shifts as the opportunity to move from a defensive strategy to an offensive one.

Fuels

The fire hit us so hard; the houses became just another fuel type.
- Engine Company Captain

In higher elevations, extensive tree mortality resulting from pine beetle infestation provided abundant fuel to carry the fire. Light, flashy fuels, and decadent chaparral fueled the fire at lower elevations. Witnesses reported mass ignition in grassy fuels ahead of the fire—the result of dry winds, high temperatures, low humidity, and low fuel moistures.

As the fire transitioned from the traditional WUI into the urban environment, heat emanating from fully involved structures allowed the fire to spread to neighboring structures by direct flame impingement, radiant heat, and embers emanating from palm fronds and other ornamental foliage. In terms of radiant heat, municipal firefighters reported no difference between being outside these houses and being inside a fully involved structure.

Palm trees provided an unusual and significant fuel source, carrying the fire rapidly across streets and through neighborhoods both through torching and by fronds creating a spotting source.

Dense ornamental foliage proved a significant problem in older neighborhoods. Other highly flammable fuels included Eucalyptus (especially when in groves), olive trees, and Italian Cypress. Dense accumulations of Italian Cypress needles threw embers in all directions once ignited.

Belts of natural "open space" in WUI neighborhoods (versus greenbelts) helped spread the fire by carrying it along roads or helping fire to jump a road.

Summary of Lessons Learned—Fuels

- Fire moved very quickly through trees killed by bugs and chaparral. Mass ignitions were reported in light, grassy fuels.
- As a type of fuel, involved structures emanated intense radiant heat. Heat levels in the street were unusually high.
- Ornamental vegetation created an unpredictable and significant fuel source that blew into attic vents and eaves and spread through neighborhoods by torching, crowning, or throwing embers.
- Natural open space areas contributed to fire spread. Greenbelts were effective barriers.

Effects of Fuels Programs and Fuel Treatments

Respondents reported that fuel treatments resulting from quality hazard abatement programs influenced fire behavior—in some cases dramatically. Areas with more effective prevention and fuels hazard abatement programs fared better than those without.

Newer houses constructed of stucco and sealed eaves with reduced ladder fuels and cleared defensible space survived better than new homes in areas with less restrictive building codes (still allowing shake roofs or unsealed eaves, for example). In one area, over 90% of the homes lost (over 700) had wood shingle roofs. Older houses in urban neighborhoods with dense ornamental vegetation and palm trees were also at risk.

Respondents reported considerable differences between communities in how they had handled hazard abatement. Some had mandatory programs that were well enforced, with stiff penalties for non-compliance. Other communities had voluntary programs or didn't enforce their mandatory programs. The reported differences in how these communities fared was striking. Fewer homes were lost in communities where local government actively supported and enforced hazard abatement programs, and firefighter safety presented less of a concern. However, the normal 30' abatement limit was not sufficient in most cases to prevent flame impingement and ember-driven fires from starting. Some WUI areas had 100' abatement limits, and those were extremely effective.

In one of the areas with the 100' clearance requirement, many homes survived even though no fire resources were available to protect them. In this community, residents are required to create a 100' defensible space, and local firefighters divide the homes and go door-to-door to communicate with residents. If the resident does not comply with the defensible space requirements, a notice is issued with a deadline and a fine. Similar to some traffic tickets, the fine

doubles then triples the longer the resident takes to comply. Eventually, the jurisdiction fines the resident $635, contracts the abatement work out, and adds the cost (about $300) to the fine. The whole amount is then billed to the resident's property taxes for the next year. Last year, this jurisdiction originally issued about 18,000 hazard abatement notices. They ended up having to contract out and bill residents for only 138 of those 18,000 parcels.

Local jurisdictions that took the responsibility of maintaining government-managed lands to very high standards were also successful. Greenbelts were highly effective, as were open spaces where fuels were abated or treated. In addition to reducing the fire hazard, these areas set an example for area residents.

In one successful example, a resident created a defensible space around their home by clearing several feet of native coastal sage scrub vegetation and replacing it with gravel and fire resistant plants including ice plant (non-native, but does well in this area) as ground covering, pencil bush, again a non-native but does well in the area (*Euphorbia trucalli*), lemonade berry, a native (*Rhus integrifolia*), Catalina cherry, a native (*Prunus lyonii),* California wax myrtle, a native (*Myrica californica),* and native oaks, (*Quercus agrifolia),* which are not only resistant to burning but grow naturally in Southern California. In contrast, costal sage was often burned beyond recognition.

In wildland areas, it proved critical for natural resource agencies to focus their limited resources on priority projects. The National Forests have hundreds of thousands of acres of dead trees and accumulated fuels. Treating the whole area is unrealistic given the resources available to the agencies. As one respondent put it, "Six or eight projects, 10 to 100 acres in size made a difference on this fire because they were in key areas. We need to focus on treating fuels around the structures. We can't treat the whole forest."

One successful project involved a school where middle and high school students provided defensive space clearance, trash, and brush removal. The local Fire Marshall had visited the school every month and helped them set up measures that saved not only the school but were credited with saving the whole town. Twice firefighters were able to beat back the flames from the deck of the school and the lodge next to it. The hotshot crew who had defended the structures wrote on a classroom blackboard, "Thanks for doing your work. Because of you we were able to save [your town]."

Areas burned by wildfires in the previous year did not necessarily stop fires because light, flashy fuels had grown in the burned areas. However, fuels treatments and prescribed burns conducted in the past 5 years were generally more successful. Using existing community fuel breaks and planned points (often old burn projects) worked effectively to keep fire out of the mountain communities.

Summary of Lessons Learned—Effects of Fuels Programs and Fuel Treatments

- Strict building codes and fuels abatement programs in the WUI were extremely effective compared to less aggressive programs in other areas. Shake shingled homes suffered very high loss rates compared with other types of roof construction.
- Greenbelts and open spaces where fuels had been treated or abated or both were effective as control points in the WUI. Native, fire resistant plants were effective in creating defensible space that was effective and still natural looking.
- In wildland areas, the quality and placement of fuel treatments—not gross acres treated—mattered most. In some cases, five acres treated in the right spot saved a community.

Interagency Cooperation

This section describes the lessons learned regarding interagency cooperation.

Effectiveness of Interagency Cooperation

The value of interagency cooperation paid off. "Everyone spoke the same language."
Battalion Chief

Despite the normal difficulties associated with interagency cooperation, those interviewed overwhelmingly stated that cooperation between agencies was extremely strong and was a key factor in being able to deal with a series of crises of this magnitude.

Leaders stated that where interagency cooperation was established and routinely in practice before these fires, the response was more effective. In the areas where cooperation had to be established as operations were occurring, the response was less effective.

Respondents said that the Incident Command System (ICS) proved its worth as common doctrine. ICS provided common ground around which diverse cooperators could rally and begin to function effectively, even in the initial absence of effective, centralized command.

Summary of Lessons Learned—Effectiveness of Interagency Cooperation

- Strong interagency cooperation practiced by many agencies in Southern California had a direct positive impact on the ability to manage these incidents.
- ICS was rated invaluable as the common doctrine to facilitate interagency cooperation and establish and exercise effective unified command.

Interagency Training

Respondents believed that interagency training had an impact on how effectively responding agencies coordinated their response to these incidents. They felt that agencies that had trained together were able to establish a unified command faster and had a more effective response.

Agencies that provided ICS training down to the tactical level were decidedly more effective prior to the establishment of unified command, as well as after it had been established. Respondents reported that joint training with ancillary agencies, such as the Red Cross, exposed firefighters to the planning and operational considerations of cooperators and gave cooperators training needed to function in the wildland fire environment.

Respondents indicated that tabletop planning and exercises proved especially important in those areas with strong pre-incident planning. Joint sessions brought cooperators together and enabled them to identify and plan for areas likely to be impacted by WUI fires. This planning involved reviewing fire history records, conducting fire hazard analyses, and having leaders talk through the planning and response issues. This process provided the opportunity to become familiar with local areas and cooperators and allowed cooperators to "work-out the bugs," identifying opportunities and potential problems.

Respondents said they would like to see the same kind of training done at the tactical level with firefighters. Agencies with responsibilities in the WUI conducted training sessions to plan strategy and tactics and walk through an anticipated incident. Fire managers simulated the fire suppression planning and execution with engine and hand crews walking through their expected activities such as engine crews driving into WUI neighborhoods, implementing triage procedures, and practicing tactics.

Structural and wildland leaders reported that municipal and county fire departments that had participated in WUI fire training programs were better prepared to respond to this type of incident over those that did not. Although respondents indicated that serious improvements are still needed in the training and standards, those who participated in the California Office of Emergency Services (OES) wildland fire curriculum believed they were better prepared to function as part of a strike team. Other departments had taken advantage of training provided by cooperator agencies or their own wildland divisions for training. Respondents felt that those who did not have that training were exposed to greater risks by being less familiar with wildland tactics and not fully understanding their role in a strike team.

Summary of Lessons Learned—Interagency Training

- Agencies that trained together were able to function more effectively as a unified command team. This was true at the tactical level as well.
- Interagency training with cooperators provided valuable pre-incident planning as well. Tabletop and walk-through exercises were cost-effective ways to plan for incidents and build relationships.
- Structural units and leaders who had received wildland training were more effective and safer as single resources or part of a strike team operating in the WUI. Those without the training were not proficient in wildland tactics.

Interagency Relationships

> *Making a fire successful begins years in advance.*
> **- Type 1 Incident Commander**

Nearly universally, respondents reported the importance of trust, developed through established personal and professional relationships with peers and cooperators. During the initial chaos of these incidents and at the times when dispatch and incident command systems were overwhelmed, these relationships became the primary means by which things got done, until the system could be brought on-line. These networks, enabled by these relationships, were frequently the primary force behind successful operations.

Respondents also reported that networks of personal relationships minimized unproductive conflict. In situations where conflict did occur—sometimes under incredibly stressful conditions—it was often resolved by leaders who sought out their counterparts for face-to-face meetings. At the management level, agencies that had ongoing programs to foster relationships with important cooperators, media, politicians, and communities were more effective at managing information and negative perceptions than those without such programs. These programs build support by participating in important community events, such as ride-alongs for influential contacts and media and regular briefings on projects and activities.

Summary of Lessons Learned—Interagency Relationships

- A strong network of interagency cooperation, based on personal and professional relationships, was critical in responding quickly and establishing command and control in such a chaotic environment.
- Face-to-face meetings were far more effective at resolving conflict under stressful conditions than relying on radio or telephone, especially at the tactical level.
- Ongoing contact programs made relationships with the community and the media more effective and efficient.

Communications Systems Interoperability

> *Without communication, all you have is independent action.*
> **Emergency Operations Coordinator Captain**

Municipal and county fire departments in California have all converted to an 800 MHz radio communication system. Virtually every respondent cited the incompatibility between this communications system and the VHF systems used by state and federal agencies as the largest problem encountered on these fires. Radio interoperability problems caused coordination problems between cooperating agencies, command and tactical units, air and ground units, and even between engines on the same strike team. Units became temporarily unaccounted for and were unable to communicate their status, placing firefighters at unnecessary risk.

In one case, respondents reported the lack of communication system interoperability contributed to two structure protection groups being created and tasked with staging and deploying resources

as the fire entered a city, even though neither group was aware of the other's existence. Unit leaders in the WUI zone and within the urban environment s could not determine where or when ordered resources were arriving. Communication problems prevented effective situation awareness from flowing from resources back up to unified command. Resources lost local knowledge of neighborhoods, streets, planned actions, and analysis of defensible/non-defensible areas.

As the structure protection group leaders recognized the communications disconnect, they took the initiative to find each other, meet face-to-face, and resolve the situation. Once this error chain was broken, resources began to flow to critical areas and the IMT started receiving more accurate situation awareness from resources in the city.

Leaders repeatedly reported that the most effective way to overcome communications incompatibility and conflicts was to meet face-to-face to coordinate. However, while leaders were engaged in face-to-face discussions, they could not always give updates and new information to resources under them. In many areas, especially those protected by resources that were not local to the area, leaders reported this information gap caused a hesitancy to engage because they felt they faced increased risk resulting from the lack of communication. Other units, recognizing the lack of communication, were forced to exercise their initiative and take independent action in areas where they felt the situation and the values at risk required it.

Fire departments that coped best with radio communications interoperability had equipped their command vehicles with radios that enabled them to monitor multiple channels and talk with USFS/CDF incident networks. Many units have created workarounds that prove adequate for one incident. For example, some Battalion Chiefs carry one to six handheld radios compatible with cooperating agency frequencies. However, this workaround had limitations. During a series of disasters as was the case in Southern California, the result was that both systems became so overwhelmed with radio traffic that it was impossible to monitor all traffic back and forth. As a result, respondents said that people tended to default back to their own frequencies, degrading common tactical and command communications.

Cell phones were heavily used to overcome communications problems. This strategy worked well, but some areas lost cell towers or experienced power outages because of the fire. Cell systems were overloaded by overwhelming phone use, and cell phone use was affected accordingly.

Because of dire need for resources, units reported they were being dispatched directly to assignments on the line. Incident leaders stated they began to route incoming resources through staging areas to make sure that they were briefed face-to-face and had a workaround for the communications issue. Law enforcement was instructed to help direct incoming resources to the structure group or branch staging area. Leaders said they helped to overcome the communications incompatibility issue by pairing crews and vehicles equipped with VHF radios with crews and vehicles equipped with 800 MHz radios within strike teams and by re-distributing handheld radios.

Summary of Lessons Learned—Communications Systems Interoperability

- Because the 800 MHz municipal and county communications system is not compatible with the state and federal VHF systems, command and control was severely disrupted and firefighters faced dramatically increased risk because of communications problems. Normal workarounds for incompatible communication systems were not sufficient for these incidents.
- Face-to-face coordination was the most effective means to resolve problems in the absence of communication interoperability but had a direct impact on leaders' abilities to stay in communication with subordinates.
- Because of the radio incompatibility, municipal and county department command vehicles with VHF capability allowed leaders to be far more effective than those without.
- Cell phones were effective in overcoming communications problems because of the complete coverage in the region but were unreliable when power failed or cell towers burned. Some cell networks were overloaded, preventing calls.
- Leaders began running incoming resources through a choke point to brief and pair or cross-level communications so that each division or group supervisor, crew leader, or strike team leader could reliably communicate.

Integration of Pre-Incident Planning Information

Respondents reported that many local agencies had master plans and other planning documents prepared that showed previous burns, fuel types, structure and neighborhood analysis on defensibility, evacuation routes and sites, staging areas, helispots, and water sources.

They felt the challenge came with trying to disseminate this information at all levels. On occasion, commanders and their staffs reported they were making decisions without benefit of planning information, or resources were assigned to gather information even though that information was available in planning documents. Non-local engines and crews reported operating in several watchout situations, in unfamiliar WUI neighborhoods without knowing egress routes, and in situations in which they triaged structures that had already been triaged.

Where pre-incident planning information was well integrated, respondents rated it as invaluable. Incident commanders stated that when available, the information allowed more effective decisions concerning overall strategy and tactics. Ground resources reported that the information saved valuable time in allowing quicker triage and in maintaining broader situation awareness of their operating areas.

The respondents who reported the most success were the local agencies that brought local planning information to the Incident Command Post and ensured that it got incorporated into the planning process. Or from the opposite end, the incident management teams that proactively reached out and requested the information.

