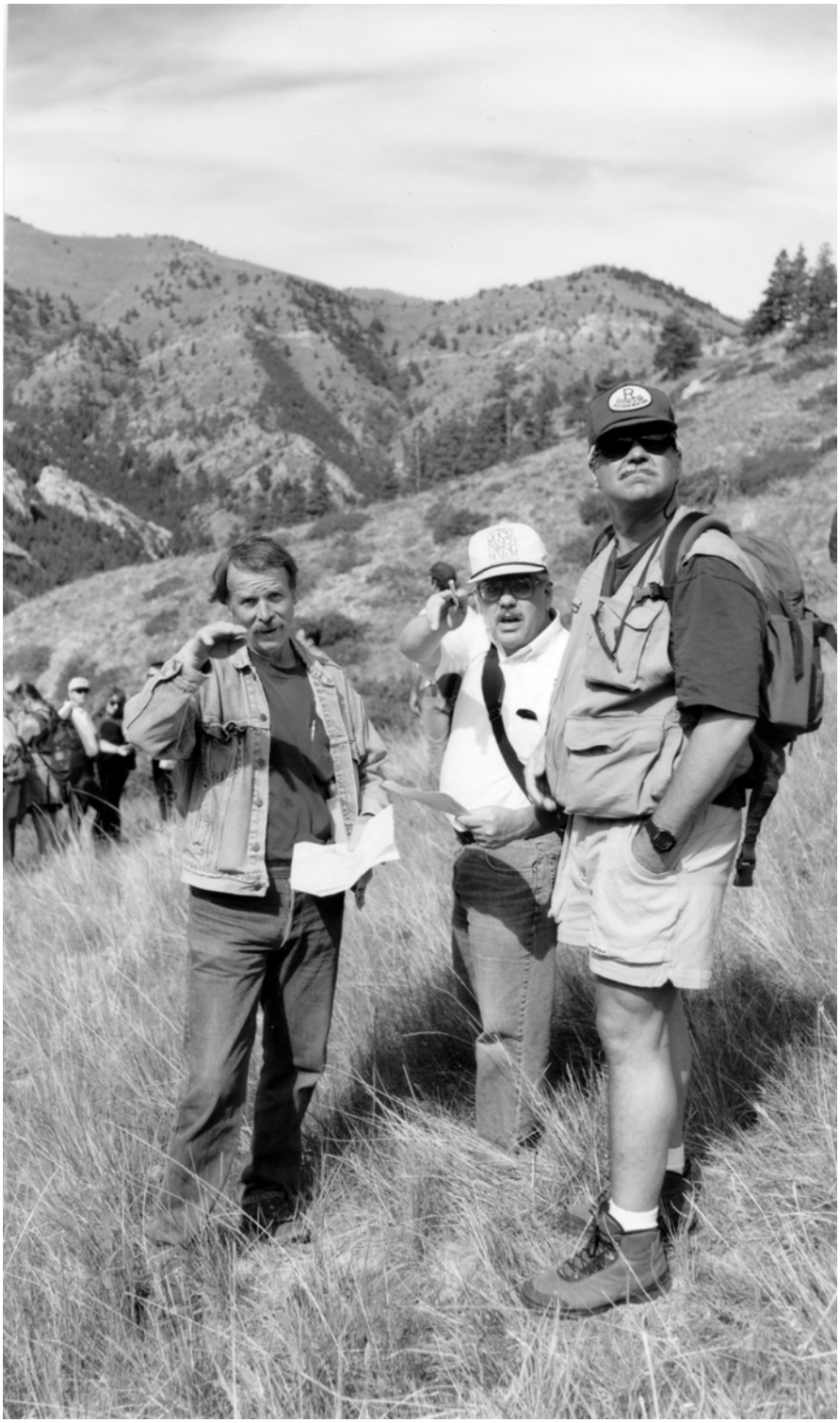
The Start

From the beginning, workshop emphasis was on people, not fire. It was about peopling fires, not fire suppression. With the former, we organize trained people to perform a task safely and efficiently, and the relevant task is fire suppression. In the latter, we suppress fires using people. Historically, this has led to overemphasizing the fire and de-emphasizing and devaluing the firefighter. We have spent millions on fire research but little on firefighter research. We have many fire researchers. We have no firefighter researchers.

On July 6, 1994, we lost 14 firefighters on Storm King Mountain. The investigation of these fatalities clearly showed both psychological and organizational failures. How did these failures come about? What can be done to bring the primary focus back to valuing people? Trees regrow, houses can be rebuilt, but the loss of a life is forever. What has unfolded in the aftermath is a reaffirmation that people are first. All else is secondary in wildland firefighting.

The 1994 fire season in which 34 people died was the catalyst that brought together firefighters, safety managers, psychologists, and sociologists for the workshop. Together we discussed the human side of fighting fires. We examined firefighters, firefighter crews, fire management, fire culture, and fire communities with the goal of enhancing the firefighter amid a more highly resilient organization.

The workshop began with four keynote speakers who discussed new concepts to give firefighters a look into ways to improve themselves, their interactions, and the entire wildland fire community. Kurt Braun discussed the role human behavior plays in safety and injury, with emphasis on risky behaviors common



Mark Linane (left), Bill Bradshaw, and Buck Latapie discuss the Mann Gulch strategies from a “human factors” standpoint.

in the wildland fire environment and how to change to reduce those risks. Gary Klein showed how experienced firefighters used recognition-primed decision (RPD) strategies and how experience is crucial for quick, effective decisions in a fast-changing, risky environment. David Hart discussed cultural attitudes that can enhance or hinder firefighter safety and effectiveness and how training can make individuals and crews more resilient to failures. Finally, Karl Weick introduced insights from high reliability organizations that help improve communication, leadership, group structure, and sensemaking, which in turn decrease stress and the chance of catastrophic errors.

That afternoon and the following day, the workshop experts discussed firefighters, firefighting, and the fireground, and explored the interconnections, emphasizing what was working or what was not. Possible solutions were discussed. The third day participants took the discussion into the field with a trip to Mann Gulch. The fire scenario was reviewed where it happened, including how people interacted with each other, the decisions that were made, and how events unfolded in an increasingly risky, changing environment. Insights not found in original reports were put forth to explain how and why 13 firefighters died on the Mann Gulch Fire. These new insights from a psychological perspective show that analysis and conclusions depend upon the experiential bias of the investigator. The Mann Gulch experience invigorated the participants. The final two days were spent exploring solutions and developing both long-term and short-term recommendations.

