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Southern California Firestorm 2003

Report for the Wildland Fire Lessons Learned Center

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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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The following is an excerpt from the entire report. It is suggested that the reader also view the Introduction to the report to put this section into context.

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.