Some structure protection group supervisors and branch directors consolidated the available planning material, including maps and summaries of local factors, and had copies of critical information ready to distribute to incoming resources at staging areas. This effort gave incoming resources more confidence to operate and mitigated many of the risks of working in unfamiliar areas.

Several respondents felt that integrating pre-incident planning data represented an area for improvement, noting that information could be exchanged and briefed during already established interagency meetings and training sessions. Many felt this was a prime area to develop a multi-agency database, using available GIS (Geographic Information Systems) tools, to help prepare for incidents.

Summary of Lessons Learned—Integration of Planning Information

- Most of the critical data to support strategic and tactical decision-making existed in pre-incident planning documents, but in general it was not effectively integrated into incident and unified command. When it was, respondents found it extremely valuable—they said it should be "pushed, pulled, or dragged" into the incident command.
- When this information got disseminated down to division and group level, it enabled more effective tactical planning and increased the situation awareness of ground resources.
- Many leaders rated the integration of pre-incident planning information as an area for improvement using existing interagency meetings or developing a GIS-based system.

Unified Command and Liaison/EOC Integration

In general, all respondents were very supportive of unified command and how it functioned. Yet these incidents presented incredible challenges to unified command. Many times the situation was developing too fast for unified command to keep up. Unified action among agencies was essential. In practical terms, given the fast-moving and chaotic circumstances, collaborative and unified tactical action on the ground was often more effective than unified, centralized command and control.

Unified command proved far more effective when agency representatives had the authority to make decisions on behalf of their agency concerning resources and strategy.

Most respondents said it was initially difficult to shift thinking from wildland fire incident to firestorm and conflagration. The Type 2 and Type 1 Incident Management Teams (IMT) that were most effective in minimizing damage in the WUI were those that could make this shift in thinking early and incorporate local municipal and county fire department commanders into the command organization. This allowed local knowledge, experience, and planning to be incorporated into the strategy and tactics more quickly. How this information was integrated varied by IMT. Some sought out local chief officers; others encountered chief officers who asserted themselves into the existing IMT organization.

In cases where one or more senior officers from a fire department were located at the ICP and local Emergency Operations Centers, they said it was easier to coordinate actions, adapt to rapidly changing tactical conditions, and integrate the city or county dispatch system into both the IMT planning cycle and the interagency dispatch system. Respondents indicated that senior department chiefs felt an obligation to stay in their districts, and that to effectively involve chiefs in unified command required a liaison to represent the chief at the incident command post (ICP).

Senior leaders reported that having city or county chief officers at the ICP allowed the transition to unified command to occur far more efficiently, especially with the inherent problem of communications incompatibility between the 800 MHz municipal and county and VHF state and

federal systems. They believed local knowledge was integrated more effectively to help shape and coordinate plans, operations, and contingencies.

Incident command and staff said that law enforcement agencies, transportation departments, utilities, and others needed to be co-located in unified command. Respondents said they would like to see plans targeting ICPs and planned trigger points to establish unified command and dispatch its staffing. For example, when a trigger point for evacuations is reached, the sheriff's office, highway patrol, and department of transportation would move toward a planned ICP and deputies would move to traffic chokepoints. If evacuation is needed, deputies are already on site.

Summary of Lessons Learned—Unified Command and Liaison/EOC Integration

- The fires were so large and fast-moving that agencies established unified command, first as collaborative action, then transitioned later to centralized command. Pre-selected ICP locations and evacuation choke points for law enforcement were found helpful.
- Many times municipal and county fire leaders were not integrated into incident command effectively, losing valuable local knowledge. Success came from integrating municipal and county fire liaisons with decision-making authority into the command team early.
- Establishing liaison with local Emergency Operations Centers (EOC) as early as possible was effective in coordinating the integration of initial attack resources from multiple jurisdictions.
- Co-locating with law enforcement and other agencies was effective in coordinating effective evacuations in concert with incident strategy and tactics.

JIC and Information Management

Respondents said that establishing a multi-agency Joint Information Center (JIC) had a significant positive effect on the timeliness and effectiveness of information management when compared to large incidents that did not use a JIC.

Respondents who had been through these kinds of experiences before, indicated that large, multi-agency incidents usually receive national or even worldwide attention, and that was true here. They have seen an individual agency's public affairs staff become overwhelmed in a short amount of time. On these incidents, public affairs staffs needed to think well beyond the routine information officer function. Since resources come from around the country, the media had diverse interests in the stories. Public affairs staffers received questions such as "What are the crews from Las Vegas doing on the incident?" Consequently, successful information efforts focused on a broader audience than normal.

Leaders reported that the public and the media went to any reasonable location with significant activity to try to get information. Air tanker bases and other centers of activity away from the ICP or JIC had media show up and managers there said they needed information officers assigned during events of this size and scope. The JIC combined the public affairs resources of numerous agencies and brought in extra staff as needed as the incident developed. The JIC took advantage of full-time and professional public affairs staff of city and county cooperating agencies, combining them with the technical expertise of the wildland agencies.

Many respondents reflected that information efforts did not consider some unique factors in a major media market like Los Angeles or San Diego. They felt the information campaign must

consider the impact of commercial mass media, including talk radio, in shaping public opinion. In one case, talk radio hosts significantly drove public opinion, with very negative influence. Consequently, respondents felt that at a time when the community needed to pull together, it was being divided over information provided by a popular radio host with national exposure. Instead of focusing on its mission of getting information out to the public, the information function had to focus on the distraction of defending itself against attack.

During these fires, the distinctions between agencies disappeared in the public's mind. Those interviewed warned that one agency's actions will become associated with all agencies. A centralized JIC public affairs effort allowed agencies to project a proactive, unified message to the media and the public, which was critical in communicating the latest fire and evacuation information to the public. Several respondents mentioned that the California Highway Patrol does a daily TV (and radio) traffic report in which a professional looking, well-spoken officer gives the traffic conditions, followed by a safety tip. They would like to see wildland fire agencies do the same.

A proactive, well-staffed JIC not only provided current information but also helped form public opinion. Senior leaders said it was important to tell the success stories of fuels hazard reduction programs in order to gain political and public support for future efforts.

In situations where a JIC was not established, many respondents reported the public and media received fragmented and often conflicting and confusing information—and different agencies had different information at different times. Rumors circulated, and the public and media filled the information voids with whatever voices were available. This usually did not reflect well on the responding agencies and created firefighter morale problems as they and their efforts were portrayed inaccurately.

In the areas that had a planned JIC function, the first players were up and running within 24 hours, and the JIC was fully functional in 36 hours. Several respondents agreed that they would like the concept to go further to see JIC staff pre-identified and designate planned JIC locations throughout the region.

The Emergency Alert (EA) system was not employed early in some of the fires. The Emergency Alert system could be used to more quickly alert people to the fire's status and resulting evacuations and evacuation warnings—just as for hurricanes and tornados.

Summary of Lessons Learned—JIC and Information Management

- Where a JIC was established, it had a positive effect on the timeliness and quality of the information campaign in the WUI environment.
- These incidents received international attention and the need for an information campaign reached a threshold much larger than any one agency could manage effectively. The JIC combined the people and unique strengths of different agencies public affairs staffs.
- On several incidents, the information effort remained defensive. The JIC allowed a unified message presented to the public and the media. The JIC could communicate key fire management issues (the use of air tankers, the need for defensible space) and address these issues proactively through public information while fires held the public's attention.

Summary of Lessons Learned—JIC and Information Management—continued

- Having a JIC plan in place ahead of time was effective. Respondents identified the further need to pre-identify JIC staff and expanded JIC staff, and identify potential JIC locations in the area.
- Areas that activated the EA system early were able to provide information to residents and facilitate evacuation planning more efficiently than those areas that waited to use the EA system until later.

Mountain Area Safety Taskforce (MAST)

We spent a lot of time thinking about our strategies and tactics before we ever needed them.
- MAST Community Fire Chief

The Mountain Area Safety Taskforce (MAST) is a county organization composed of local, state, and federal government agencies, private companies, and volunteer organizations. Among other things, these organizations are tasked with assuring public safety through the development of evacuation plans, hazard tree and fuel removal, and planning and public information.

Both San Bernardino and Riverside counties both have MAST organizations. Every respondent that participated in fires in San Bernardino and Riverside Counties (as well as many respondents who did not) rated the organization as a resounding success. There is no question in the respondents' minds that the MAST effort, including training and planning, saved a large number of lives and homes. Respondents indicated that MAST planning cut 2 to 3 days off of the time required to establish an effective multi-agency, unified command.

During roughly 18 months of pre-fire planning, MAST organized using ICS and operated as an IMT would run an incident. A multi-agency coordination (MAC) group comprised of elected officials and agency administrators was established as the governing body. Unified command was established, and the IMT answered to the MAC group. Incident commanders worked for the MAC. The organization included command and general staff positions responsible for operations, logistics, planning, finance, safety, and liaison as well as units developed within each of those sections. MAST included non-emergency response agencies (transportation and roads, utilities, solid waste management, air quality management district (AQMD), and elected officials from all levels.

The MAST had conducted tabletop rehearsals of evacuations in the event of catastrophic wildfires. As a result, nearly 100,000 people were evacuated quickly and without incident.

MAST organization prepared a training video for law enforcement officers (basic fire behavior, ICS), and all law enforcement agency leaders had trained all their personnel prior to these fires. These efforts proved instrumental, allowing law enforcement agencies to seamlessly pull together into the unified command vs. the traditional approach of a separate law enforcement command structure and ICP.

The MAST had worked with the AQMD to approve use of air curtain burners (authorized up to eight) to dispose of cut brush and trees from private property.

Summary of Lessons Learned—Mountain Area Safety Taskforce (MAST)

- The MAST was a very successful template for multi-jurisdictional planning in the interface. MAST planning was estimated to have cut two to three days off the time it took to establish effective unified command. Information is available at www.calmast.org.
- The MAST functioned using the Incident Command System in a unified command. This proved to be an effective rehearsal for the real thing. Tabletop rehearsals of evacuations were very effective in facilitating live evacuations.
- The MAST was an effective vehicle for distributing training and local knowledge to participating agencies.
- The MAST was effective at accomplishing projects by planning projects with the input of environmental and infrastructure agencies.

Command and Control

This section describes lessons learned regarding command and control.

Establishing Command in Chaotic Conditions

We need to be doing a better job recognizing the size of the crises. We were already behind the curve once the fires started.
- Division Chief

Leaders at all levels described major challenges in establishing effective command and control during the high tempo conditions the fires presented. Fires were threatening communities in the mountains as well as becoming urban conflagrations in cities. Several incidents were occurring at once. The situation was unfolding at a rate that far outpaced the tempo at which the system could operate. Respondents reported that perimeter control was impossible, and the suppression effort was purely defensive. The values at risk dictated that many incoming resources report directly to their assignment, bypassing normal check in and staging processes.

Incident leaders said they had to start out in a purely reactionary mode. Shift changes, team handoffs, and organizational development had to occur during the worst possible incident conditions. Problems between the 800 MHz and VHF communications systems exacerbated these issues because municipal and county firefighters could not talk to state and federal firefighters.

Incident commanders responded that during this reactive phase, strong, centralized command and control was impossible to achieve, reporting that, given the available resources, they could not possibly accomplish all the things requiring attention. Incident commanders found that it was more successful to set a limited number of critical priorities and work with what was available to accomplish them. They made sure those critical objectives were communicated to the tactical level.

As incidents escalated and the system became overloaded, respondents reported that pre-existing relationships based on previous interagency cooperation proved essential. There were periods when common sense and collaboration was the only effective way to respond to the escalating

nature of what was occurring and cooperators had to jointly determine and execute initial strategies and tactics with other cooperators.

Leaders at all levels reported that they had to delegate responsibilities by providing leader's intent, constraints, and zones of responsibility by functional group and then letting subordinates exercise individual initiative to control actions and resources within that area. This approach allowed resources to continue to function in ways that supported incident objectives during periods of command transition, loss of communications, and rapidly changing ground situations.

In some cases, division and group leaders made sure incoming resources received briefings and mitigated communications incompatibility issues by reporting directly to informal staging areas at the division or group level before proceeding to their assignment. A division supervisor or battalion chief staffed this small-scale collection point. Other overhead resources were out in the fire area to determine where incoming resources would be best used.

After the initial influx of resources and as the command systems overcame the initial reactionary postures and gained the initiative, they began to send out "wranglers" to tie in with divisions, groups, and strike teams to verify units and numbers of people and to ensure that documentation was complete and accurate.

Summary of Lessons Learned—Establishing Command in Chaotic Conditions

- Incidents overwhelmed established systems during the initial response, forcing incident managers into a reactionary mode and resources to have to be committed directly to the fire ground. Strong, centralized command and control was not possible.
- It was most effective for commanders to determine the top three or four priority objectives, communicating their intent, objectives, and risk criteria to all resources. They delegated tactical decision-making down to functional group level and gave the authority to adapt as the situation developed.
- Leaders thought it was effective to route all incoming resources in a way that ensured they got a quality briefing; understood intent, objectives, and risk guidance; and had the capability to establish LCES.
- As IMTs started getting established, some IC's sent *wranglers* out to tie in with subordinate leaders and verify documentation to make sure everyone was accounted for and the IMT had situation awareness on assigned resources.

Exercising Individual Initiative

> *Using the ICS framework and commanders intent while we were protecting structures in groups worked very well. The plan arrived about 10 AM, and we were already doing it.*
> **- IHC Superintendent**

Almost every respondent, regardless of position, validated that individual initiative, exercised by single resources, crew leaders, strike teams, division supervisors, and battalion chiefs, was paramount to success during the initial response phase of these incidents (up to 36 hours). However, all cautioned that there is a difference between independent action and freelancing.

Independent action is empowered and focused effort that furthered the accomplishment of leader's intent. Freelancing is unguided effort that is possibly counterproductive or even dangerous.

All respondents acknowledged that at no time should any firefighter unilaterally ignore orders or independently reassign themselves when effective command and control is in place. However, in this case, firefighters described responding to multiple, emerging catastrophes. Effective command and control and common communications were unavailable. The values at risk were so great that firefighters felt disengagement was not a viable option.

During early phases of the WUI fires and urban conflagration, respondents reported some crews were waiting for orders while nearby units were being overwhelmed. As some resources arrived in the area, the systems and processes normally used to move resources to assignments could not keep up, due to confusion, rapid rate of spread, fire intensity, communication overloads, and supervisory personnel shortages. When unable to contact supervisors, some units simply waited; others took action.

Leaders reported that both of these alternatives created some problems and solved others. In some cases homes burned while engines stood by within sight. In other cases, supervisory personnel were temporarily unable to account for units. The latter occurred in one area that was burned over, causing, until control was reestablished, several hours of considerable concern about units that may have been lost.

Leaders said that effective independent action was enabled in different ways. Some incident management teams delegated authority to divisions and functional groups, provided intent, laid out risk criteria and any constraints, and received updates as the situation allowed. As things rapidly changed on the ground, strike team leaders or group supervisors stated they could make decisions based on values at risk, reposition resources, and initiate actions, then tie in with overhead and provide updates. Leaders felt this strategy led to several successful decisions to prep, treat, or conduct burnouts that were critical in saving neighborhoods.

Other respondents reported that effective independent action was a more collaborative effort. An air attack supervisor worked with interagency dispatchers and air tankers to take action to protect subdivisions where no ground resources were available until air ground operations could be planned and tankers ordered.