The goal of the workshop was not to come up with quick solutions. Rather it was to explore the human issues of wildland firefighting and recommend to fire management corrective actions that would have lasting effects. As with all explorations of human behaviors, the complexity and variety of issues was apparent. But it became clear that a great deal of relevant knowledge already exists that other organizations have institutionalized to reduce risk and improve safety. Before we can use this knowledge in the wildfire context, we must establish baselines for relevant behaviors. Without such benchmarks, we would have no precise way to measure change once corrective changes are implemented.

It was quickly apparent in our discussions that fire agencies are not routinely collecting and analyzing data that would give us a good idea about the current behaviors of wildland firefighters. We don't even collect crucial near-miss information on the wide variety of risks inherent in firefighting. We only do a good job of recording fatalities, Ensely (1995), but this strongly biases our view of normal, routine behaviors. Such a narrow focus precludes warning trends that would become apparent in an analysis of near-miss situations. Therefore, workshop output depended on the experience level and ability to recall relevant information gathered in workshop discussions, but for purposes of future discussion and corrective actions, the information is grouped into the following three main areas.

- A broad vision of how to reorganize wildland firefighting based on insights from High Reliability Organizations (HRO's).
- A specific reorganization of Incident Management Teams and fire crews along crew resource management (CRM) lines.
- Better assessment and feedback for all wildland firefighting activities.

High Reliability Organizations: A Vision for Fire Reorganization

The wildland fire community should reorganize using High Reliability Organizations (HRO's) as a model. Examples of HRO's are nuclear power plants and aircraft carriers.

Characteristics of HRO's include (Rochlin 1993):

- The activity or service is inherently complex in that tasks are numerous, differentiated and interdependent.
- The activity or service meets certain social demands that require performance at the highest level of service obtainable within present safety requirements, with both a desire for an even higher level of activity and a penalty (explicit or implicit) if service slackens.
- The activity or service contains inherent technological hazards in case of error or failure that are manifold, varied, highly consequential, and relatively time-urgent, requiring constant, flexible, technology-intrusive management to provide an acceptable level of safety to operators, other personnel, and/or the public.

  "As stipulated at the outset, the organization must not only meet service and safety goals simultaneously, but also must be perceived to have done so."

Although fighting wildfires is not as technologically complex as classic HRO activities, the management issues are similar, particularly in the urban interface and prescribed fire arenas.

The yardsticks to determine a wildland fire HRO's reliability and effectiveness could include the following (Creed and others 1993):

❖ From whose perspective is effectiveness or ineffectiveness judged?
- Management
- Firefighter
- Politicians
- OSHA
- Public
- Media

❖ On what domain of activity is the analysis focused?
- Safety
- Acres burned
- Houses saved
- Accidents
- Near misses
- Training
- Cause and effect
- Decisionmaking
- Sensemaking
- Attitudes

❖ What level of analysis is being used?
- Individual behavior
- Crew behavior
- Longitudinal
- Baseline
- Culture

❖ What is the purpose for assessing effectiveness?
- Error reduction
- Promoting safety
- Determining causal relationships

❖ What time frame is being employed?
- Short term
- Long term

❖ What types of data are being used for evaluating effectiveness?
- Error rates
- Incidents
- Accidents
- Compliance
- Safety checks

❖ What is the referent against which effectiveness is being judged?
- Agency standards
- OSHA standards
- Similar organizations

In analyzing the safety culture in HRO's, the factors and their contributory weights were (Koch 1993):

Factor	Percent explained by factor
Accountability/Responsibility	23.2
Adaptiveness/Responsiveness	16.3
Openness/Cooperation	15.4
Hazard awareness	14.2
Inquisitiveness/Search for detail	13.2
Role clarity	9.7
Maturity	8.0
	100.0

While HRO's depend more on technological controls than wildland fire agencies, the process of looking at their organizational structure is relevant.

Using the Crew Resource Management Model in Fire

Crew resource management (CRM) focuses on behaviors of crews. Adoption of CRM training and cultural changes has dramatically reduced near misses and accidents in the airline industry. Most of the organizational and interactive behaviors that are part of CRM are relevant to the entire wildland fire community.

CRM focuses on honing seven skills: situational awareness, mission analysis, decisionmaking, communication, leadership, adaptability, and assertiveness (Prince and others 1993; Frantz and others 1990).

These seven skills can be divided into taskwork skills and teamwork skills. Taskwork skills include: situational awareness, mission analysis, and decisionmaking.

❖ Situational awareness is the perception of what the fire is doing and what you are doing in relation to the fire and your goals. It involves an awareness of fire behavior and terrain and the ability to predict where the fire and you will be in the future. This skill depends both on individual perception and sharing it with the rest of the team.

❖ Mission analysis involves organizing and planning. It involves breaking the mission down into subtasks, assigning priorities to these subtasks, and monitoring completion until the mission is over. It begins with an organized briefing and clarifies important issues related to the mission.

❖ Decisionmaking involves deciding which decision model is most appropriate for firefighters, such as Recognition-Primed Decisionmaking. It also involves training firefighters in decisionmaking and using it under simulated stressful conditions. Decisionmaking includes collecting, integrating, and implementing information for the most effective task performance.

Teamwork skills include: communication, leadership, adaptability, and assertiveness. Communication and leadership involve at least two people,

❖ Effective communication primarily depends upon the clarity, quality, and timeliness of the message. Miscommunication has been a causal factor in many accidents.

❖ Leadership skills include delegating tasks, providing feedback, promoting crew motivation and cohesion—all in an atmosphere that fosters openness by allowing crew members to present alternative views without fear of criticism. The most effective leaders take an active role in involving the entire crew in a team effort, discussing interactions required for the tasks, and clarifying norms and roles.

❖ Adaptability refers to the ability to change behaviors during a fire to react to changing conditions and to other crew members. It refers to trying new behaviors when old behaviors are no longer effective.

❖ Assertiveness is necessary to help individuals who may feel intimidated by a person's position or fire experience. It assures that everyone's special knowledge will become group knowledge.

