CONTENTS

EXECUTIVE SUMMARY

There are many characterizations of wildland firefighters and their work culture. These characterizations vary across all levels of organizations, jurisdictions and types of jobs. As closely held as these perceptions are, as confident as each of us is with our own perceptions – it begs the question of what a systematic look at firefighters and their culture, from within and without, would reveal.

This report summarizes the results of Phase II of a four phase study to examine the Federal wildland firefighting community and to improve firefighter safety. The first phase described the strengths and problem areas of the current organizational culture, and considered leadership and accountability issues, human factors, and external influences that affect firefighter safety in the five federal agencies most directly involved in wildland firefighting. These include: the Department of Agriculture Forest Service, and the Department of the Interior Bureau of Land Management, National Park Service, Bureau of Indian Affairs, and Fish and Wildlife Service. Phase II defined the desired organizational culture of the future that will enhance safety. Phase III will identify the implementation steps needed to move from the current culture to the desired culture of the future, and Phase IV will evaluate, assist in, and monitor the change.

The focus in Phase I was on systematically interviewing and surveying over 1000 federal (and some state) wildland firefighters to get their perceptions of the underlying issues of firefighter safety, and the organizational culture in which they operate. All ranks from basic firefighter to agency administrator were included. Senior experts on wildland firefighting were interviewed and the literature reviewed. The study considered all factors that wildland firefighters said were important to safety.

The Phase I report summarized the current organizational culture, leadership, human factors and external factors that affect safety. It identified the strengths of the current system with respect to safety, and a wide array of issues that need attention –about 250 issues falling into 24 general categories.

The results of Phase I were used in Phase II to define a set of goals for guiding the five agencies – a vision of the future organizational culture, leadership, human factors and external environment that would improve safety.

Ranking of "Solutions" From the National Survey

In addition to identifying problem areas, the national firefighter survey undertaken in Phase I had firefighters rate the likely impact of 114 proposed "solutions" to improve safety. Most of these proposed "solutions" had been suggested by firefighters in the course of in-depth interviews in Phase I, with some additional input from experts and the literature. Table 1 shows the top rated suggestions. There was generally good agreement across agencies, geographic areas and other subgroups.

Table 1
Solutions with Highest Score of "Much Positive Impact"
(Over 50 percent)

SURVEY QUESTION NUMBER	SUBJECT	SOLUTION (AS PRESENTED ON THE WILDLAND FIREFIGHTER SAFETY SURVEY)	MUCH POSITIVE IMPACT	MUCH OR SOME POSITIVE IMPACT
S52	Fire Protection Strategy	Implement a large scale, long range program of hazard fuel reduction	60%	86%
S14	Training	Improve firefighter & crew training on situational awareness	59	91
S38	Certification	Don't certify people for next supervisory command position if they don't have the skills or temperament	55	85
S79	Decision Making	Develop a safety culture that encourages people to think rather than just obey the rules	53	85
S60	Training	If you can't give satisfactory experience and training to all, ensure the competency and experience of FMOs and crew supervisors	53	84
S67	Experience	Require or encourage agency administrators to release experienced fire personnel for fire duty, without any career penalty	53	81

Table 1 (continued)
Solutions with Highest Score of "Much Positive Impact"

(Over 50 percent)

SURVEY QUESTION NUMBER	SUBJECT	SOLUTION (AS PRESENTED ON THE WILDLAND FIREFIGHTER SAFETY SURVEY)	MUCH POSITIVE IMPACT	MUCH OR SOME POSITIVE IMPACT
S54	Fire Protection Strategy	Pull crews back and let fires get larger when lack of experience threatens safety	53	78
S51	Fire Protection Strategy	Better educate public and media on risks in urban-wildland interface, and the limitations of wildland firefighting (i.e., lower expectations, increase budgets or increase acceptance of losses.)	52	85
S28	Training	Lengthen seasonals' work tour; bring in before start of season for training	52	83
S41	Physical Fitness	Allow fire personnel to exercise an hour a day on the job	52	75
S4	Accountability	Don't redispatch a crew or firefighter sent home for a safety violation without some interval or corrective action	51	85
S55	Fire Protection Strategy	Encourage insurance companies to rate structures on their safety features and not just location (to encourage owners to reduce hazards)	51	79
S23	Training	Put more hands-on practice and field exercises into training courses	50	91
S53	Risk Reduction	Educate or require the public to better mitigate the urban/wildland interface problem	50	82
S9	Information Flow	Improve distribution of radios to crews (at least one per squad boss)	50	79