The most commonly reported type of effective independent action occurred in the WUI. Both structural and wildland resources had responded, and the incident was escalating at a phenomenal rate. Respondents said that limited available resources were fully committed, and few reinforcements were on the way. Communications presented a serious problem. Leaders said they just started forming strike teams or functional groups from available resources. They assessed the situation and started taking action where they believed they could do the most good, forming their own incident organizations: exercising command, creating staff positions where needed, and starting to document the resources assigned. They described functioning in this manner until they could tie-in with the emerging incident management organization.

Another reported aspect of exercising initiative was leading upward. Many leaders mentioned the importance of leading upward to offer ideas and alternatives to senior leaders. Under the stressful conditions, most leaders said they were susceptible to the natural tendency to "tunnel in" and focus on one thing. Many times people said they were unsure whether or not to speak-up, either because everyone was under tremendous stress or because they wanted to let leaders do their jobs. Those who did speak-up said they were glad they did because it usually broke a chain of errors.

That same message was validated by successful senior leaders interviewed, who perceived this as "keeping me honest" or as having lookouts and personal safety officers while they were operating under high stress conditions.

Summary of Lessons Learned—Exercising Individual Initiative

- Individual initiative and independent action at the tactical level was critical to success in the first 36 hours of the incidents. Respondents made a distinction between this and *freelancing*.
- Respondents felt independent action had pros and cons, but taking action that was in the best interest of their leaders had a far better outcome than when resources took no action and waited for further guidance.
- From the top, leaders enabled safe and effective independent action by giving leader's intent, objectives, risk criteria and limitations, and delegated responsibility to act within that guidance.
- From the bottom, leaders at the tactical level established ICS, exercised command, and began documenting resources assigned when no guidance was available.
- Speaking-up to offer alternatives or break error chains contributed to the overall ability of senior leaders to make better decisions under stress and prevents accidents.

Size Up and Intelligence

Almost all respondents, whether engine operator, hotshot superintendent, or battalion chief, reported that a proper and deliberate size-up was essential to success and survival. In such extreme circumstances, with values at risk so high, there was a great temptation to just get at it and engage.

At such times, leaders said taking that tactical pause—to really look around, "feel the winds", "smell the smoke" as some respondents put it, and consider *what-if* scenarios, establish trigger points and contingency plans—paid off time and again because they said they were better prepared when conditions radically changed.

At command levels, leaders stated that intelligence was a critical factor with fast moving fires in the WUI. With all firefighting resources fully committed, it was difficult to maintain a big picture of the fire's activity as it moved so quickly and in many different directions. Some of these fires were unusually large, so the sheer size of the flame front and perimeter made it hard for leaders to maintain complete situation awareness.

Where air assets were used, leaders reported a significant improvement in the ability to effectively commit or reposition resources and brief incoming resources on the actual fire situation, status of evacuees, and ingress and egress routes. Confidence also rose as firefighters felt that air resources provided another layer of lookout safety beyond their own lookouts.

To provide ground resources situation awareness as early as possible, some commanders adjusted flying schedules to get air resources airborne as early as 0600 or 0700. This effort enabled ground resources to engage fires earlier in the morning, during the low points in the burning period. Several people reported that these adjusted flying schedules allowed them to start getting ahead of their fire because they could start perimeter control during low fire activity.

In those areas where air assets were not available, retired firefighters, citizens, and police officers went out as mobile field observers. These observers also were sent to high ground vantage points such as towers, tanks. Law enforcement information was also included; however, most law enforcement officers were totally committed to evacuations and route clearance.

Summary of Lessons Learned—Size Up and Intelligence

- The extreme conditions made everyone feel a sense of urgency to commit and take action. It was even more important under those circumstances to do a proper and deliberate size-up and make contingency plans.
- It was very difficult to maintain situation awareness of the fire activity as it moved through urban areas and split into multiple heads. Air resources were most effective to overcome this problem.
- Retired firefighters, law enforcement, and citizens were used as field observers to provide leaders situation awareness of the fire behavior in urban areas. Observers were mobile or placed on high ground, towers, or tanks.

Planning Cycles and IAPs

During situations where fast-moving fires entered the WUI and urban conflagrations started, respondents reported that the customary 12-hour planning cycle proved ineffective. The situation was so dynamic that it was difficult to plan operations more than six hours into the future. In many cases, fires were doubling or tripling their size every hour, going from a few hundred acres to 50,000 in four or five hours. Leaders said that the rapid development created a situation that made normal planning documents (like IAPs) obsolete by the time they were distributed.

For this kind of incident, commanders reported feeling way behind the power curve. They said they had had to adjust their contingency planning miles ahead of the fire, to determine alternative courses of action and places where resources could make successful defensive stands or begin perimeter control. Respondents indicated a need to focus planning beyond 12 hours from the immediate fire threat to the fire's potential impact. This need involves developing contingencies with associated trigger points and coordinated planning for each trigger point. This strategy was effective but difficult because it forced people into non-traditional or unconventional planning modes.

Some respondents used a less detailed IAP that focused on the big objectives and then followed up with detailed and more frequent briefings down through the chain of command to adjust strategy and tactical operations.

One IMT formatted their IAP in folded and stapled booklet form that is small enough to carry in the cargo pocket of fire pants. Part of the IAP is a "mini-communications plan" that can be clipped-out of the IAP booklet and conveniently taped onto a radio.

Summary of Lessons Learned—Planning Cycles

- Plans generated using the 24-hour planning cycle were obsolete in a short time. The 24-hour cycle was not adequate in these fires. Plans rarely remained valid beyond six hours.
- To start getting ahead of the fire, planners focused on what the fire might likely be doing in 12 hours. They had to extend contingency planning and associated trigger points out in time and space much farther than normal.
- Tailored planning documents that contained immediate objectives and intent while enabling subsequent changes were more effective than a standard IAP. Changes were communicated with more frequent operational briefings to make adjustments.

Role of Area Command

The incident was a catastrophe of biblical proportions and more than any one team could handle.
- Type 1 Incident Commander

Respondents explained that area command is rarely used in Southern California - not because of specific resistance- but because California has several available Type 1 and Type 2 Incident Management Teams. Historically, area command teams have not been needed to handle multiple fire situations in Southern California because FIRESCOPE Multi-Agency Coordination assumes this role.

Area command was established for one of the large fire situations and was widely regarded as a success. (A coordinating group that performed some area command functions was requested for another large fire situation.) Area command added value by helping prioritize limited resources and making adjustments based on current and projected incident activity. Area command was also able to interface with line officers and administrators on larger issues, allowing the IMT focus on accomplishing their objectives.

Many respondents indicated that they would want Area Command ordered and established sooner in a similar, future situation. They stated that when the agencies recognized the need to pre-position resources, they should have used that same trigger point to pre-position IMTs and an Area Command Team. “The writing was on the wall,” as one respondent put it.

The area commander said he tried to look ahead 24 to 36 hours, share information among IMTs, and communicate what conditions might look like on a larger scale. He could begin to project requirements and extend the decisional space of engaged and incoming IMTs. The area command team contacted incoming IMTs and pre-briefed them on their intent and objectives so their staffs could start planning, even before their departure from their home units. Area command tried to help get resources pre-positioned and briefed to help IMTs take advantage of the predicted weather change when it arrived.

Realizing the very complex nature of this incident, area command augmented their staff heavily with trainees. In this situation, the deputy area commander took over the Joint Information Center and fed information back to area command from there. The trainee area commander went to the county emergency operations center and began to coordinate with local governments and resources there.

Summary of Lessons Learned—Role of Area Command

- Southern California has many available IMTs and does not traditionally use area command. This created a delay in ordering area command. Once area command was established it performed its function well.
- Area command augmented heavily with trainees because of the complexity of the incidents. They task organized to provide liaison to county EOCs and assumed command of the JIC.

Community Protection Incident Management Teams

We've evolved from the structure protection group to the structure protection branch now to community protection teams.
- Type 1 Incident Commander

On one incident, the fire had extended beyond what is typically considered the urban interface and developed into urban conflagration. At the same time, the fire was moving up into the mountains. The extreme nature of the fire behavior and the fuel load created by dead trees led incident planners to believe that several large WUI communities in the mountains could be threatened. Anticipating the lead-time necessary to prepare, evacuate, and defend the community, an entire Type I IMT was assigned the functional role of community protection. The IMT was staffed with a minimum of firefighting resources.

Respondents reported that it was essential for the protection and suppression effort to work collaboratively with line officers, their natural and cultural resource specialists, and city and county government. Fire suppression and resource management goals are often in natural conflict with one another, and it is important that the land management agency line officer, resource specialists, and the incident organizations all have the same goals and that those common goals translate into planning and are communicated to the community with a unified voice.

Transportation, road, and public utilities departments represented another key group of non-traditional cooperators. These agencies were vital for assuring protection of critical community infrastructure, local information, evacuation planning, clearing access and egress roads, and planning to restore services prior to residents returning. Local fire departments also proved valuable to the planning effort because of their extensive knowledge of the local area.

Summary of Lessons Learned—Community Protection Incident Management Teams

- Fire potential was so large that a Type 1 IMT was assigned the role of community protection for a mountain area far ahead of the fire. The IMT was to create a fuel break and coordinate preparation and evacuation.
- The natural conflict between damage caused by suppression activities and protection of natural resource values required better coordination between fire managers, line officers, and natural resource specialists earlier in the planning process for community protection projects during the incident.
- The IMT worked with infrastructure and utilities people to coordinate activities: planning evacuation routes, assuring access and egress, and restoring services. They brought local fire departments into the planning process, incorporating their extensive knowledge of the area.

ICP Planning

> *Historic fires are the rule now, not the exception.*
> **- Type 1 Incident Commander**

Respondents felt that planning ought to be done in local jurisdictions to select likely ICP and support locations ahead of time. They suggested selecting likely places where tree mortality, severity, or historic conditions point to potentially large fires; and designating multiple infrastructure locations such as ICPs, staging areas, and helibases in that area.

Many felt a need to discuss severity and season conditions at joint IMT meetings and training sessions and talk through possible scenarios together.

Almost all respondents expressed two worries: first, even with all the extensive planning and interagency cooperation in place in Southern California, it wasn't enough for a series of incidents like this; second, incidents like these would undoubtedly occur again, not just in Southern California, but all over the western United States, as fuel loads and urban interface areas increase.

Summary of Lessons Learned—ICP Planning

- Pre determining sites for use as potential ICPs and key support facilities was noted as a lesson learned. Analyze local areas and visualize possible large or multiple incident scenarios in advance. Make the large or multiple incident scenarios part of discussion and training provided at IMT meetings.

Team Transitions and Shift Changes

Respondents reported that team transitions and shift changes posed unique challenges during these fires. Operations always remained at a high tempo, and structures were always threatened. Firefighters reported that on incidents without good shift change planning, structures burned as one shift returned to the ICP while another shift headed out to the line.

The most effective team transitions occurred when incoming IMTs could be pre-briefed as early as possible by the current IMT or area command. One incoming IMT asked line overhead (division and group supervisors) to remain for an extra shift to provide continuity on the ground.

The most effective shift changes occurred when the IMT planned for overlap between operational periods. This ensured a continuity of operations and allowed an exchange of current information to occur between resources.

Summary of Lessons Learned—Team Transitions and Shift Changes

- Poorly planned team transitions and shift changes caused a loss of effectiveness and increased property damage. The most effective occurred when overlaps allowed a continuity of operations.

Safety Officers

> *It turns people off to the "message" when you sweat the small stuff.*
> **- Type 1 Safety Officer**

From area command down to division and group, safety officers had a key role in helping to affect positive command and control. Safety officers who received high marks from firefighters and overhead stated that they see their role as an extension of the eyes, ears, voice, and conscience of the incident commander, rather than that of an enforcer.

Respondents said they found applying influence a far more effective process than demanding compliance. Safety officers accomplished this by trying to invoke critical thinking about a firefighter's situation awareness, LCES, and decision making processes by asking questions and trying to help crews or engines see how their efforts tied in to the big picture. They also tried to encourage firefighters to anticipate possible outcomes, make contingencies, and set appropriate trigger points.

Safety officers indicated they were most effective when they were proactive and highly mobile: communicating often with residents, law enforcement, and the media, making sure these people understood risks, and giving advice on how to manage it. Some respondents said they tried to use these opportunities to influence media perceptions and communicate key forest management and defensible space themes to the media.

Civilians who decided not to evacuate posed an ethical dilemma for safety officers. Safety officers encouraged firefighters to adapt to higher levels of risk but set realistic disengagement trigger points because the residents who remained had made a conscious choice to do so. They would stop and communicate with these residents and explain the rules of engagement the firefighters were under and how to best survive when the flame front passed through.

Summary of Lessons Learned—Safety Officers

- Exerting influence through asking questions that required firefighters to think about the impacts of their decisions was an effective method of encouraging risk assessment and situation awareness.
- Taking the opportunity to communicate key themes with residents and media while helping them to make their own risk decisions was an effective way to influence the public.
- Safety officers had to help firefighters interpret rules of engagement and values at risk in extreme circumstances, especially concerning acceptable risk in helping citizens who refused to evacuate.

Evacuations and Homeowners

This section describes lessons learned about evacuations and homeowners.

Pre-Incident Planning

Respondents reported that pre-incident planning was the biggest factor in determining the efficiency and effectiveness of evacuations. Frequently, streams of evacuees congested the roads and made both evacuation and response difficult. They said that evacuations were more chaotic and dangerous in areas that lacked a plan. Respondents reported that even in areas that had conducted pre-incident planning, that there were incomplete plans for managing evacuation centers, reinstating utilities, or letting residents return to their homes. This caused unexpected problems for IMTs.

The MAST (Mountain Area Safety Task Force) organization had conducted significant planning and tabletop rehearsals for the mountain communities in San Bernardino and Riverside counties. Because of this interagency preparation, the evacuations in these areas were reported as timely and without major incident.

Respondents also reported the need to cooperate with ancillary agencies such as the Red Cross and animal control. Those agencies are instrumental in taking care of the evacuees and dealing with pets and livestock. They felt that fire agencies working closely with law enforcement can effect an evacuation, but that far more was involved afterward.

As soon as firefighters recognized the potential for evacuation, the need to coordinate with law enforcement became paramount. Leaders said the most effective method was to have a sheriff's representative co-located in the ICP to facilitate decisions to get routes cleared into the upper ends of WUI neighborhoods. It was extremely difficult for fire resources to maneuver around evacuees, and early support from law enforcement allowed fire resources to get on scene as soon as possible.

Summary of Lessons Learned—Pre-Incident Planning

- Pre-incident planning was essential to effective evacuation compared to those areas that did not conduct extensive pre-incident planning.
- Incorporating agencies that manage evacuees into the interagency planning process was effective in ensuring a smooth handoff from firefighters and law enforcement to supporting agencies like the Red Cross.
- Fire resources were significantly slowed moving through evacuation areas until routes were cleared. Early coordination with law enforcement as soon as the potential to evacuate was recognized was critical in preserving freedom of movement for fire resources.

Route Control

Route control was reported as critical in maintaining freedom of movement for fire resources during evacuations. Areas that had planned evacuations reported more success than areas with no planning. This included educating residents on what actions to take prior to evacuating their home and what routes to follow. MASTs issued an IAP covering these items. In areas without planning, respondents said that trigger points set to initiate voluntary and then mandatory evacuations were not defined in advance, so they came within 30 minutes of each other. So many evacuees on the road at once added to the confusion and to traffic jams.