Communication and leadership involve at least two people, whereas adaptability and assertiveness are more individual characteristics.

Components of the CRM Taskwork Skills as They Relate to Fire (Prince and Salas 1993)

Situational Awareness—
- Identify problems/potential problems
- Recognize the need for action
- Attempt to determine why discrepancies exist with information before proceeding
- Provide information in advance
- Demonstrate ongoing awareness of fire assignment status
- Demonstrate awareness of your own task performance
- Note deviations

Mission Analysis—
- Define tasks based on fire assignment
- Structure strategies, tactics, and objectives
- Identify potential impact of unplanned events on a fire
- Critique existing plans
- Devise contingency plans
- Question/seek information, data, and ideas related to fire plan

Decisionmaking—
- Cross-check information sources
- Anticipate consequences of decisions
- Use data to generate alternatives
- Gather pertinent data before making a decision
- Evaluate information and assess resources
- Identify alternatives and contingencies
- Provide rationale for decision

Components of the CRM Teamwork Skills as They Relate to Fire

Communication—
- Use standard terminology
- Provide information as required
- Provide information when asked
- Ask for clarification of a communication
- Make no response (negative)
- Acknowledge communication (okay)
- Repeat information
- Reply with a question or comment
- Use nonverbal communication appropriately

Leadership—
- Determine tasks to be assigned
- Establish procedures to monitor and assess the crew
- Inform the crew members of fire assignment progress
- Verbalize plans
- Discuss ways to improve performance
- Ask for input; discuss problems
- Tell crew members what to do
- Reallocate work in a dynamic situation
- Focus crew attention to task
- Provide a legitimate avenue for dissent
- Provide feedback to crew on performance

Adaptability/flexibility—
- Alter fire plans to meet situation demands
- Alter behavior to meet situation demands
- Accept constructive criticism and help
- Step in and help other crew members
- Be receptive to others' ideas

Assertiveness—
- Advocate a specific course of action
- State opinions on decisions and procedures even to higher-ranking crew member
- Ask questions when uncertain
- Make suggestions
- Raise questions about procedures

This enumeration of examples under each of the seven CRM skills clearly shows the similarity in requirements for success between the cockpit and the fireline. Both place a premium on individuals operating as close-knit teams. Because of this similarity, CRM research data and training courses can be readily tailored to wildland firefighting.

Assessment and Feedback

Assessment and feedback are essential for effective individual, team, and agency success. That is why assessment and feedback are such an important part of both HRO's and CRM. But within the Federal wildland fire establishment, assessment and feedback are used so seldom that the workshop singled them out as the third area of major concern.

Throughout the workshop it was evident firefighters are being sent conflicting messages from a variety of sources: political oversight, the agency, the public, and the fire organization. Most firefighters feel the task of putting out the fire is primary and concern for their safety is secondary. Despite claims to the contrary, safety is not yet the number one priority.

Firefighters want to be safe and avoid injury, but there are times when the demands of the job obscure safe practices. To deal with these instances, firefighters need to be equipped with better situational awareness and decisionmaking skills. And they need feedback about how they are performing these tasks. Individuals and crews seldom receive feedback. But without it, there is no way to measure performance improvements. Assessment is needed at all levels of the fire organization to establish a baseline for policy, attitudes, and behavior. As changes are implemented, measurements can determine results. Feedback at all levels is crucial for achieving positive changes.

Dave Thomas points toward Wag Dodge's escape fire while Ted Putnam and Dave Turner consider his analysis.

The first three days focused primarily on determining where the fire community is organizationally, where it should be going, and how the needs of both the firefighters and the fire organization could be brought into closer alignment, with safety the first priority. Workshop participant inputs were organized into three areas: (1) reorganization strategies for fire agencies based on HRO's; (2) fire management Incident Management Team (IMT) and fire crew reorganization using CRM as a model; and (3) better assessment and feedback. The fourth day focused on future organizational studies, changes, and training that would move safety to the forefront and improve firefighter attitudes and effectiveness.

Fire Organization and Culture

❖ The wildland fire agencies should compare themselves with HRO's and use research results to improve the agencies.

❖ Fire crews should be organized using relevant CRM concepts for improved safety and effectiveness.

❖ There is a need to clarify management and public expectations of firefighters. Management and the public need to be more realistic in their expectations of the fire community. We should not feel pressured to do more while resources continue to dwindle. We cannot always do a good job with what we have now, and the situation is getting worse. There are too many conflicting messages about safety first versus getting the job done.

- Maximizing forest growth means more severe fires in the future.
- Often politicians and the public exert pressure to go all out to save homes in the interface.
- Unqualified personnel are making firefighting unsafe. This includes inexperienced EEO, downsizing laterals, and others who have not worked their way up in the fire organization with a combination of training and experience.
- Lack of financial and position incentives to keep experienced firefighters in the organization.
- We taught the public we should and can control all fires. Now they expect us to fight all fires with people, planes, helicopters, and retardant. This has led to higher cost fires and more risk taking in the sky and on the ground. There is a real need to re-educate the public about all the issues of fire management. We need to return to a more natural view that all fires are not stoppable in the same sense that we cannot stop hurricanes, earthquakes, floods, and other natural events.
- Management needs to redefine "success" and "failure" in firefighting, together with priorities and consequences. Evaluate all messages against agency goals especially the goal of safety first. Eliminate miscues.

❖ It is easier to modify behavior than attitudes. Changing attitudes occurs after a 3- to 5-year effort. Attitudes need to be exemplified in behaviors.

- Agencies are not well organized to handle extended initial attack and transition fires, where most fatalities occur.

- The current fire culture does not foster respectful interaction. If a fire is going to blow up, is it culturally acceptable for anyone to voice an opinion? Do all firefighters have the courage to raise this point? All firefighters should be allowed to verbalize their fears. Firefighters should be given situational assessments in a respectful context. When the situation is unsafe, they should also be allowed to pull back without loss of respect or threats. There is a need for organizational clarity on factors involved in not engaging or disengaging, and when these factors align to result in action to pull back. Some crews and crew supervisors have a good, experience-based comfort level for when to pull out, whereas others do not.

- Firefighters need to be responsible for their own destinies and help work through the "more with less" period. It will be worth it in the long run.

- We need to identify constants between firefighters' attitudes and management, and identify firefighter rituals, norms, values, etc.

- What is controlling fires about? What are we trying to do? Who is making sense out of all this—fire management? Firefighters? Are we on the same mission? Whose vision?

- Are rational models of fire organizations synchronized with the informal work culture?

- Worsening organizational strains include mixing personnel, declining experience levels, uncertainty of experience, under-funded training, downsizing, then placing laterals and EEO personnel with little or no experience in high responsibility fire positions.

- There is a critical organizational need to rebuild a sense of community from the top down and the bottom up, because it seems to be disintegrating now. If it takes up to six weeks for crew cohesion and trust to develop, are people and crews really interchangeable as managers presume? Are there better ways to accelerate cohesion and trust? Continually emphasize the fact that the humanity of the fire community is far more precious than any other resource. Remove barriers and inconsistencies between cultural expectations and actual practices. Promote better cohesion.

- Cultural differences between groups of firefighters:
  - The public and firefighters promote group images that pressure "elite" groups to "aim to please" and "live up to expectations."
  - The group culture affects risk taking and decisionmaking.
  - More respectful interactions are needed to bring expectations into line with capabilities, for a better sense of community.
  - Management and IMT's need to take group differences into account.
  - Elite crews need to feel that they are allowed to back down from risky, unsafe actions without any loss of respect.
  - Crews of different racial mixes have unique cultural concerns.

- Too many red-carded personnel do not have the expertise indicated by their cards and positions on fires. As a result a mistrust of all individuals is growing, and this in turn is a mistrust of the organization. There is an "us" versus "them" attitude between firefighters on crews versus IMT's or FMO's and dispatchers. Most of the training opportunities, hence higher red card ratings, go to PFT's as opposed to seasonals who have considerably more fire experience. Filling fire vacancies with engineers, foresters, and EEO candidates rather than seasonals further undermines the experience base, and it is getting worse. Creating unsafe managers through hiring practices flies in the face of upper level management pronouncements about safety first. These "new" fire managers who do not see the big fire picture often are overzealous micromanagers. The agency needs to take a hard look at qualifications of FMO's and dispatchers. They need CRM type training to better size up situations, make good decisions, and communicate the outcomes in an open, two-way atmosphere. There are too many incompetent people on the fireline. The red card system is failing, which puts more firefighters at risk. New evaluation processes such as "hot-seat" simulations, panel reviews, etc., are needed for key decisionmaking fire positions, to eliminate the possibility of one person being able to sign off another in a "buddy system" because of perceived pressure or because the organization needs them. The rating system must be consistent throughout the nation and between agencies.

- Management needs to stop talking and promote actions that foster real changes in the organization. Policymakers could use decisionmaking and situational awareness training.

- Working safely is a natural outgrowth of clear, effective management and leadership. It is the result of actions, not words.

- Most of the fireline firefighters are seasonal employees. What is the best way to organize, train, and acculturate them for the future benefit of both them and the fire community? There may be real benefits to bringing them on two weeks before the start of the fire season to foster safety training and cohesion. Currently, most

recognition goes to permanent employees. More recognition of seasonal employees and their value to the program is needed. Better incentives for seasonal workers would promote safety and learning.

- Organizational defensive behaviors are leading to unsafe practices. When investigation teams or managers cover up the causes of accidents and near misses, no learning takes place for the individuals or the organization. There is a need for forthright information and open discussion at all levels of the fire community.

- Psychologically, there is more pressure on firefighters to put the fire out than to do it safely.

- There appears to be too many fire orders and watchouts. A formal content analysis study may be able to reduce these guidelines to a few key ones such as LCES (Lookouts, Communications, Escape safety zones) that then should be prioritized. If some should never be violated, no matter what the circumstances, then they should be identified. Some fire orders and many watchouts are routinely disregarded. This is necessary at times to accomplish some fireline tasks and can lead to violating orders that are not just guidelines. When an order is violated and it works out okay, this can lead to more future violations. There is a general feeling that you must violate some, but that can get you in trouble when you string them together. Need to look at all the orders, watchouts, LCES and reorganize them for maximal clarity, minimum rules with clear direction from management, then enforce them routinely. Since attitudes and rules do not always predict behaviors, who is responsible for oversight and ensuring compliance?

- The agency should reorganize to support the firefighters and maximize their potential. The firefighters want to perform at a high level and need the organizational support to achieve that level. The agency has made fire suppression number one, and this needs to be changed so people are number one.

- There is an agency failure to follow up to see if objectives, training, etc., actually accomplish their goals. Often management sets things in motion without any idea what effect it produces in the field. Without feedback the organization does not learn.

- Fire managers, IMT's, and fire crews should periodically shut down their entire operation for a day, especially after near misses or accidents. Stop doing normal routines and reassess larger goals. Groups need to focus on what is going right and what is going wrong. What is the worst that can happen, and what can be done about it. Organizational shut downs can be valuable learning experiences.

- Agencies should encourage more job swapping for one year or one fire season. Examples would be hotshot/ smokejumper or FMO/hotshot swaps. We could also have a safety officer, FMO, or dispatcher shadow a hotshot crew or be shadowed by a hotshot. This would help bring down barriers and create a true community feeling.

- The long-range forecast is for a period of cooler fire seasons. This is coming at a time of accelerated skill erosion of fire personnel, fewer FTE's and declining training dollars. As prescribed burning increases tenfold, the "classroom" should be moved to the burn site. OJT needs to be incorporated into the prescribed burn process.

- There is a need for more FTE's and career tracks for key firefighter supervisory personnel in order to promote better experience levels and provide a more professional nucleus for supervising seasonal hires. A shift should be made to more tenured firefighters as opposed to more FMO's and managers. Overdependence on firefighting as a collateral duty has diluted the professional firefighter base.

- Type I crews should have common physical fitness requirements. Current standards are too low, and the poorer fitness levels of a few are compromising the safety of the rest of the crew. This problem is especially disturbing when supervisors are less fit than their crews.

Fire Management, Incident Management Teams, and Fire Crews in a Crew Resource Management Context

Situational Awareness (Size-up)

- Basic situational awareness is highly dependent upon good information, skill, and experience. It is one of the most difficult skills to master and is a weakness in the fire community.