In areas where routes were not well controlled, residents were flowing out of neighborhoods on all streets, and firefighters reported swimming upstream to get to areas most threatened by the fire. Some areas did not impose one-way traffic restrictions, so evacuees were moving in two directions on the same streets, adding to the problem. Residents who delayed leaving and the *rubbernecking* factor also created challenges for firefighters trying to move into the area. Leaders said that evacuations of less threatened neighborhoods clogged critical ingress and egress routes from neighborhoods that were most threatened in areas without good route control and planning.

Respondents indicated that in the smoothest evacuations, law enforcement moved to pre-determined choke points when evacuation trigger points were reached. Neighborhoods were emptied by allowing traffic out but not in. Eventually this strategy provided the freedom of movement that fire response resources needed. One very effective technique involved law enforcement keeping one street cleared for incoming emergency traffic, prohibiting outgoing evacuation traffic on that street. This allowed firefighters into the upper neighborhoods earlier to prepare structures.

Summary of Lessons Learned—Route Control

- Route control planning was an important part of evacuation. Poor planning resulted in clogged ingress/egress routes and lesser priority evacuations blocking the routes of high priority evacuations.
- In planned evacuations, evacuations were based on pre-established trigger points. Law enforcement moved to known choke points and controlled routes with one-way traffic restrictions and keeping certain streets clear for ingress.

Values at Risk and Homeowners

They were engulfed in heat and smoke. Showered by sparks and embers…trying to decide, "Should we risk our lives to save someone who refuses to evacuate?"
- Type 1 Safety Officer

These incidents placed incredible stress on both wildland and structural firefighters. Municipal and county fire departments found themselves confronting a fast moving wildland firestorm within their cities. Wildland agencies found themselves confronting urban conflagrations. Firefighters faced ethical dilemmas and operated in conditions riskier than they had previously considered acceptable. However, firefighters felt they could not disengage because civilian lives and private property were constantly threatened.

The need to shift one's mindset quickly became important; from one of saving single-family residences to one of infrastructure protection. This made triage difficult because firefighters are used to discussing and making decisions about individual residences and in a relatively detached and dispassionate fashion. Using language like "loser" or "goner" to describe an indefensible area, although accurate, added to the public's concern and their perception of the suppression effort. This added to the debate in the media.

Respondents felt there was a lack of clear engagement criteria concerning residents who refused to evacuate. Some people who had not evacuated were screaming and demanding that their clearly indefensible home be saved while firefighters worked to save a more defendable home of

someone who had evacuated next door. Many families of the firefighters were themselves evacuated. Firefighters were aware that their own homes were being threatened or lost, and this added to their dilemma about placing themselves in risk situations that, in some cases, were so dangerous that luck was the only deciding survival factor.

Respondents reported that stopping and communicating with residents, as much as the situation allowed, was very important in preventing homeowners from becoming dangerous distractions. In some cases, firefighters provided fire shirts and hard hats to residents who would not evacuate, and got them busy preparing homes and assisting firefighters as field observers or sources of local information. Respondents said that communicating their risk criteria, trigger points and contingency actions seemed to reduce the stress in the residents and subsequently the stress the residents placed on firefighters when the situation worsened.

Most respondents indicated that at the tactical level they did not receive much risk guidance from above, other than standard wildland fire safety doctrine. The situation had clearly transcended the norm, and as a result, most of the adaptations to the increased risk were being made at the tactical level. Respondents at the command level also indicated that, while they were making decisions and forming strategies with these increased risk levels in mind, that they did not do a good job at providing adjusted and useable risk criteria to the tactical resources. One strike team leader's comment "It just went unstated that we were operating in whole new territory", summed up the feeling of ambiguity of many of those interviewed.

The result was that firefighters and support staff at all levels were being left to make many of these decisions themselves. While it appears that these decisions were made successfully, it was done in an environment lacking firm guidance. Respondents almost universally reported that they based decision-making and independent action on their experience. Less experienced people said they were at a significant disadvantage in being able to weigh the risks in the absence of clear guidance, and that they frequently questioned themselves and their judgment in the emotion and chaos of the situation.

Experienced firefighters reported the importance of having confidence that their tactical decisions—based on training, planning, doctrine, and experience—were the right ones. In the aftermath, after revisiting affected areas, these same firefighters reported that they could see their decisions were the best they could make under the circumstances.

Summary of Lessons Learned—Values at Risk and Homeowners

- The values at risk in these fires placed firefighters in new risk and decision-making territory that current wildland firefighting doctrine and training have not necessarily prepared them for. Firefighters had to adjust their thinking to triaging city blocks and whole neighborhoods.
- Communicating with and involving residents who decide to stay-behind were effective ways to mitigate the danger and distraction they presented to firefighters. It was important not to use language like "loser" to triage when residents could overhear.
- There were incidents where engagement criteria concerning the increased values at risk did not reach the tactical level. A lack of clear engagement criteria concerning residents who would not evacuate led to firefighters placing themselves in extreme risk situations.

Evacuation Centers

Many respondents indicated they did not feel they had good plans to establish and manage evacuation centers. They found themselves dealing with issues concerning large numbers of evacuees needing food, shelter, and assistance with contacting relatives and providing for animals. They stated that although they were not directly responsible for evacuation centers, it took a lot of the IMT's time and energy to coordinate and support evacuation centers and disseminate information to evacuees.

Planned evacuation centers ranged from shelter-in-place safety zones like parks and a casino to more formal centers at large public facilities like fairgrounds and schools.

Summary of Lessons Learned—Evacuation Centers

- Many identified the need for management plans of evacuation centers as a lesson learned. Incident overhead had to deal with a variety of issues concerning support to evacuation centers and evacuees.

Reintroduction of Residents

Reintroducing residents into previously evacuated areas was an issue that most respondents indicated was not adequately addressed even with planning. As a result there was congestion and confusion as firefighters were maneuvering around residents, utilities, insurance people and so on. Respondents felt it was important for unified command to coordinate the sequence of hazard mitigation and the restoration of services with the return of residents. They recommended involving utilities and public works departments before allowing residents to return to their homes.

Incident Resource Management

This section describes lessons learned in incident resource management.

Pre-Incident Planning and Resource Positioning

The Southern California fires grew in size and complexity to Type 1 incidents overnight. Most agencies responded using standard doctrine and protocol for the notification, dispatch, and staging of firefighting resources.

ICs and IMTs usually place resource orders as they assume control, although often these orders are coordinated and planned before the commanders and teams arrive on site. However, in this situation, delays in the dispatching process meant that it often took 36 hours to order and get a Type 1 IMT emplaced. In that time, the fire grew dramatically and burned into highly populated urban interface zones. Consequently, agencies were not able to respond with resources adequate to meet the tactical or logistical requirements of the situation: they were overwhelmed both tactically and logistically.

Most respondents indicated that dispatching delays severely impacted effectiveness because, although adequate planning had taken place, management resources were not available to

implement those plans. Respondents indicated that planned trigger points for pre-positioning resources had been reached, based on the severity of fire conditions, but the plans did not include pre-positioning of IMTs or Area Command Teams. Nearly universally, people indicated that they felt far behind the power curve in ordering resources early enough to affect the outcome. With incident dynamics expanding faster than command and control could be effectively established, getting Type 2 and Type 1 IMTs in place earlier would have been beneficial.

As reported elsewhere, some of the mountain communities had completed extensive planning, which saved many homes in those communities. Although planners said they felt prepared to handle their portion of the incident, they didn't plan on the other incidents being so big, nor did they plan for what they would do when available resources are taken away to respond to higher priority incidents.

For example, in one community the plan called for seven additional strike teams to protect certain areas. When the fire actually occurred, they ordered seven strike teams as planned, but three of the strike teams were diverted to other areas before reaching the mountain top communities. This left the community in a position of "making things up as we went along."

Respondents also felt that added resources would have contributed significantly to saving neighborhoods. It was common to have one engine defending an entire block or street simply because no other resources were available. Additional resources would have allowed more tactical flexibility during defensive operations and provided more effective coverage to patrol, which would have prevented situations in which homes were lost to residual fire.

Respondents indicated a need to order and pre-position IMTs, Area Command, and other resources when conditions indicated dangerous fire potential, in areas of large WUI, for fires to quickly escalate and exceed the ability of the system to deliver resources in a timely manner. Respondents also identified the need to overcome delays in the dispatch system by allowing teams to get on the road and start preparation and movement concurrently while the ordering and processing systems catch up and assign resource numbers after the fact.

Summary of Lessons Learned—Pre-Incident Planning and Resource Positioning

- The increase in size and complexity of these fires quickly exceeded the capability of the system to order IMTs in a timely manner. This placed initial attack resources in the position of managing incidents far beyond their span of control.
- Fire severity trigger points associated with positioning other resources were not applied to IMTs and area command. Teams constantly felt behind the power curve because they arrived after the incident had exceeded complexity thresholds.
- The shortage of resources impacted the effectiveness of pre-incident plans because adequate resources were not always available to implement them.
- IMTs identified the need for teams to initiate movement earlier and not have to wait for the system to complete the ordering process and issue resource numbers.

Dispatch Organization

> *We thought we knew how to prepare for the worst. We weren't even close. We processed over 4,000 requests in five days and dealt with incredible stresses.*
> **- Dispatch Center Coordinator**

Dispatch center respondents said the same requirement to make the mental shift from normal wildfire to a series of disasters applied to them as well. One interagency center had to contend with the impending evacuation of the center itself while continuing to function.

Respondents reported that the ability to expand and task organizing the dispatch staff was critical. Noise levels and crowding quickly reached unmanageable levels at dispatch centers. These conditions threatened to cause significant delays and inefficiency, but, more importantly, the chaos and distractions were potential causes of safety issues for air and ground resources.

One illustration of the distractions involved contractors: large numbers of contractors called to get their equipment dispatched and as a result blocked incoming phone lines. To mitigate this problem, 25 people were brought in and set up in a trailer to screen calls. In addition, a deluge of volunteers overloaded the system. Law enforcement had to provide security at the center to prevent anyone from walking in.

One center established expanded dispatch in trailers, where two or three people could focus on processing overhead orders, two or three handled equipment orders, and so on. This arrangement separated them from the 911 calls, the aircraft dispatcher, the initial attack dispatcher, and so on. Dispatchers set up noise screens around the aircraft dispatcher to increase clarity of radio traffic and minimize outside distractions.

Large maps were placed on the walls for additional staff that were not familiar with the areas where they were sending resources. Respondents reported these measures made everyone more confident that they were providing accurate information to incoming resources.

At one center, interagency cooperation was a decisive factor in the success of operations. Dispatchers had cross-trained in other agency dispatchers' duties on previous fires. They had become knowledgeable on agency similarities and differences to minimize agency specific problems. One respondent said, "Our goal is to be seamless. They hear one voice no matter who answers the phone." Respondents indicated that this level of interagency cooperation took many years to develop before they could begin to work on the functional design of the center and possible plans and contingencies for mega fires and other disasters. The center found ways to organize more efficiently. "Now an IA dispatcher just looks up, and there's the person she needs to talk to right in front of her, instead of across the room looking in the wrong direction."

This center had conducted contingency planning for power requirements, phones, and computer networks so that when expanded dispatch was required, everything could be set up and ready to go in modular units. This planning was particularly valuable when the center was faced with the unexpected requirement that they themselves might have to evacuate because of fire. Terrorism and bomb threats had been considered, but not an entire center re-location.

This center created a plan to select a new location and set up laptops over a virtual private network set up to run Multi-Agency Incident Resource Processing System (MIRPS). Portable radios were in short supply, and the center decided to rely on vehicle-mounted radios. Again,

interagency cooperation was crucial to the plan's success. A center manager declared, "We shared everything [between us], vehicles, radios, everything, no boundaries, and no agency lines." Ultimately, the dispatch center did not need to be relocated, but respondents said the experience taught them some valuable lessons for future contingency planning.

Summary of Lessons Learned—Dispatch Organization

- The huge increase in activity and distractions at dispatch centers posed a safety threat to resources (due to dispatcher distraction) and delays in ordering. Dispatchers compartmentalized key functions to minimize distractions.
- Interagency cooperation significantly increases the ability to adapt and respond to a crisis. Conflicts had already been worked through and improvements implemented by the time the crisis occurred. Dispatchers had cross-trained in other agency dispatchers' duties on previous fires.
- The large number of dispatchers coming in to assist from outside the area made it important that that staff from outside the area has an adequate orientation and access to local maps and information.
- One center had conducted contingency planning for power requirements, phones, and computer networks so that when expanded dispatch was required, everything could be set up and ready to go in modular units.
- Dispatchers said a lesson learned was that their center's contingency planning should include total evacuation and temporary operations at a remote location.

Resource Management Systems

The following two resource management systems were in place:

- Resource Ordering Status System (ROSS)
- Multi-Agency Incident Resource Processing System (MIRPS)

Many respondents reported that the scope of the fires and the urgency required in getting resources to the scene in this series of WUI fires was far more than what the resource systems were designed to meet. A *blitz package* is a pre-established resource order that provides everything needed to set-up a finished fire camp. One dispatch center ordered six *blitz packages* in five days.

Dispatchers said the magnitude of the situation created two problems. First was the delay and inaccuracy of information transferred between MIRPS (the older, California system) and ROSS (the national system). Second, resource-ordering delays were caused by not moving resources until resource numbers were assigned.

MIRPS and ROSS do not communicate with each other. Ordering information had to be manually transcribed from one system to the other. Managers said that with the huge volume of ordering, data entry mistakes caused resources to go to the wrong locations with the wrong resource numbers. Since some of these incidents had three or four different reporting locations, this

problem caused delays of up to 24 hours before resources arrived at locations where they were needed.

Moreover, out-of-region staff did not know MIRPS (a California specific system.). Many of the dispatchers that came from out of state did catch and correct many of the translation errors, but many others got through. When people realized that the data transfer was a source of problems, dispatch centers had to assign additional staff to translate and transfer data as error checkers. Respondents indicated that although the ROSS needs serious overhauling, using one system would speed and simplify the ordering process.

Respondents indicated that ordering delays caused resources to wait for resource numbers before initiating movement toward an assignment, resulting in unnecessary and unreasonable delays in getting resources to fires, especially considering the critical need for speed. Dispatchers expressed frustration at processing 120 "E" numbers for individual engines instead of 20 strike team E numbers or entering 100 "O" numbers for resources that everyone knew were not available.

Respondents assigned to functional areas throughout the organization also expressed frustration at not being able to *lean forward in the saddle* and get things in motion. An air tanker would taxi to the ramp in anticipation of a dispatch only to sit and wait. IMTs wanted to get on the road to get in place but had to stay at their home units.

The most effective mitigation to these delays happened when dispatch and an IMT worked collaboratively to determine needs and find and order resources. As one respondent reported, "One IC sat down and worked with us and had good ideas, contacts, and suggestions. I really appreciated that." Since jurisdictional boundaries have a tendency to mask the reality of resource availability, in this case the IMT provided important ideas about where and how to get resources.

Summary of Lessons Learned—Resource Management Systems

- The large demand for resources placed a strain on the ordering system. Manual translation of data from MIRPS to ROSS caused mistakes and delays in resource ordering. Additional people had to be assigned to check for translation errors.
- Delays in movement of resources caused by having to wait for resource order numbers were perceived as unnecessary and unacceptable. They prevented IMTs from being able to initiate movement.
- When dispatchers and IMTs worked collaboratively to resolve resource problems they were able to find and order resources more quickly.