- Although basic subskills are taught in various classroom courses, little is done to see if the overall skill has transferred to the fireground.

- Most firefighters possessing situational awareness demonstrate declining performance as the fire accelerates. This indicates a need for simulation training in faster paced decisionmaking, to facilitate quick size-ups that keep pace with the fires.

- With lower tempo fire situations, we have better recall and use rational processes for assessing our situation. With high tempos, rational processes are too slow. We need recognition-primed decision (RPD) skills that come primarily through years of experience.

- The focus here is more on sensemaking than decisionmaking. Sensemaking (Weick 1995) is observing or creating patterns as we experience reality. These conceptual expectations form the basis to comprehend, explain, attribute, and predict events. It is experience driven rather than a logical decision process. When expectations are disconfirmed an ongoing activity is disrupted and then sensemaking is the process of coping with interruptions and surprises. It is the process of making things sensible.

- During OJT, situational awareness needs to be an expected, formal action and made public to others or written down. Then feedback should be used to compare predicted versus actual results to improve predictive skills. Otherwise, we tend to revise our past predictions to fit what actually happened. This latter process actually makes us worse at predicting future events. Later, under high-tempo conditions, this skill will be fluid and rapid.

- Part of the process of understanding situational awareness is to ask what are the adverse effects of incorrect size-ups.

- Does the local FMO or dispatcher accept your size-up? Do they give you all the resources you order? Are the resources timely? How does your situational awareness compare to theirs? Do they advise you of resource status, recommend alternatives, and assess consequences?

- Situational awareness is critical for making decisions on whether or not to fight the fire and later on whether to stay engaged or disengage from the fire.

- The higher the tempo the more often you need to perform another situational check.

- When any significant event changes, then another situational check must be made. When situational checks become too frequent, this is a cue to consider disengaging.

- Whenever you become unsure of your situational assessment and vacillate over various inputs then “safety first” directs you to assume the worst because people tend to underestimate the severity of situations. For example, if you are vacillating between whether the situation is severe enough to order retardant, then order the retardant.

- Part of situational awareness is to have a clear understanding when you are getting in over your head, when the situation no longer makes sense. Then it is time to call for more resources or to pull out.

- There should be a requirement to communicate revised size-ups among crews, FMO’s, and dispatch every “x” hours, depending on fire danger and time of day.

- Identify situations requiring heightened awareness such as extended initial attack, transitions, interims until resources arrive, urban interface, the actual arrival of the resource, and interims after accidents or near misses.

- May need a checklist of factors to consider when sizing up a situation so no factor is missed. As a minimum, LCES should be included. Discuss emergencies, what are the early warning signs and what to do if they occur.

- Part of situational awareness should include giving good briefings and debriefings that communicate all the essential facts. This becomes the basis for the situational awareness of other firefighters. There should be standard briefing practices that are given and expected. Briefings should be face-to-face whenever possible. Ask questions to see if the essential content of the briefing has been understood.

- A pre-accident situational awareness would be to run through all known and suspected risks associated with a fire. This initial information becomes a checklist to consider once you get to the fire.

- Need a good sense of time. How long do certain actions take, how long until resources arrive, and how long to shadow during transitions?

- Situational awareness cannot be mandated. We need people to be thinking, discussing, and observing constantly for most effective use of this skill.

- Consider using the Campbell danger rating system or one like it for formalizing situational awareness and the language to communicate it to others. Need a system that teaches inexperienced firefighters to size up fires the way experts do. The same system should be used by the Incident Commander (IC), FMO, and dispatch for maximal information transfer.

- Part of situational awareness is knowledge of safety and deployment zones, escape routes, and escape time. This must be planned and communicated to all firefighters. Emergency actions must be well practiced and understood for them to be available and effective when needed.

- Situational awareness should include the fire, other people and resources, and a periodic internal check, and how all these interrelate over time.

- What are situational awareness red flags?
  - Change—large, unexpected, faster rate
  - Expectations not met—resource changes, times
  - People not communicating
  - Stress—various stresses are additive

- FMO's at the district, forest, or area level must develop clear criteria for determining when they are in severe or extreme fire danger. Then they must warn against business as usual and function in a high-tempo mode. They must communicate the situation to local and nonlocal fire personnel.

- Dispatchers, FMO's, coordination, and resource allocation centers must develop clear criteria for determining when they are in over their heads and then call for help. The process and criteria must be in place before the need, then reviewed weekly or daily as the fire season progresses.

- It is useful to project a likely situation and a worst plausible situation, then build a plan that can survive the worst plausible situation and can also work effectively for the likely situation.

- Judgment of safety margins, patterns of cues that signal that risk is too high, must be carefully trained before the assignment is accepted or crews deployed. It is easier to avoid than get out of a bad situation. The judgment can be refined to reflect changing conditions to determine when the safety margin has been gradually reduced to a point where it is unacceptable. Gradual reductions are particularly difficult to observe.

- Training should ensure breakpoints are overlearned for improved safety. Breakpoints involve the rapid recognition that the situation has become untenable and, rather than cope and adjust, it is time to radically change the game plan; survival has become the number one priority. This includes learning to abandon firelines that were built at considerable cost of effort.

Mission Analysis

- Mission analysis begins with overall fire strategies and tactics, situational awareness with size-ups and briefings. Then the larger tactics are broken down into specific tasks, task assignments are made, tasks are monitored, then tactics reassessed.

- Mission analysis tends to work well except for extended initial attack and transitions, and during interims before resources arrive, etc. In these situations environmental changes are occurring faster than strategies, tactics, and tasks can be changed to try to keep the mission on track.

- Mission analysis also includes awareness and knowledge of when the mission can no longer be accomplished safely. Do not start, or disengage as appropriate.

- It is crucial for overall mission success to explain the mission to the crew, explain their individual parts, then allow them a chance to ask questions and clarify the mission. It involves both briefings and debriefings. End of mission debriefings are important learning processes for transferring knowledge and learning.

- Mission analysis must take into account LCES and be ready to implement alternate plans when current plans fail. Complications occur with mixed resources, indefinite resource arrival times, and unexpected fire behavior.