Stage or Reassign Resources

Always take the known catastrophe over the potential, and be flexible enough to adapt again if needed.
- Resource Manager

With several incidents simultaneously reaching catastrophic proportions and so many resources committed, IMTs, resource managers, and dispatchers had the daunting task of determining the priority for resource assignments. Resources, initially dispatched through mutual aid, said they became frustrated at sitting in staging on an incident while their home districts were burning.

Most respondents felt that there were times when resources that were being held in staging at one incident could have been assigned to a growing threat or a new incident to greater advantage.

Respondents said that on those incidents where area command was established, that it was an effective method of balancing priorities on multiple incidents. Until the area command was established and in other areas without area command, respondents indicated that a collaborative effort between IMT and dispatch was the only way to determine how to balance needs among incidents.

Summary of Lessons Learned—Stage or Reassign Resources

- Simultaneous incidents created difficulties in deciding whether to hold resources on existing incidents or reassign them to new incidents. In the absence of area command, IMT and dispatch managers had to collaborate to determine how to balance priorities with limited resources.

Recall of Off-Duty Resources

Communications to recall off-shift city or county firefighters presented a challenge in some areas. Those departments with automated systems had an easier time with staffing than those without. In one case, the automated system was backed-up with personal phone calls in order to convey the gravity of the situation to off duty firefighters. One department reported that notifying television and radio stations to recall off-shift firefighters was an effective technique. Several areas lost power, so commercial radio and cell phones were the only way to get the word to off-duty firefighters in those areas.

As all engines became committed and as off-duty firefighters began to report in large numbers, more firefighters were available than engines. Transport relays using trucks and buses were effective to get individual firefighters to staging areas or out to assignments where they could reinforce engine crews already on the line. These transport relays were very effective in overcoming shortages caused by three-person staffing on many structural engines.

Summary of Lessons Learned—Recall of Off-Duty Resources

- Automatic recall systems were effective in getting off duty firefighters to report in. Notifying TV and radio stations to recall firefighters was also effective. Cell phones and radio were used in areas where the power went out.
- As off duty firefighters reported in they were shuttled in buses directly to staging areas or the fire ground to augment short-handed engine crews.

Staffing of Resources to Apparatus

Many municipal and county departments reported that three-person structural engine crews were at a severe disadvantage in urban conflagration conditions compared to four person crews. As fires crossed the interface into urban areas, the high number of involved or threatened structures that one engine crew had to handle at the same time required the engineer of a three-person crew to leave the pump panel and run a hand line. In these conditions, some firefighters found it effective to pair a three-person engine with a four-person engine.

As more people reported in, more firefighters were available than are usually assigned to man the available equipment. Leaders assigned as many as eight firefighters to an engine. In one case, this type of augmented engine crew was able to simultaneously staff the pump panel, use the engine's master stream device on the most involved structure, and stretch several hand lines to protect neighboring structures.

Municipal and county captains and battalion chiefs reported this augmentation allowed engine crews to move equipment quickly from location to location, managed fatigue better and provided better lookouts and situation awareness.

Summary of Lessons Learned—Staffing of Resources to Apparatus

- Three-person engine crews were not sufficient for urban conflagration situations. Pairing three and four-person engines together was an effective technique.
- Assigning off duty resources to augment existing crews (up to 8) enabled maximum use of the engines' equipment, and provided for effective LCES, situation awareness, and aided in mitigating fatigue.

Use of Administratively Determined and Retired Firefighters

Respondents reported that during catastrophic conditions, tapping into local sources of Administratively Determined (AD) firefighters provided a pool of resources that did not have to go through the much overloaded resource ordering and status system. AD firefighters could be immediately and locally hired and sent to an appropriate assignment. Retired firefighters were used in urban areas to act as mobile observers and assist with logistical and staging efforts.

Logistical Support

According to many respondents, the logistics system was unable to keep up with the initial pace of operations. Normal sources of logistical support were not available during the initial chaos of these incidents. In many cases, initial attack resources could not respond to any centralized location to eat or to draw supplies for 36 hours. In cases where areas were evacuated or places of business ordered closed, there were no sources for fuel, water, or food. Further, it was not practical to disengage to go to a centralized point or a camp.

Several respondents said that the known severe conditions prompted them to make sure there was extra drinking water and Gatorade on their vehicles, but they had not anticipated the difficulty with getting food. This was particularly true for municipal and county fire departments.

One city department overcame this obstacle by coordinating with its purchasing staff to order meals through local sources and restaurants. Other respondents reported that the only other effective ways to feed firefighters during the initial response periods were by getting food from storage (MREs) or by having leaders buy food and drinks from local restaurants and deliver it to crews and engines on the fire ground.

Respondents said they would like to see certain gas stations designated as official re-supply points closer to the fireground.

Summary of Lessons Learned—Logistical Support

- Initial attack resources had to remain self sufficient for up to 36 hours. The logistics system was initially overwhelmed by large, complex, and multiple WUI incidents. Evacuations caused shortages of locations to obtain fuel and food.
- Municipal and county firefighters stocked extra water based on severity conditions, but did not anticipate the need for food. They felt designated fuel and water points should be part of pre-incident planning so that they are in close proximity to the potential fire ground.

Work-Rest Guidelines and Personal Safety

This section describes lessons learned regarding work-rest guidelines and personal safety.

Initial Attack to Extended Attack

> *If you rested, houses burned and people died.*
> **Incident Commander**

No other issue generated such strong agreement. Interviewees responded with one voice in saying that work-rest guidelines could not be implemented during the initial and extended attack phases that lasted up to 48 – 72 hours. Leaders at all levels reported that honest efforts were made to manage work and rest, but the enormity of these incidents, combined with the lack of ground resources and the values at risk, made it impossible to implement the guidelines.

According to firefighters, few replacement resources were available during the first 48 hours. Even when offered the opportunity, firefighters frequently would not leave while structures were still burning or lives were threatened. Firefighters tried to get rest as the situation allowed, but the fire intensity and values at risk required resources to remain engaged. After 72 hours, the initial resources were generally relieved as additional resources became available.

Incident commanders and overhead indicated that requirements of the Thirty Mile Abatement Plan were overly restrictive and that the work-rest guidelines were not practical in initial or extended attack under these kinds of conditions. Most felt that on incidents with adequate staffing, the 2:1 work-rest ratio is manageable, achievable, and even popular with many crew leaders. Under the conditions that these incidents occurred in, the universal view was it was not manageable or achievable. People said leaders need more flexibility to apply common sense and good judgment to adapt work-rest guidance without going through the cumbersome documentation process required now. Incident commanders said that this process, while important, should be streamlined.

In regard to disengaging in order to meet work-rest guidelines, nearly universally, respondents said things like, *Never considered it* or *No one even mentioned it* or *It was unspoken.* Leaders indicated that, by almost any standard, it was obvious that the work-rest guidelines could not apply during the early stages of these fires. They felt that because the policy is perceived as inflexible, it forced ICs and their staffs into the ethical dilemma of choosing between giving clear guidance that violated policy, or let it go "unspoken" and attempt to document it later.

Leaders said they felt they faced a no-win situation and as a result, firefighters were left to make their own, individual decisions about the same thing. Firefighters reported a great deal of ambiguity around the situation and uncertainty about whether their actions would be supported.

Eventually, some ICs said they recognized this problem and provided clear guidance to incident firefighters. In one case, work-rest requirements during the initial and extended attack periods (a set number of days) were waived. After the designated period, resources had to strictly adhere to the 2:1 work-rest ratio. This change in policy was clearly communicated to everyone on the incident. When another subdivision was threatened shortly afterwards, the IC did not reengage firefighters. He reported that he had determined that they were just "too exhausted." "It was the hardest decision of my life," he said.

These leaders felt that the most practical approach would be a flexible policy that allowed leaders to make work-rest decisions at their level, as required by the situation during the initial and extended attack period (up to 48 hours), with a return to the 2:1 work-rest standard after that. Exceptions after the initial or extended attack period would require approval and thorough documentation.

Pilot duty limitations remained in force during the conflagrations. Most air and ground resource leaders interviewed felt that there was no shortage of air resources to justify exceptions to pilot work-rest ratios or flight duty limitations. Pilots expressed the importance of maximizing aircraft availability, turnarounds, and productivity during on-duty periods but still supported *timing out* as appropriate.

Summary of Lessons Learned—Initial Attack to Extended Attack

- The values at risk on these incidents made the current work-rest guidelines unrealistic during initial and extended attack. Few reinforcements were available for the first 48 hours to provide relief.
- The inflexibility of work-rest guidelines placed leaders in ethical dilemmas about how to proceed. Leaders were not sure how their actions would be supported. This left their decisions *unspoken* and resulted in a lack of clear guidance to tactical resources.
- Leaders reinstated the 2:1 work rest ration as soon as conditions permitted. In some cases they gave blanket approvals for exceptions up to a specific time and then gave clear guidance to all resources that normal work-rest guidelines were in effect.

Fatigue Management

Most respondents reported difficulty in managing fatigue during initial and extended attack. Initially, no replacement resources were available, and later there was so much work to do that incoming resources were not available to replace others but were assigned to immediate needs. Units reached the point of physical exhaustion. Many firefighters worked 36 hours straight. Structural engines with only three people assigned were particularly stressed, until additional off-duty firefighters could be assigned. The addition of extra people to structural engine crews, allowing people to rotate out for brief periods of rest, proved to be an effective fatigue management tool.

Leaders reported coping by ensuring that vehicles were stocked with water and food. Senior leaders made sure that food was purchased and delivered to the resources on the fireground.

Firefighters took advantage of catnaps while refueling or when they were nearing exhaustion. Ice chests were refilled, and firefighters drank and ate as they moved to the next location.

Leaders also reported they allowed crews to nap near the fireline during breaks in the action and mitigated the watchout situation by positioning lookouts.

Summary of Lessons Learned—Fatigue Management

- Fatigue management was a serious issue during initial and extended attack. Leaders had to manage it based on the situation. This ranged from catnaps with lookouts posted to ensuring frequent hydration of firefighters.
- Assigning off-duty people to structural engines was an effective method for mitigating fatigue, especially for three person engines.

Personal Protective Equipment

Facemasks or filters were ineffective in the dense smoke of urban areas. They would become clogged and quickly restrict air supply. Structural firefighters reported that the most effective protection offering adequate air supply was using the jacket collar and hood as a filter (even though it is unknown whether this filter provides effective protection from respirable products of smoke).

The use of quality goggles was reported as critical to keeping debris out of the eyes. One captain called this: "The difference between seeing the next day or being blind." Structural units reported stopping frequently to purchase eye drops and using them continuously.

The increased amount of heat generated by involved structures in densely populated WUI areas was a serious risk to firefighters. Intense heat was cited by the California Department of Forestry and Fire Protection as a debilitating factor in the Green Sheet Initial Summary Report regarding the firefighter fatality on the Cedar Fire. Structural firefighters reported that being out on the street when fires moved through a densely populated WUI area was no different from what they experience when they are inside a fully involved structure. Several respondents reported that roof tiles on newer homes were exploding—"*pop-pop-pop* like firecrackers"—because of the intense heat and showering firefighters in the street with debris.

Summary of Lessons Learned—Personal Protective Equipment

- Facemasks and filters were not effective in urban areas. Jacket collars and hoods were more effective (though probably offered little respiratory protection).
- Goggles and frequent use of eye drops were beneficial to firefighters exposed for long periods in WUI and urban areas.
- Intense radiant heat emanating from involved structures in WUI and urban areas was a significant watchout.

Smoke and Driving Conditions

Smoke in the WUI was reported as very thick. Both structural and wildland engines reported that at times they managed to stay on the road only by the feel of the tires leaving the road. One firefighter said that he switched his watch to military time in order to know if it was day or night because he was so tired and there were no external references for judging time.

In older neighborhoods, firefighters said the smoke was acrid and contained hazardous materials including asbestos from older homes. Downed trees and power lines presented safety hazards on roadways. Fire behavior created violent, horizontal showers of sparks and embers that presented serious safety issues on open cab engines.

In one situation, a wildland engine parked under a palm tree when a flaming frond fell on the top of the engine and cut off the crew from using the engine's equipment. (Usually up to 1/3 of a palm tree's foliage is made up of dead fronds that weigh 10 to 15 pounds and often fall intact.) A neighboring engine had to put out the fire on the engine.

Respondents said that fallen trees, power poles, and other obstacles presented hazards and made it difficult to keep ingress and egress routes open. Using hand crews to keep roads open, leap-frogging them with engines was effective.

One structural battalion chief reported that, as a strike team leader on a wildland portion of an incident, his map and compass skills were not adequate. He mitigated the situation by putting a navigator with his vehicle. Wildland leaders also reported significant navigation problems staying oriented and weighing risk appropriately in unfamiliar WUI subdivisions. They recruited law enforcement officers, off-duty firefighters, and in some cases, local residents, to act as their navigators.

Summary of Lessons Learned—Smoke and Driving Conditions

- The smoke density caused visibility to approach zero. Firefighters had to navigate in extremely difficult conditions including downed trees and power lines and intense showers of sparks. Older homes generated acrid smoke containing chemicals and HAZMAT particulates.
- Palm trees presented a significant overhead threat to firefighting vehicles. Open cab engines faced a higher threat from ember attacks.
- Hand crews were used to leap frog with engines to make sure ingress and egress routes remained open.
- Incorporating local resources in strike teams or adding crew members from local departments to engines was an effective method of mitigating risks associated with a lack of local knowledge.

Stress Management

It is different when you are "the victim," and it is traumatic to see your neighbors lose their homes. Need to keep control. Young people will need reassurance.
- IHC Superintendent

We were taking some 911 calls from people with family members trapped by fire at a casino that was surrounded by flames. The cattle guards had burned out, so people could not drive out and were trapped with their families. Firefighters were spraying down the edges of roads in order to escort civilians out on other routes. They were close enough to have their headlamps melted on their engines.
- Dispatch Center Manager

Many respondents indicated that stress management was a major factor on these fires: not only from the fatigue management standpoint already discussed but also because the fires reached an unfamiliar level of intensity. Additionally, firefighters and support staff were constantly exposed to homeowners and evacuees while they were losing hundreds of structures and experiencing civilian and firefighter fatalities. Participants said the incidents extracted a high emotional toll from everyone.

Leaders reported how important it was to keep their people informed and keep them reassured. Communications breakdowns caused numerous false reports of burnovers and injuries. Many firefighters and support staff were also victims: their families had to be evacuated, and their houses were burning, but they could not help their families or stay abreast of the situation because they were fully engaged elsewhere. Some firefighters found out their homes had burned after coming off 36 hours of continuous operations. Leaders said that providing firefighters situation awareness about the status of their loved ones and neighborhoods was extremely important to enable them to keep functioning effectively.

On one incident, a Critical Incident Stress Debriefing (CISD) team was ordered on day two of the incident. The team organized as a drop-in center. Twenty to thirty people per hour visited the CISD team members. On another incident, roughly 1800 people took advantage of the availability of CISD staff to just release stress. Respondents referred to these as *Defusing Sessions.*

Leaders said they were faced with difficult decisions. When notified of a confirmed firefighter fatality and three injuries, the dispatch manager told the staff that four firefighters were injured and to coordinate the necessary evacuation missions. After the injured were rescued and the body recovered, the manager told the staff about the fatality. They all broke down sobbing. The manager reported that they were all so close to the edge by that point, "I was afraid none of us could function through the recovery [if they had known that one of the firefighters had died]. If one of them broke down, I would have gone next. I don't know if I did the right thing or not."

The unanimous assessment of all team members of the LLC Information Collection Team is that people still have a lot to discuss and that CISD efforts need to be ongoing during this winter and spring. Data from similar incidents indicates that CISD services are important for up to two years after significant traumatic stress situations.

Summary of Lessons Learned—Stress Management

- Stress management was important. Providing situation awareness to local firefighters whose homes are threatened was crucial to enable them to manage personal stress.
- Ordering CISD teams early was beneficial. CISD teams organized group sessions and offered *walk-in* individual services as well. They kept services informal and routine to make people more comfortable.
- Firefighters said that leaders providing support and encouragement was important to their being able to remain focused in situations of increased risk.
- Experience shows that it is important to continue to provide employees with access to CISD services for up to two years after incidents of this nature.

Strategy and Tactics

This section describes the lessons learned regarding strategy and tactics.

Reactive to Proactive Strategies

Fire behavior was so extreme that initially everyone said they were forced into defensive strategies. Structures could be protected, but perimeter control was impossible. These circumstances continued for up to three days in some cases. Incident leaders spoke of the challenge of moving from a reactive, defensive stance to a proactive, offensive strategy. Trigger points that would normally assist commanders in deciding where and how to gain the initiative where rendered useless by the extreme fire behavior almost as soon as they were established. Extreme fire behavior made direct attack out of the question and indirect attack unpredictable and dangerous.

Successful planners realized early on that they would receive few additional resources anytime soon. They also realized that it would be unwise to scatter existing resources in a widespread defensive effort. Respondents said they had to work with what they had and establish a small number of critical priorities.

On two fires, incident leaders indicated that they started to gain the initiative in several ways. First, they knew that the easterly Santa Ana winds would eventually cease and a westerly on-shore flow would return, bringing with it more humid marine air. They began assigning resources to the heel of the fire to bring it under control and *close the back door* in anticipation of the wind shift. This strategy was very successful as it allowed resources to be in advantageous positions to flank the fires when they started moving back the opposite direction.

Until that wind shift, respondents reported that the most effective means of getting ahead of the fire was to be prepared, while defending structures, to take aggressive tactical action whenever the wind let up. Leaders set trigger points tied to the wind conditions and pre-positioned hose lays so when the wind calmed they could take advantage of the break to construct line and burn out.

One respondent said, “I started to think—how big could this thing get?” Once planners began to understand the potential scope of the incident, incoming resources (in one case an entire IMT) were assigned to community protection far in front of the fire.

Summary of Lessons Learned—Reactive to Proactive Strategies

- Fire behavior forced a purely defensive strategy initially. Leaders realized they had to be self-sufficient and establishing critical priorities with the limited resources on hand.
- Leaders split their planning capabilities to look beyond the defense in order to plan an offensive strategy based on predicted wind shifts and weather changes to begin perimeter control. At the line level, leaders had tactical plans in-place, including trigger points, and took advantage of favorable conditions to conduct burnouts and construct line.
- Leaders were surprised initially at how far ahead of the fire they needed to start thinking in order to gain the initiative. An example was an entire Type 1 IMT assigned to community protection.

Adapting Strategic Thinking

Almost all respondents reported that their biggest challenge was adapting their thinking from a wildland fire incident to a firestorm and then to an urban conflagration. The situation required people to quickly grasp the enormity of events and think creatively to improvise solutions, adapting tried-and-true tactics or standard operating procedures for a new and evolving situation.

Most leaders stated they did not think far enough ahead at the start. They said that they felt as if they were "behind the power curve" for ordering resources and IMTs, transitioning command, anticipating weather or fire behavior, maintaining an effective span of control, preventing fire extension across major administrative boundaries, and so on. The situation was so dire that respondents at all levels reported feeling "provoked" into wanting to take immediate action without keeping the big picture in mind.

Several senior leaders reported that under these circumstances, they were prone to *tunnel vision* and consequently did not think about contingencies and alternatives. Many senior leaders stated that going out of their way to seek the ideas of peers and subordinates helped maintain discipline and keep the focus on the big picture. They indicated that actively seeing input helped them avoid getting into the weeds during group decision-making.

Respondents at the tactical level also reported this same need for input. Line overhead and crew leaders offered comments like these:

- *Take extra time to size-up prior to engaging.*
- *Engage in more collaboration with other resources.*
- *Get second and third opinions.*
- *Be much more cautious and much more deliberate prior to engagement.*

Respondents said that the most significant lesson was that, whether you are a single resource or an IMT, one must have a well thought out plan before engaging in the interface. Ingress, egress, trigger points, and contingencies are critical factors to both survival and success.

Many interviewees said that having the mental discipline to focus on opportunity and maintain a positive attitude was critical to sound decision-making. The stress of the situation required remaining emotionally detached and trusting doctrine and training. As one respondent put it,

"You have to be resourceful and make decisions based on logic and training, not emotion. Avoid getting caught up in excitement and feelings of frustration and hopelessness."

Others recommended staying focused on success and the impact you could make at your level. "Avoid thinking about fact that you could be doing more if you had more resources. Think—What can I accomplish now, with what I've got?"

Summary of Lessons Learned—Adapting Strategic Thinking

- Leaders at all levels said that collaborating with and seeking input from others to maintain a focus on the big picture helped combat tunnel vision and the tendency to narrow focus in high-stress situations.
- Remaining emotionally detached and trusting doctrine, training, and experience to guide decisions was a key theme leaders related. Conducting proper size-up and planning were even more important during the chaotic and extreme circumstances before engaging.
- Leaders said it helped their focus to think about the opportunities the situation presented, and to impact what they could with what resources were available.

Structure Triage

When we were triaging homes we decided to write-off shake-shingled roofs and understood that the house next to it was as good as gone too because they were set so close together. 500 gallons, 60 mph winds, and a 10-mile fire front don't cut it. 10 to 20 % involved, and we had to write them [structures] off.
- Structural Fire Captain

When the fires began spreading fast, firefighters said they had to shift their thinking from triaging individual houses to evaluating entire city blocks. The problem worsened as the fire surged through the WUI, well into the urban environment.

Firefighters created anchor points by taking advantage of neighborhoods with relatively few exposed structures. Municipal and county firefighters said that pre-incident planning provided valuable information that enabled them to make quick decisions about which structures or neighborhoods were defensible and where they might make safe, effective stands in their local areas.

In general, firefighters agreed that, under these conditions, if smoke was emanating from the attic of a house, the house was considered lost. The fire was too big and too fast moving to allow interior attack by structural firefighters. In urban areas, engines could not carry enough water to knock down the intense, radiant heat from involved structures, so as soon as any structure became involved, the effort had to shift to protecting exposures.

Firefighters said they could put more effort be into newer homes built in areas with fire-conscious building codes or homes where residents had completed weed and fuel abatement and created defensible space. It was just not considered practical to attempt to defend homes with brush or fuels near the house.

Summary of Lessons Learned—Structure Triage

- During these fires, thinking on structure triage shifted from individual structures to entire neighborhoods and communities. Pre-incident planning saved time in determining defensibility and viable locations to establish anchor points.
- In general, 10 to 20 percent involvement was the trigger point for firefighters to abandon an individual structure and concentrate on protecting neighboring structures.
- Firefighters had to concentrate efforts on areas where defensible space had been created; little effort was justified in areas without these preparations because of the extreme fire behavior.

Structure Protection Branches and Groups

Respondents reported effective results from organizing into structure protection groups and branches rather than divisions in WUI areas. Tactical officers, recognizing that centralized command and control was impossible, facilitated individual initiative that supported incident objectives by designating geographic *zone defense* areas that extended from the edge of the WUI deep into urban neighborhoods. Units could bump and run, or use temporary anchor points and fall back if needed within their area. Resources could immediately respond to spot fires within their zone. As the flame front passed, units could patrol within these areas and attend to residual fires.

On several incidents, leaders established a structure branch contingency plan that was ready to implement when the fire reached certain trigger points. They reported that having this contingency plan, with resources pre-assigned, saved valuable time when fire conditions demanded a shift in strategy or tactics. Respondents recommended that, during incidents like this, trigger points for implementing contingency plans be adjusted to allow more advanced warning for taking action.

Summary of Lessons Learned—Structure Protection Branches and Groups

- Structure protection resources in the WUI were more effective when organized into functional groups committed to a zone defense, and were delegated the responsibility to act within these areas.
- Contingency plans for establishing structure protection groups and branches were most effective when made early. Most trigger points to initiate implementation did not allow enough time from recognition to when the group needed to be functioning.

Strike Team Organization

Traditional, five-engine strike teams were very effective when making a stand or holding the fire at the perimeter of a neighborhood. Respondents indicated that, inside urban areas, two-engine teams were more effective for patrolling an area and implementing a zone defense to deal with spot fires, residual fire, and holdovers.

When several homes in one block were threatened, using one engine as the pumping unit and reinforcing staffing with the crew of a second engine, allowed for crews to work several lines at

once. This enabled leaders to focus on situation awareness, management, and safety instead of getting drawn into working hose lines.

Strike Team Leaders found that single engines with three person crews were stretched thin when the flame front moved into urban areas and engine crews had to deal with several homes at once. In these cases, firefighters felt that safety margins and crew effectiveness were reduced. In some cases, agencies had people available but lacked engines, so they supplemented engine crews, staffing engines with up to eight people. Respondents reported excellent results using this technique. It allowed teams to effectively run four hose lines and use a master stream device without compromising LCES.

One respondent reported an issue with trying to man his engine and perform duties as a strike team leader: he was assigned to be an engine strike team leader (STEN), but no one was available to backfill him on his engine. The division decided to dispatch the strike team without a STEN. The Captain originally assigned as the STEN attempted to pull double-duty as an Engine Captain and the STEN, but his proved to be unmanageable. The strike team was composed of Type 3 engines conducting structure protection, in an environment where risks were already increased by communications problems caused by a lack of 800 MHz /VHF interoperability.

The overhead continued to look for a STEN but could never fill the assignment. In the meantime, they kept the strike team configuration. The respondent said he wished he would have stepped-up and addressed the STEN issue with the line overhead to break the error chain.

Some firefighters reported that using a task force of four engines paired with a dozer and a water tender worked better for structure and community protection than four engines alone or a dozer alone.

Firefighters reported that, at times, Type 1 engines were assigned to strike teams operating in WUI areas with small narrow roads and minimal turnarounds. They felt this was not effective, and that Type 1 engines were better suited for assignments in urban areas where firefighters could take advantage of their ability to deliver water from hydrants at high volume.

Summary of Lessons Learned—Strike Team Organization

- The traditional strike team configuration was effective in wildland areas—when holding line or making a stand. In urban areas, two-engine teams in a zone defense worked well. Augmenting engines with off-duty structural firefighters increased the effectiveness of engine crews. Type 1 Engines were less effective in WUI areas with narrow access and turnarounds.
- Strike teams ran into span of control problems when the captain tried to function as part of the engine crew and the STEN. One captain felt the lesson he learned was to speak up. If a Strike Team Leader is not available to lead and supervise an engine strike team, the strike team should be disbanded and the engines re-assigned as single resources.

Bump and Run versus Anchor and Hold

Most respondents indicated they initially defaulted to their preferred tactics: Structural firefighters headed for the fire's origin. Wildland firefighters tried to find an anchor and start perimeter control.

Leaders said the nature of many of these fires as they moved through different types of wildland and urban terrain made both those tactics impossible. Respondents reported that *bump and run* tactics worked well in the WUI intermix areas where homes were disbursed in larger lots or in areas where weeds had been abated or previously burned.

When fires entered urban neighborhoods, many firefighters said the bump and run tactic proved ineffective due to the speed and multiple heads of the fire, combined with the intense radiant heat generated from involved structures. Some structural firefighters reported that they tried to tie into hydrants and defend areas as if they were dealing with a large warehouse fire. However, they felt this tactic was ineffective because firefighters became over committed to one area and were not mobile enough to deal with the multiple spot fires and residual fires in an area. The challenge was in adapting the tactics to a new situation.

In more densely populated urban neighborhoods, firefighters reported that intense radiant heat emanating from involved structures was more of a threat to surrounding structures than flame impingement or ember attack. In these cases, respondents said that standard 1½-inch hose with 500 gallons of water was ineffective at getting enough water on to an involved structure to knock the heat down before it spread to surrounding buildings. They also reported many incidents of residual fires claiming homes in the areas where they had used bump and run tactics without returning to patrol.

Some municipal and county departments reported that they adapted by implementing a tactic they called *anchor and hold* or *temporary anchoring.* These firefighters switched to using hydrants with 2 ½ inch hose and lower flow nozzles in order to pump enough water to cool involved structures in enough time to stop flame impingement on neighboring houses. Firefighters ran three to four hand lines from one hydrant while they used a master stream device to engage the most threatened area.

Respondents indicated they were aware this tactic carried the potential risk of getting over-committed to one area for too long. To mitigate this risk, they made additional effort to maintain LCES and remain highly mobile by laying out minimal hose and abandoning it or dragging it from location to location. This effort prevented firefighters from over-committing by enabling them to remain mobile enough to react to new spot fires started by embers thrown from the main fire. The amount of hose pulled was based on hands available: 100 feet if only three crew members were available, 150 feet if there were four, up to 200 feet if the engine was staffed with additional people. Crews also tapped citizens who would not evacuate to help pull hose.

Respondents who used this tactic said it was extremely effective, and they felt it combined the best of wildland doctrine with the additional capabilities of structural engines. They cautioned that a reliable water supply and pressure is required to make the mobile anchoring tactic effective.

Summary of Lessons Learned—Bump and Run versus Anchor and Hold

- Bump and run worked well in the WUI but became ineffective in the urban neighborhoods where multiple structural spot fires and intense radiant heat was more of a threat than flame impingement or ember attack. 500 gallons was not an adequate amount of water to control heat.
- Traditional hydrant use was ineffective because crews tended to get over-commit to one area for too long. A mobile system of temporary anchoring was more effective in dense, urban areas.

Summary of Lessons Learned—Bump and Run versus Anchor and Hold—continued

- Temporary anchoring required increased attention to LCES. The potential for over-commitment was mitigated by limiting the amount of hose used based on available crewmembers.
- To be an effective tactic, temporary anchoring requires a reliable water source and adequate water pressure.

Hoses, Nozzles, and Foam

Structural engine crews reported that using 1¾-inch hose with 150 GPM nozzles while employing bump and run tactics wasted water and increased fatigue. Engine crews also found that they were unable to use available water because they lacked fittings. Carrying lightweight 1 ½ inch hose with 30 to 60 GPM nozzles was more effective on brush, grass, and some structure exteriors. The reduced hose weight helped manage fatigue and increased mobility. Lower flow nozzles allowed for much longer tank time, using water more efficiently and effectively. Carrying a broad array of fittings allowed engines to tap a variety of water sources—from faucets to hydrants when hook-up to a water source was available.

Respondents who used fire resistant barriers such as compressed air foam (CAFS) and thermo gel reported that products were effective at protecting structures from radiant heat and direct flame impingement. These firefighters indicated that many people in their agencies still regard these tools as unproven technologies, but those who used them recommended they should be distributed widely. One firefighter recommended encouraging homeowners to purchase these materials and leave them in the driveway for firefighters to use if their homes are threatened.