- Each team member must have appropriate training and knowledge to accomplish a specific task. Mission analysis must clarify roles and ensure each person performs a role, yet interacts well with people or crews they border. When the mission changes, the people may need to make role changes quickly. The more risk or faster the tempo, the more supervisors must pay less attention to specific work tasks and more attention to the big picture and oversight supervision. At some point everyone must switch to emergency roles where escape becomes paramount and all individuals stop ordinary actions and focus on supervisory orders.

Decisionmaking

- Different decisions necessitate different models. A rational model looks at strategic decisions and therefore prescribes best tactics. Naturalistic models look at decisions under stress with minimal response times and focus on making sense of the situation and taking rapid action to alleviate problems. RPD is a naturalistic model. Firefighters need training with both models and guidelines that help determine when each model is better.

- Current firefighters receive little or no training on decisionmaking skills. Firefighters need to recognize a need for balance between individual decisionmaking and group decisionmaking. They need training on how situations, stress, other people, and groups affect their decisions, and on aids for clear decisions. They need to discriminate between sensemaking and decisionmaking.

- Training needs to be specific to the job. Firefighters need to make tactical decisions, and managers need to make organizational decisions.

- Factors in decisionmaking:
  - Decision point or branch
  - Errors
  - Does person have prerequisite skills?
  - Biases
  - Cultural differences
  - Intelligence differences
  - Reliability of the information

- Need to study decisionmaking in crews, operations, and IMT's. Training should be group specific. Some positions, such as division and crew superintendents, may need more than one type of training due to variable roles.

- Currently there is no clear sense of what is expected of firefighters. Institutional messages are conflicting, so decisions are not always consistent with management

expectations. Firefighters are asked to take risks, fight fire aggressively but safely. Where is the boundary between risk and safety. Who decides on where the boundary is: management, IMT, crew supervisor, or individual firefighters?

❖ There is a need to do a factor analysis on all the decision aids currently in vogue:
- 10 Standard Fire Orders
- 18 Watch-out Situations
- 5 Common Denominators
- 4 LCES
- 10 Downhill/Indirect Line Construction Guidelines
- 9 Urban/Wildland Watch-outs

56 total

A factor analysis would reduce these to a bare minimum. They should be grouped into never violate, transgress with extreme caution, and watch outs to avoid. If all these aids are only guidelines, then we should not criticize firefighters who do not follow them perfectly and accept that they made the best decision given their experience, training, and awareness level. Putting them in order of priority would help.

If we adopt a rule "safety first," then it must be reflected in all decision aids or at least be the top priority.

❖ Internal Watch-outs
- Physical fatigue
- Mental stress
- Fear/Anxiety
- Tight stomach muscles
- Action tunneling
- Want to speak out but don't
- Overconfidence, confidence increases
- Decisions made without feedback
- Situation ambiguous or doesn't make sense
- Microsleeping
- Changing belief to match action
- Accepting increased risk
- Recent family problem
- Organization or individual distrust

❖ Intrapersonal/Crew Watch-outs
- Two inexperienced persons in direct line of command
- Other person/crew is tired or stressed out and is making crucial decisions
- Person won't talk or is hostile
- Cocky, overconfident individuals
- Group polarization
- Declining communication and feedback; supervisors are reluctant to ask for help
- It is unclear who is in charge of the "big picture"
- Group consensus without sufficient information

❖ Management Watch-outs
- You don't receive resources or the dispatchers argue about what resources you need
- Resources will be late arriving
- Politicians are in the area
- Multiple agencies are involved
- Dispatchers/FMO's keep track of things in their heads rather than on paper
- Norms for radio discipline are loose
- Agency is reluctant to ask for help
- Administrators are getting on-the-job training
- Administrators say keep it simple
- When overheads are unknown or tough to find
- Dispatchers are more concerned with homes than firefighters
- News media are in the area
- Tensions and conflicts exist before the fire season

❖ Stresses that interfere with good decisionmaking include:
- Anxiety
- Frustration
- Noise
- Alcohol
- Heat
- Fluid loss
- Drugs
- Fear
- Anger
- Sleep loss
- Vibration
- Hunger
- Cold
- Time pressure
- Time of day
- Incentives
- Punishments
- Personal problems

Stresses are additive!

❖ Stress affects decisionmaking by:
- Lowering awareness
- Lowering concentration or ability to focus
- Making it harder to access long-term memory
- Locking us into repetitive, habituated behaviors
- Focusing more on task, working harder, and ignoring environment

❖ There is a crucial need to study factors involved in deciding whether to engage or disengage a fire. This includes initial attack and standard fireline duty. This whole area is vague to firefighters.
- What objective factors are involved?
- What subjective factors are involved?
- What is official agency policy? Rules take pressure off individuals.
- What rewards and punishments affect the decision?
- Where is the boundary between safety and normal, risky, aggressive firefighting? How narrow is the margin of safety?
- After difficult engagement decisions are acted upon, we need to follow up with good feedback and debriefing, then use the incident to improve decision factors.
- Must use a common language so it can be discussed more accurately.

❖ Should agencies enforce the use of LCES at all levels? Needs to be top to bottom, bottom to top. If institutionalized, LCES would be part of every briefing on the fireline, as well as for the IMT, FMO's, and dispatchers.

❖ Can LCES be an absolute, never violated? What are safety zones if a spot fire is in the middle of a 5-square-mile brush field? Do you need a lookout? Or does the procedure that says to discuss fire in relation to LCES become the basis for situational awareness on which to make the decision to engage?

❖ Making decisions without feedback shouts watch out. The tendency is to be overconfident when feedback is weak. No learning without feedback. Should give feedback to others and expect it from them.

❖ Explore types of decisions and when they are made. When are most crucial decisions made? Do we make them in an active or reactive state? If much information is being processed, is the information reliable, timely, and necessary? Are inputs assumed or is a checklist used?

❖ Consider adoption of the Campbell danger rating system or one like it to foster better decisions.

❖ Currently, there is no training to teach you when you're in over your head. Usually, by the time it sinks in, your safety has been compromised. Tendency is to hang on too long because it is admitting defeat if you do not. There needs to be more agency direction here to take pressure off the individual. Need training to recognize cues and early warnings to pull out or to ask for more resources before the situation becomes desperate. FMO's, dispatchers, and others need to monitor fire activity and assume a more active role in these decisions from a position of mutual respect with the IC.