Summary of Lessons Learned—Hoses, Nozzles, and Foam

- Larger diameter hose and high flow nozzles normally used by structural firefighters was not as effective as smaller hose and lower flow nozzles used in traditional WUI areas. Units who carried a broad array of fittings and nozzles were more effective in the wide variety of conditions encountered.
- Fire resistant barrier products were effective for protection against radiant heat and direct flame impingement. Examine the idea of encouraging homeowners to purchase and store barrier products on their property for fire department use.

Residual Fire

We would work all day to save a group of structures, then get pulled out too quickly and the fire would creep back in. We would lose too many structures like this. It was sad and so frustrating.
- Engine Captain

Firefighters reported that after the flaming front passed, some units were ordered to *bump and run,* reposition, or fall back to attack again further downstream. Houses were watered and foamed per SOP, but several later burned. Firefighters attributed the difficulty of controlling the intense radiant heat in more densely populated areas, premature reassignment of resources, and ember

driven spot fires to structure loss from residual fire. Respondents indicated that the losses would have been reduced or prevented if they had been able to leave some units behind to patrol.

Other respondents reported success when some units remained in an area to patrol and caught several residual fires and spot fires. Although this strategy reduced the number of units available to work the flaming front, leaders said that organizing using the zone defense approach ensured that only a minimum number of resources had to be assigned to patrol duties. Firefighter effectiveness was increased when a small task force of engines and crews focused on residual fire and command vehicles or observers patrolled and identified potential problem areas.

After a relatively short time, these units had mopped-up the residual fires or otherwise protected threatened structures and were available to be repositioned for the next assignment. Leaders reported that it was effective to set a time-based trigger point for the patrolling resources to rejoin the main effort.

Summary of Lessons Learned—Residual Fire

- Many structures were lost when resources were not assigned to patrol for residual fires while using bump and run tactics in the WUI. Assigning field observers to patrol and report problems, using a smaller task force to deal with residual fires was effective.
- Leader set trigger points for patrolling resources to rejoin the main effort after an appropriate amount of time.

Firing Operations

Respondents reported that firing operations were most effective when prepared well in advance. Hose lines were laid in place, and trigger points were established based primarily on wind conditions. Preparation was the key to getting the most out of the available burning window. Respondents also said that coordination with adjacent units was very important. Respondents reported multiple incidents of one group firing and sending fire down to another group that was not informed of firing operations.

Respondents indicated that the most successful firing operations occurred when interagency units combined with the local city or county department units to conduct firing operations jointly. This approach combined the burning expertise of wildland firefighters with the local knowledge of municipal and county firefighters and filled in many of the information gaps, allowing operations to proceed faster with firefighters able to burn larger sections of ground.

Firing operations had to be flexible and allow for individual initiative, interpretation of intent, and authority to act accordingly. In one situation, a mobile firing group was formed and given specific instructions to burn a specific area by a certain time. This effort would be a last ditch attempt to keep the fire from crossing an interstate highway. Communications problems and rapidly changing conditions prevented coordination among the operations section, the burning group and the division. The division supervisor (DIVS) was unaware of the planned operation.

When the respondent (who was the leader of the crew conducting the burn) got to the location, he recognized that a wind shift had occurred and that the Santa Ana winds had given-way to the prevailing westerly wind, causing the fire to begin backing through thin fuels without crowning or torching.

The leader reported a significant amount of pressure to conduct the burn. Dozers were working; holding crews were ready; the media was there with cameras. At the time, the DIVS was in another location and could not provide immediate input. As the crew leader assessed the smoke column and the winds, he was convinced that if they added any energy to the fire, the fire would climb into the taller fuels, torch, and carry the fire across the interstate on transport winds, which were by then shearing off over the highway.

The situation placed the crew leader in a dilemma. He had been given specific orders to conduct the burn, but by his assessment the burn had less than 50/50 chance of success in current conditions. The crew leader was unable to contact the firing group supervisor on the radio for further guidance. Fortunately, at this point, the DIVS showed up at the crew leader's location. The DIVS (also interviewed for this report) said that together he and the crew leader made a conscious decision to "take a tactical pause to assess, discuss, then act." The DIVS concurred with the crew leader's assessment, and they decided not to conduct the burn. Instead, they developed several contingencies to implement if the situation changed again.

The respondent contrasted this experience with an earlier one on the same incident. The mobile firing group was functioning but the command structure was chaotic at the time. The IAP guidance for the group was to "fire as necessary." The respondent said that this instruction, combined with leader's intent from the operations section chief, provided the latitude to work collaboratively with branch directors and division supervisors and enabled them to coordinate firing operations that integrated tactical plans and met the incident objectives.

Summary of Lessons Learned—Firing Operations

- Preparation was key to taking advantage of favorable wind conditions to complete firing. Coordination with adjacent units was critical to prevent the unintended consequences of sending fire to unknowing firefighters.
- Combining wildland resources with local experts was effective for conducting firing operations in more difficult urban conditions.
- Providing leaders intent and general guidance for firing operations rather than detailed instructions allowed greater flexibility was more effective when communications and coordination between overhead failed.

Air Operations

On one incident, respondents reported that with early morning support from air resources they contained the entire flank of that fire by noon. In typical fires, aviation resources do not engage until late in the morning. However, with these fires, suppression efforts—including air attack—had little effect once the fire reached the height of the burning period, which coincided with the time when aviation resources were starting to engage.

In this example, leaders shifted the flight schedules with air support flying at first light. Both aviation and ground crew respondents reported this strategy as highly effective. Aircraft were able to augment ground lookouts and provide situation awareness to ground crews that were operating in confusing, elongated subdivisions and steep canyons. The change allowed air and ground resources to conduct a series of aggressive, coordinated attacks, taking advantage of optimum firefighting conditions.

Respondents reported that using helicopters, especially Air Cranes, to drop water in coordinated attacks in dense urban areas was highly effective in knocking the heat out of an involved structure. These airdrops provided footholds that allowed ground units to suppress the fire and secure the surrounding structures. Municipal and county ground units were able to successfully communicate with helicopters using hand and arm signals to coordinate effective attacks when radio communication was not possible.

In some areas, air tankers assumed an initial attack and independent action role. The following paraphrases an interview with one respondent, an air attack supervisor:

I came in at 0400 to process orders. Looking out the window and hearing the radio, I realized that (1) the fire had grown very large, (2) there was no effective command and control over the entire fire and that ground resources were taking independent action to do what they could, where they could, and (3) that we would be sitting on the ground, ineffective, if we waited for requests like we normally do.

This was the common experience at various tanker bases throughout the area. At this point, IMTs were in a reactionary mode, attempting to establish incident and unified command. Perimeter control was out of the question and the only realistic priority was to protect life and property. Tanker bases and pilots readied themselves for action in advance, taxiing out to the runway in anticipation of a dispatch. Resources were stretched so thin in many areas that many air tankers had to conduct independent attacks when no ground resources were available for follow-up. They said their choice was to take this action or risk losing entire neighborhoods.

At one base, air attack, helicopters, air tankers, and the interagency dispatch aviation coordinator worked together to take action until normal orders for aircraft were placed. They worked the operation as a coordinated team. The air attack supervisor flew reconnaissance, selected the highest priority targets, briefed pilots, assigned communications, directed operations from the air, and coordinated with dispatch as needed.

Air tanker pilots reported that dropping retardant to box or "V" individual structures and building a retardant line between the fire and structures was the most effective tactic. The usual tactic of putting retardant just downhill of the structures did not work because of the winds driving the fire in different directions.

Pilots reported that an average of eight loads of retardant were needed to provide effective protection for an entire subdivision. This base flew 240 sorties with no operational or safety problems. In one case, they reported their efforts saved all but 12 houses out of a subdivision with over 500 homes.

Numerous pilot respondents reinforced the concept of keeping things simple during high intensity aviation operations. They used Safe, Efficient, Effective (SEE) as the aviation version of LCES. Respondents reported that pilots admit that they can forget their take off and landing procedures during repeated, short turnarounds in high tempo operations. To prevent this, one base assigned a "wheel watcher" with binoculars and a VHF radio to ensure tankers were landing with wheels down.

The volume of traffic at all tanker bases and some of the helibases, required temporary flight restrictions and increased coordination requirements at local airports to prevent accidents. Helibases could not be conveniently located near some of the fires because of urban sprawl and the expansion of the WUI. Many were forced to work out of municipal airports, creating safety

and coordination issues. Pilots had to complete a special risk assessment for helicopters with buckets and had to land and attach/detach the bucket traveling to/from the helibase.

Aviation respondents said they would like to see agencies work with city and county governments to identify or incorporate helibases into greenbelts and open space in the pre-incident planning process.

Summary of Lessons Learned—Air Operations

- Getting aircraft up early in the operational period facilitated aggressive and effective coordinated attacks that gained ground on perimeter control while fire behavior was minimal.
- Aircraft were particularly useful at providing situation awareness to ground resources in WUI areas where navigation was difficult and visibility obscured.
- Helicopters were effective at dropping enough water to control the radiant heat of involved structures in urban areas and providing a foothold for ground resources to follow up. Operations were facilitated with hand and arms signals when radio communications failed.
- Independent action by air tankers was effective for structure protection. Up to eight loads of retardant were needed for effective structure protection of a subdivision with no immediate ground reinforcement.
- Dispatch, air attack, helicopters, and air tankers worked as an effective independent action team during initial attack before command and control was established.
- Additional risk mitigations (such as "wheel watchers") were needed for multiple quick turnarounds. Additional coordination and flight restrictions were needed at airports during high intensity flight operations.
- Aviators identified a need to work with community planners to incorporate helibase sites into the community infrastructure as part of interagency pre-incident planning.

Documentation

This section describes the lessons learned regarding documentation.

Documentation during Initial and Extended Attack

Incident leaders reported several incidents where good documentation by lower-level leaders at the beginning of the incident became critical later. Delays in establishing effective command and control over a series of large incidents meant that firefighters functioned more independently than usual for long periods of time before documentation began at the incident level. People interviewed reported that when documentation was not started early, problems often surfaced later—from difficulty in tracking resources to accident and liability questions.

Several respondents stated that they began documentation at their level as if they were running their own Type 3 incidents. When leaders on lower levels created documentation, members of Type 1 and 2 IMTs indicated that they were able to tie the documentation of initial attack and

extended attack resources into the team's documentation package smoothly and with few problems.

Summary of Lessons Learned—Documentation during Initial and Extended Attack

- Good documentation by tactical leaders became important in providing facts in resolving issues on several occasions.
- Establishing thorough documentation of events and resources assigned by initial and extended attack leaders in the absence of command and control facilitated a smooth assumption into the incident organization.

Damage Assessment Teams

Respondents remarked on the value of damage assessment teams and reports. Thorough damage assessment reports helped the IMT comprehensively document the fire and became the master document used for calculating overall loss.

Respondents recommended that IMTs should anticipate the need for damage assessment and order a team as soon as they realize that structures have burned or are likely to burn. Anticipation and early ordering allows the team to assemble, arrive on-site, and begin assessing and documenting damage before the task becomes too large and while the physical evidence remains relatively undisturbed.

One IC indicated that a damage assessment report is most useful when it documents not only losses but also properties saved. One that same incident, the IMT recommended a particular damage report format as a potential national model. It is a Microsoft Word document with drop down menus. This format was shared by its creator and is available electronically upon request from the Lessons Learned Center.

Summary of Lessons Learned—Damage Assessment Teams

- Thorough damage assessment reports helped comprehensively document the fire event and became the master document to calculate overall loss.
- Ordering a damage assessment team as soon as the IMT knew that structures were likely to burn allowed more accurate documentation of the incident and allowed the team to calculate values saved as well as lost.
- An effective property damage assessment form is available in Microsoft Word format upon request from the Lessons Learned Center.

Cost Apportionment Team

One Type 2 IC reported that when managing multi-jurisdictional fires, it was important for the IMT to order a cost apportionment team immediately to avoid lengthy post-fire efforts to reconstruct events and negotiate costs. The fires quickly spread across multiple jurisdictions and major administrative boundaries at all levels of government (local, county, state, and federal). Suppression costs needed to be allocated or "apportioned" to each jurisdiction. Agencies can

better apportion costs if a cost apportionment team is present during the fire's progression, as decisions are being made and agency representatives are available to answer questions.

Preparing for Post Incident

This section describes the lessons learned regarding preparing for post incident.

Critical Incident Stress

Some senior leaders reported a concern that their agencies would not provide an effective bridge between the critical incident stress counseling services available at incidents and an ongoing, comprehensive program at home units. Respondents reported that they believed that critical incident stress resulting from these incidents, affected a tremendous number of people in the agency workforce. Many respondents took advantage of the services of critical incident stress debriefing (CISD) teams at incidents, and voiced the opinion that a lot of people still needed someone to talk to about their experiences.

Several leaders felt that CISD teams should be ordered as standard procedure for large, late-season fires. They indicated that even though firefighters routinely experience these kinds of stresses, extreme, late-season fires involve firefighters who have already have logged hundreds of hours of overtime and are likely to be dealing with cumulative stress. Respondents indicated that this stress buildup was an increasing trend as fire seasons lengthen and firefighters are called-on to perform out-of-the-ordinary missions such as the *Columbia* shuttle recovery and post-9/11 recovery.

Summary of Lessons Learned—Critical Incident Stress

- Ordering a CISD team early was effective for these large, complex incidents. Most firefighters had already had a long fire season and stress buildup is an increasing problem.
- Resources found on-site CISD services helpful. Senior leaders feel this is still an open issue and would like to see these services continue for firefighters and support staff at their home units.

Utilities and Service Restoration

Respondents recommended that, following evacuations, IMTs must coordinate service restoration and the return of evacuees.

Other respondents reported significant conflicts between fire operations and utility restoration operations. At times, the operations of utility companies were almost as large as those of the fire organization, with camps, helicopters, dozers, and fleets of vehicles. Road congestion became a significant issue, particularly on narrow roads in residential areas. Respondents indicated that fire agencies must be prepared to interact more extensively with utilities crews as major WUI incidents become more common.

Respondents indicated operations went more smoothly in areas where multi-agency, pre-incident planning was in place. However, respondents reported that, even in these areas, coordination and planning between fire agencies and utilities represented a weak point in incident planning.

Respondents recommend that, in the absence of pre-incident planning, IMTs must anticipate this issue and involve utilities in the incident organization as soon as possible, either through a liaison or by involving the utilities in unified command. Operations section chiefs, planning section chiefs, and deputy ICs should be most cognizant of this issue.

Summary of Lessons Learned—Utilities and Service Restoration

- Pre-incident planning improved coordination between fire agencies and utilities but many incident overhead did not anticipate the difficulties in sequencing the return of evacuees and services restoration. They said that in the future they would involve utilities in the incident organization and planning early to coordinate restoration of services.

Integrating Suppression and Resource Advisor Functions

Several respondents reported a need to better integrate the fire suppression and resource advisor functions during fire suppression operations and rehabilitation efforts. Some reported unnecessary, unproductive, and adversarial relationships between the fire suppression organization and the natural resource specialists. The fire suppression organization works under delegated authority from the line officer, and the natural resource specialists are representatives of the district or forest, providing an interface between the line officer and the IMT.