❖ When there is a difference between expectations/beliefs versus action, we change our expectations and beliefs to fit our actions. If we are trying to foster new expectations such as "safety first," then we need to use incentives to reinforce the expectation and use feedback to correct inappropriate actions.

❖ When a group of risk takers is put together, the group will take more risks than any individual would take alone. This and other factors associated with risk taking need to be incorporated into the decision process. Even the way you think about risk affects risk taking. When we talk about saving something we are more conservative in taking risks. When we talk about losing something we will take greater risks.

❖ Information occurring close in time tends to be automatically linked together even when it is unrelated. Be aware of this when making decisions. When unsure of information, request clarification. Also be careful about how you put information together to brief others.

❖ Factors affecting whether to engage or disengage:
- Fire resources committed
- Fire resource timing
- Risk assessment
- Fire behavior—actual and expected
- Urban interface
- Public pressure
- Political pressure
- Value of resource you are protecting
- Recognized options
- Clear management guidelines

Communication

❖ Functions and Problems (Kanki and Palmer 1993)
- Functions
  - -Provides information
  - -Establishes interpersonal relationships
  - -Establishes predictable behavior
  - -Maintains attention to task and monitoring
  - -Is a management tool
- Problems
  - -Lack or misinformation
  - -Interpersonal strain
  - -Non-standard, unpredictable behavior patterns
  - -Loss of vigilance, situational awareness
  - -Lack of or misdirected leadership

❖ Communication on the fireline
- Good within a crew but not between crews
- Better between similar crews (i.e., hotshots)
- Better between people who know and trust each other
- Hard during transitions; need guidelines
- Need more skill training on maximizing information with fewest words
- Need to foster a cultural attitude of respectful interaction to promote trust
- Temporary employees have a hard time communicating upward
- Need nonthreatening method to communicate personal experience level. Try to communicate face-to-face as soon as possible.
- Need for more dialogue when people first meet, even if on radio, as this reduces the number of words needed for effective communication later as the people better understand each other's point of view.

❖ Story telling is an effective method for communicating agency values and lessons learned.

❖ Essential to have a common language (English), common terms, and common expectations (size-up and LCES) to convey more information in less time.

❖ Need for training, especially supervisors, IMT, FMO's, and dispatchers on interacting more effectively and removing mistrust and communication barriers. Need language and training to resolve differences of opinion as opposed to avoidance or going around someone we have difficulty with.

❖ Everyone in the fire community needs to talk and interact more with their counterparts both during the fire season and off season. This will re-establish a feeling of fire community and trust and improve communications when the tempo increases in severe fire seasons.

- Greater information flow up, down, and across improves everyone's experience and competency. This process takes years to develop. We should start now, stay enthused, and expect change over a longer period of time.

- Need for open dialogue when problems occur. Discuss and manage problems while they are small and less emotional. If you're thinking it, express it out loud.

- Firstline supervisors set the tone for communications. Agency must send clear signals to supervisors concerning their responsibility to promote open, two-way, respectful interaction. Supervisors should lead crews to avoid emotional-laden topics until mutual respect and crew cohesion have formed. Supervisors should clearly communicate expected norms of behavior, then use incentives and feedback to ensure compliance. Crews and individuals want cohesion and trust if it's allowed to develop naturally.

- Need a common tactical language such as the Campbell danger rating system to foster clearer communication of fire behavior, expectations, briefings, and feedback.

Leadership and Cohesion

- Leadership is a crucial skill for improving firefighter safety. An open, democratic leader promotes crew spirit, cohesion, and maximum crew growth. This occurs through an active teacher/mentor role to foster crew knowledge. A cohesive, knowledgeable, open crew is a safe crew.

- After a size-up, a good leader shares the information with the crew. Individual crew members are encouraged to do their own size-up, determine the outcome, and ask questions about why their size-up or the leader's size-up was on or off target. The leader should quiz crew members, who in turn should quiz the leader.

- A good leader provides maximal feedback to the crew to foster crew learning. The leader shares experience, training, and knowledge with the crew.

- In times of declining budgets and training dollars, a crew leader must take the classroom to the field on the job.

- On initial attack and transition fires, it is not always clear who is in charge. When authority is delegated, the chain of command should be clear to all firefighters. Official transfers should be face to face and signed in diaries. If a leadership change occurs on the fireline, the change should be relayed to dispatch and recorded.

- All leaders must have leadership and supervisory training, even if their official jobs do not require that skill. To be a leader on the fireline, you must be trained. Too often untrained leaders regress to being regular firefighters when conditions become stressful.

- Leadership training for firefighters is poor. Being an office supervisor does not equate to being a leader on the fireline. We need to determine what skills a fireline leader needs, then train people in those skills. Many problems occur on the fireline due to assuming office rank equates to fire rank.

- There is no good system in place to promote individuals who excel in fireground leadership. More FTE's should be set aside to create a career track for people who exhibit fireline leadership. They are the nucleus of the fire crews, and their experience is essential for safety on the fireline.

- It is essential for crew leaders to debrief their crews after each incident. Leaders should insist on a debriefing from the IMT or IC and give their own debriefing to the crew. This feedback is essential for learning to occur. Leaders should give orders, then explain them as much as possible.

- Crew supervisory job descriptions should be revised to reflect the need for people who are open and honest, and who can act as teachers and mentors as well as being skilled in leadership and knowledgeable about fire behavior.

- All incident leaders need to foster more intermixing between people and crews to create an open atmosphere for sharing experiences and knowledge. This should be expected behavior among all firefighters.

- Identify skills needed for effective fireground leadership, including:
  - Command and control practice
  - Time and space relationships
  - Quick, bullet-type communication
  - Stress awareness
  - Experience
  - Situational awareness and assessment
  - Criteria on when to engage or disengage
  - "Hot-seat" decisionmaking under stress for quicker decisions—RPD type decisions
  - Task assignment
  - Mission awareness

- Leadership training courses should be mandatory for all IC's and division superintendents. Courses should be Marana style (upper level) with simulations under stress.

- There is definite skill erosion during light fire years. Leaders should be heavily involved in prescribed fire to hone skills.