Both fire suppression and natural resource respondents reported that they felt it would be more effective for the IMT to work collaboratively with line officers and natural and cultural resource specialists on resource protection and environmental compliance issues. Fire suppression and natural resource management goals are often in conflict with one another. Respondents pointed out that it is unproductive when the land management agency line officer, resource specialists, and the incident organizations do not have the same goals. Respondents indicated that common goals should translate into unified planning, with plans consistently communicated throughout the community.

In one case, respondents reported that a change in strategy—reduced urgency for completing a fuels break brought about by changing fire conditions—created an impression in the community that the agency placed natural resource values over the safety of the community. Most of those interviewed felt this situation could have been avoided if an initial strategy regarding cost and environmental constraints had been worked out among the line officer, natural and cultural resource specialists assigned as resource advisors, and the IMT.

Summary of Lessons Learned—Integrating Suppression and Resource Advisor Functions

- Respondents felt this was a weakness overall and said that next time they recommended:

  Working closely with line officers and their resource advisors to create a unified strategy, which must be communicated to the community consistently;

  Coordinating plans and operations with resource advisors;

  Positioning a resource advisor with the Operations Section to provide direction in mobilizing equipment, handle equipment issues, and coordinate with suppression operations. WUI strategies would be more effective if a dedicated resource advisor from the host agency's natural and cultural resource staff is assigned from the start.

Burned Area Emergency Rehabilitation (BAER) Team Structure

In some areas managers report some difficulties in communicating important rehabilitation information to the public in a timely and effective manner. One respondent suggested that it would be valuable to add a qualified fire information officer (FIO) to the Burned Area Emergency Rehabilitation (BAER) team on large WUI fires. The FIO can assist with information flow from the BAER team back to the IMT and manage an effective public information program pertaining to rehabilitation efforts.

Another respondent said that including an archeologist on BAER teams as standard practice would be beneficial. Large WUI fires will likely threaten cultural resources. However, BAER teams rarely include an archeologist or cultural resource specialist. On one incident, BAER operations were delayed when the IMT had to order an archeologist through the dispatch system.

Summary of Lessons Learned—BAER Team Structure

- One recommendation was to assign a FIO to the BAER team to assist in the communication of important rehabilitation and safety information through a distribution campaign.
- A delay occurred when the need for an archeologist wasn't realized until later on in one incident. The team recommended ordering an archeologist (or any unique resource) as soon as it appears those values are likely to be impacted.

Issues for Organizational Leaders

This section describes the issues for organizational leaders.

Communications Interoperability

Respondents indicated unanimously that resolving the communications interoperability problems between the municipal and county 800 MHz and state/federal VHF systems should be the number one priority of management. They indicated that this issue affected safety and operations more than any other. Respondents voiced frustration that progress has been so slow on projects like the LARTCS (Los Angeles Regional Tactical Communications System) and other alternative solutions. Respondents recognized the financial difficulties involved in developing an interoperable system. Some suggested an alternative that takes advantage of available technology to build cross-band repeaters and other solutions allowing the two systems to interface.

One respondent mentioned that Orange County in the greater Los Angeles area had initiated a technological solution to provide common interagency communications across systems (This is unverified by the LLC Information Collection Team). Other respondents also cited that the Inyo and Sequoia National Forests had implemented a solution to create an interface between their air operations frequencies and military air guard frequencies (Also unverified by the LLC team).

Work-Rest Guidelines During Initial and Extended Attack

Another unanimous message delivered by respondents was that the current work-rest guidelines were not appropriate during initial and extended attack on high tempo incidents when values at

risk outweigh the need disengage for crew rest. Respondents indicated that under normal conditions, the work- rest guidelines are appropriate and can be implemented. On these incidents, respondents at every level of the organization felt that they were forced to bend or violate policy in order to do the right thing in terms of balancing fatigue mitigation with legitimate operational needs. Most found the documentation process associated with the work-rest guidelines cumbersome and inflexible.

Respondents suggested an immediate re-examination of the guidelines to determine how agencies can empower incident commanders with more flexibility in applying work-rest guidelines and employ more streamlined process for documenting decisions.

Integration of Local Pre-Incident Planning Information into Incident Command

Respondents from every agency and functional area recognized an unmistakable need to improve procedures for integrating local knowledge into incident operations. At nearly every fire firefighters described situations in which detailed pre-incident planning information from the local jurisdiction was available but was not used by the incident organization, either because they did not ask for it or the local agency did not offer it. They also related a similar problem with integrating local commanders' and firefighters' knowledge into incident operations. At the tactical level, many firefighters stated they felt uncertain operating in smoke-obscured and confusing WUI areas.

In those cases where pre-incident planning and local knowledge was effectively integrated, leaders from all agencies indicated that it contributed to success and facilitated safer and more efficient operations.

Respondents indicated that they would like to see this issue addressed at the interagency level. They suggested possible solutions ranging from more formal sharing of pre-incident planning information at scheduled interagency meetings to creating Geographic Information System (GIS) databases and accessing local information via GPS receivers in emergency vehicles.

Respondents also suggested a more formal interagency arrangement to include interagency and local liaisons in incident command.

Training in ICS and Unified Command in all Emergency Responder Public Agencies

Respondents expressed a strong theme that the Incident Command System (ICS) provided the critical foundation for trust between agencies and effective interagency cooperation. City and county respondents who had completed ICS training stated how valuable it was and cited how their knowledge of ICS affected command and control and their ability to interface with the larger incident organization.

Respondents indicated that they believe that the trend toward functioning in a unified command will increase with large fires and the involvement of wildland IMT in all-risk incidents. A majority wanted to see standardized ICS training adopted by any agencies involved in emergency response, including volunteer organizations and public utilities.

Preparing for Urban Conflagration in Policy and Training

Respondents proposed that the National Wildfire Coordinating Group (NWCG) training curriculum should be updated to include more of the skills needed to operate effectively in large WUI incidents. Many respondents said they were not adequately prepared for incidents of this scale and scope. Leaders who were interviewed stated that the trend toward catastrophic interface fires or all-risk assignments demands a wider range of skills than the NWCG training curriculum currently develops. In listing required skills, they included the following:

- Recognize and predict extreme fire behavior potential in WUI and urban areas.
- Develop and implement more effective initial and extended attack strategies and tactics.
- Work more effectively with the public and cooperators.
- Deal with the political dimension.

Respondents also said that doctrine for strategy and tactics in the WUI should be revised to incorporate the lessons learned on large WUI fires in the last few years. These respondents stated that this shift in doctrine should be incorporated in upcoming updates to training curriculums.

Respondents suggested that updated training curriculums should be coordinated with wildland training available to city and county firefighters. Although respondents had concerns with the lack of standardization of wildland training offered through the Office of Emergency Services, they believed overall that the training offered was very beneficial for structural departments who commit resources to WUI fires.

MIRPS and ROSS Responsiveness Supporting Large Magnitude Incidents

Respondents voiced frustration at what they perceived as unnecessary and unacceptable delays in resource ordering. Nearly all respondents who commented on this issue indicated that these delays resulted, in part, from a large volume of orders having to be manually exchanged between the California-specific Multi-Agency Incident Resource Processing System (MIRPS) and the national Resource Ordering Status System (ROSS). Respondents strongly suggested adopting a single effective system for managing resource ordering and status tracking. They also recommended that improvements be made to ROSS to make it more efficient.

Critical delays occurred because key resources such as IMTs had to wait for their order to be processed and have their *O number* issued before being allowed to initiate movement. Every incident commander interviewed asked the question, "How can we allow people to get on the road and start planning and let the *O numbers* catch up to us?" These ICs suggested that answering that question would cut as much as 36 hours from the time between a Type 1 IMT being ordered and assuming command.

Exercising Individual Initiative During Initial and Extended Attack

A large majority of respondents commented on the need for firefighters to be able to exercise initiative and take independent action in a way that meets leader's intent and furthers the accomplishment of incident objectives.

Because of the vast scale of several of the southern California incidents, units found themselves in initial attack mode (or conducting independent action in extended attack) for unusually long periods before agencies could establish effective command and control. The dynamic nature and size of some incidents created periods where effective central control was lost or just not possible.

Respondents from all levels of incident organization cited numerous examples when success was achieved (or at least failure averted) when leaders exercised initiative and took action. Often leaders took the actions they did because they believed that their chosen course of action best supported their supervisor's objectives. Consequently, they believed that it was important for senior leaders to empower subordinates to take the initiative by making their intent clear, providing guidance, and delegating authority for action as appropriate.

Respondents reinforced that a firefighter should never, in any circumstances, unilaterally ignore orders or independently reassign themselves when effective command and control is in place. However, those interviewed wanted to see the ICS remain flexible enough to allow for safe, effective action in the absence of communications or established command and control. They wanted to see wildland and structural firefighting culture, doctrine, and training support this concept.

Air Resources in the Initial Attack and Independent Action Role

Respondents who had participated in both ground and aviation operations indicated that independent air operations were very successful in saving residential structures and neighborhoods. "Independent" air operations refer to those conducted autonomously during the initial and extended attack periods, but with the full knowledge and collaboration of the incident commander. In some areas, air resources were not permitted to operate in this fashion, and pilots and managers expressed frustration that they felt they could have been effective if they had been enabled to contribute.

In air attack management training, aviation managers learn the acronym SEE (Safe, Effective and Efficient.) In the opinion of those interviewed, initial attack air operations employing both helicopters and air tankers on these fires were safe, efficient, and effective when they were:

- the result of collaboration between aviation managers, the IC and incident operations
- coordinated by a fully qualified Air Tactical Group Supervisor
- fully coordinated with the dispatch function
- conducted within a fire traffic area established per policy and procedure
- a product of organized teamwork conducted within a clear command structure – essentially an autonomous air attack group authorized by the IC
- conducted under the same guidelines as an initial attack fire
- suspended, and the operation re-grouped if any element of the SEE concept was violated

These operations enabled aviation resources, that otherwise would have sat idle, to engage the fire. Respondents would like to see air operations policy and procedure mature to include autonomous tactical action when coordinated with, and approved by, the incident command organization. They would also like to see aviation officers and dispatch centers work together to

conduct pre-incident planning to establish contingencies for large catastrophic incidents such as these fires.

Adjusting Air Operations Cycles to Maximize Air-Ground Coordinated Attacks

Respondents on one incident reported that they conducted highly effective coordinated attack using air and ground resources by adjusting air operations cycles so that aircraft were flying at first light. Coordinated attacks during early and mid-morning hours facilitated perimeter control by taking advantage of relatively moderate fire behavior early in the burning period.

Many respondents expressed frustration over the typical operational cycle, when aircraft come on station during late morning, just as the fire is becoming active. These respondents would like their agencies to explore options for enabling aviation supervisors to adjust planning and operational cycles, allowing ground and air resources to begin operations concurrently in order to gain ground on a fire while conditions are optimal.

WFSA on Large Multi-Jurisdiction and WUI incidents

Senior leaders expressed concern that the current Wildland Fire Situation Analysis (WFSA) process is not adequate to address large WUI incidents—particularly when fires burn across multiple jurisdictions and when numerous agencies are functioning in unified command. In its current form, the WFSA cannot effectively support strategy formation when fires take on the aspects of non-wildfire incidents on the scale of a natural disaster. As one respondent put it, "What is the allowable final fire area of an urban conflagration?"

Respondents said that, on these large fires, they felt increasingly uncomfortable trying to work within the WFSA. Circumstances often forced them to revise the WFSA on a daily basis. "How do you prepare a WFSA for a fire that is going to cover several hundred thousand acres in and around one of the most densely populated wildland-urban interface zones in the country?", said one Type 1 IC.

Respondents reported that in some cases the WFSA was obsolete one hour after preparation. Respondents also complained that, as the fire spread into across jurisdictional boundaries, the WFSA became increasingly irrelevant and biased the IMT's priorities because the WFSA represented the viewpoint only of the land management agency preparing it. Consequently, by many respondents' assessment, the WFSA became an inappropriate tool for determining strategy in a multi-jurisdictional, unified command environment.

Respondents also reported serious concerns about a growing trend in which agencies view the WFSA as a budgetary tool rather than as a decision-support tool. Many pointed out that the intent of the WFSA had been expanded last year to include this goal: to develop suppression strategies to minimize costs without compromising safety. In their opinion, this addition made the WFSA into a document that holds IMTs accountable for costs. Respondents reported feeling that they were inappropriately pressured to account for costs in a situation in which it was not possible to account for the many factors and complexities involved in these large, fast-moving interface fires.

Respondents would like their agencies to examine the effectiveness of the WFSA process for similar circumstances and modify or replace the tool to produce an effective situation analysis tool for fires like these.

Fuels Reduction Limitations

Many respondents indicated that lessons learned regarding hazardous fuels abatement are very straightforward. Fuels treatments and brush abatement programs were highly effective. Respondents reported that communicating this message to the public and encouraging implementation of such programs (both by agencies and communities) presents a challenge.

Respondents indicate success stories may provide effective models. Many held up the Mountain Area Safety Taskforce (MAST) as a model for interagency pre-incident planning. They also reported that fuels treatments and prescribed burning significantly minimized fire activity in areas where agencies had completed projects. They said it was evident that jurisdictions with effective and enforceable 100' clearance limits and effective building codes suffered far less property damage.

WUI communities are still expressing concern that environmental compliance prevents critical fuels projects from moving forward. Tree mortality and fuel buildup in forested areas are still of major concern. One district ranger said, "We have a disaster of biblical proportions still waiting." Respondents said they want their agencies to take advantage of the opportunity presented by the fires to communicate the success stories and to educate and influence public and local governments to do as much as possible to protect communities and natural resources from fire.

Impacts of Mutual Aid Agreements

Respondents reported that the mutual aid and the mobilization system caused many to be on assignment elsewhere while large incidents were in progress on their home units. As incidents started, cooperators were dispatched to assist, causing many resources from many jurisdictions to be gone when large fires started in their own districts. Firefighters as well as incident commanders were affected, and the result was that resources with valuable local knowledge were fighting fires on someone else's home unit while someone else was fighting fire back on theirs.

This inefficiency prompted many respondents to question whether mutual aid agreements or the mobilization system ought to have a provision to keep resources at their home units during severe fire conditions or to reassigned resources back to their home unit when the situation requires.

The Southern California Fire Environment

> *There is no such thing as "fire season" in Southern California.*
> **- Battalion Chief**

Respondents, from nearly all agencies and at all organizational levels, expressed the belief that in southern California agencies have passed the point where a seasonal organization is practical. *Fire season* in Southern California runs nearly 365 days per year. The media quoted one fire official saying, "We're trying to run a twelve-month operation on an eight-month budget." In the current operating environment, agencies need to staff their resources through a full year to be effective. This expansion would require significant additional resources and with it, a different planning and preparedness mindset.

Respondents noted that normally 97% of the land consumed by wildfires in San Diego County burns outside the designated fire season. To accomplish critical fuel reduction goals, agencies

must be able to conduct prescribed burning outside the designated fire season. Seasonal staffing patterns make this extremely difficult. These patterns also contribute to the critical resource shortages that the agencies experienced during these fires.

During this series of incidents, agencies experienced engine staffing shortages as well as a critical shortage of strike team leaders and other line overhead. These shortages required fireline leaders to dramatically expand their supervisory span of control during high intensity operations, an set preconditions for undesirable, unsafe, and ineffective operations.

Respondents would like to see agencies explore options such as permanent part-time positions to extend the availability of seasonal firefighting resources in southern California.

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