- When leadership changes on the fireground it should be formal:
  - Face to face
  - Declared to dispatch and entered in the dispatch log
  - Both IC's should sign diary with time and date of exchange
  - Consider other positions for sign off (in addition to IC's)

- Leadership, crew cohesion, and safety are strongly correlated. Open leadership style fosters better cohesion and safety.

- Good crew supervisors do not focus on safety but rather on good supervision, crew cohesion, and work ethics. Safety is the result. Supervisors who constantly talk about safety have more accidents than those who focus on working relationships.

- A lot is known about crew leadership, cohesion, and trust, which takes 6 to 8 weeks to develop. It may develop quicker for fire crews. Is there a way to study this and accelerate the effect?

- When people off districts, forests, etc., are brought together to form a crew, they are much more effective and safer if they spend a day together getting to know each other before going on the fireline. This technique should be further investigated as a method to speed up group cohesion.

- There used to be a better sense of fire community among firefighters and managers. Has this sense been lost or has the fire family become dysfunctional?

- Leaders need to work with crew members and promote respectful interactions; encourage their input so they feel part of the crew. Once leaders get input, crew members should expect leaders to make decisions and lead them to accomplish goals.

Adaptability/Flexibility

- Adaptability skills need to be addressed. How flexible are wildland firefighters to quickly change tactics as environmental conditions change? Do our crews stay too long at the task at hand when a new approach is called for?

- Need flexibility to keep reassessing the situation on a routine basis.

Assertiveness

- Assertiveness is natural for some firefighters. But for others, it is a skill that must be learned, then practiced.

- Leaders of teams and crews are pivotal in creating a climate that encourages all firefighters to speak up.

- Firefighters have a tendency to internalize what's bothering them rather than speak up about it. We need to emphasize more external dialogue.

- We also need more assertiveness between leaders to communicate their size-ups to others and to discuss their experience level with others. We need this exchange so both leaders perceive the same external environment as a basis for future decisions and know what to expect from the other person based on their past experience.

- Assertiveness is also necessary to request fire and weather information, briefings, debriefings, etc., when they are not given. This includes asking questions or requesting that someone repeat information you did not understand.

Assessment and Feedback

- The current system for reporting entrapments is working, but not very effectively. Some entrapments are reported only after long delays, and some aren't reported formally until someone follows up on rumors and pressures a person or crew to fill out the forms. This system should be re-examined and made more effective. Firefighters should not have the option to fail to report entrapments without penalty. They should not be penalized when they do report entrapments in a timely manner.

- A new system must be implemented to record and track near-miss situations for all wildland fire operations. It should include all accidents and incidents, even minor ones. This baseline information is necessary to determine where we currently have problems and if management or training changes decrease near-misses, accidents, and incidents. This system should be modeled after the airline industry where there is no penalty for calling in an accident or near miss when reported at the earliest opportunity. An open, nonthreatening system will promote more frequent and more accurate reporting, therefore greater safety.

- It would be useful to have trained individuals or teams go out on the fireline each fire season to observe crews and individuals in action. The information gathered would show whether training or management objectives have transferred to the fireline. IMT and crew members could be quizzed or interviewed to determine skills and knowledge.

- The agencies should require that leaders reassess their situation every 15 to 60 minutes, depending upon fire danger. Taking time out to reassess allows you to determine if new actions are required. There should be a formal checklist like LCES.

- Every person in the fire community and on the fireground needs to increase communication and feedback up and down the chain of command to maximize learning. Everyone needs to become more expert at both giving and receiving feedback.

- Attitudes don't always predict behavior. So it is important to determine what behavior is encouraged or discouraged in the actual work environment. What are the real consequences for following various orders. Stories, games, and videos are three methods of communicating expectations and consequences.

- Once entrapments and close-call data are analyzed, the facts must get to individual firefighters for learning to take place. This feedback heightens situational awareness and the ability to recall the information if needed. The individual and crew names can be removed as long as the key facts are well communicated.

- Firefighters need quality briefings when they first arrive on a fire. If they start out behind, they will remember and process less information in critical situations.

- Individuals must practice behavior before it happens automatically.

- Consider a 1-800 hotline to collect safety data. It should be a nongovernmental agency to ensure higher reporting rate and anonymity.

- Try to teach in the field as much as possible. It promotes better learning and recall because that's where it will be needed in a critical situation. Prescribed burns are a great classroom setting.

- An agency protocol is needed for briefing each other on our current firefighting qualifications. The red card ratings are deceptive and there needs to be more face-to-face discussion of qualifications to size up individuals or crews you will be working with. That is part of the overall situational awareness. What is agency protocol if you feel the other person isn't qualified?

- There is a need to explore alternative training and feedback methods:
  - Interactive investigative books
  - CD games
  - Hot-seat simulations

- MTDC should publish a quarterly human factors newsletter similar to ***Health Hazards of Smoke.*** Target all fire safety personnel and firefighting crews in addition to normal region/ forest/district distribution.

- Are extended initial attack, transitions, urban interface, helicopter downwash, etc., really our most risky, hazardous situations or is this rumor? What are the trends and how significant are they? What are the situations that cause the most firefighter injuries?

- Start using computers to move people to and from fires and while on fires to eliminate all the waiting time. Figure out ways to use down time for training.

- Small individual AM receiving radios are a dollar or two. If each firefighter wore one, it would be a means for broadcasting weather, fire behavior, news, and other general information.

- Situation checks should be required within a crew and among crews as a double check that everyone agrees with the situational analysis. The check could follow LCES. Respectfully discuss differences. When a situation gets critical, ask the recipient to repeat the analysis back to you.

- Fire safety officers should do spot checks on safety equipment and practices. They can determine what training has been given and if firefighters know the basics. They can ask firefighters to give them a situation size-up based on LCES and hazards in the immediate area.

- Need better, consistent post-fire debriefings for individuals, crews, and IMT's. The process should encourage feedback both up and down the chain of command.

- Need a long-range look at what we are about and what we do. Need longitudinal field studies to accomplish this task. This would make it clear whether management objectives get incorporated into behaviors in the field.

- Greatest safety factor on the fireline is clear thinking. Look for clues, analyze the input, and predict. If you can't predict, then stand back and watch what's happening until you can predict. Then take action based on clear thinking.

-End Part 2-