Table 2 shows the safety goals that were inferred from the solutions shown in Table 1 and the next highest rated group of solutions.

Table 2
Goals Inferred from Top Solution Choices

ISSUE	GOALS
Fire Protection Strategy	• Reduce hazardous fuels (by prescribed burning and mechanical thinning) • Get public to understand risks and limitations of wildland firefighting; reduce public pressures for unachievable goals • Educate and motivate public to mitigate risks of the urban wildland interface • Match strategy to resources; don't use crews beyond their capabilities • Develop plans for firefighting around subdivisions
Accountability	• Hold everyone accountable for safety decisions • Put teeth in accountability
Experience	• Make use of the most experienced "militia" personnel available. • Increase experience levels of militia. • Increase experience, requirements, and competency of FMOs and crew supervisors. • Increase retention and experience of seasonals.
Physical Fitness	• Ensure physical fitness of all Federal firefighters, including Type 2 crews and the "militia."
Leadership	• Screen candidates for supervisory positions for their suitability as leaders as well as for their technical skills. • Improve leadership and supervision skills of Type 2 and EFF crew supervisors. • Keep senior management (including agency administration) versed in strategy and tactics concepts.
Information Flow	• Make sure all crews and squads are reachable by a clear, reliable radio system. • Provide crews with adequate information on the site and situation they are going to. • Expect division supervisors to be aware of the crews' situations.
Decision-making	• Develop a safety culture that encourages people to think rather than just obey rules (including decision-making under stress) • Teach people how to stay focused and deal with a potential information overload.

Table 2 (continued)
Goals Inferred from Top Solution Choices

Training	• Make training realistic for firefighters, supervisors, IMT
	• Develop situational awareness skills of firefighters and crews
	• Give seasonals better focused hands-on training
	• Give priority to FMO and crew supervisor training
	• Give crews practice in responding to safety emergencies
	• Give priority of training to those willing and available to take fire assignments.
	• Provide refresher training (courses, on-the-job)
Fatigue	• Improve rest /and reduce fatigue of night operations crews
Human and Psychological Factors	• Train people to recognize unsafe situations and how to mitigate the danger or back off • Use positive reinforcement with examples of past successes

A Vision for the Future

Because there were so many types of issues found needing attention in Phase I, and a correspondingly large number of changes needed to the organizational culture, it is difficult to summarize the changes needed. In many cases, the "change" needed is just doing a better or more complete job in meeting an existing goal or policy (e.g., reporting injuries, distributing radios, enforcing red card qualifications, following the 10 Standard Fire Orders). But some effort is needed in new directions, too.

The following are highlights of our vision for the aspects of the wildland firefighting culture of the future that most affect firefighter safety.

HIGHLIGHTS OF THE ORGANIZATIONAL CULTURE OF THE FUTURE

Responsibility	• The responsibility for safety is distributed across all members.
Experience	• An adequate cadre of experienced and well-trained personnel is maintained at each position level (with the possibility of using realistic training as a partial substitute for experience that is not available to everyone).
Certification	• There is respect for the certification system and confidence that it is valid and uncorrupted.
Respectful Interaction	• All ranks are comfortable in raising safety issues to their immediate supervisors in a respectful interaction. It is taken as both a right and a professional obligation.
Reporting of Safety Incidents	• Reporting of safety incidents is reliable, comprehensive and free from retribution. Incidents to be reported include near-misses as well as casualties, burnovers, and shelter deployments.
Accountability	• There is a high degree of accountability for safety-related decisions at all levels.

HIGHLIGHTS OF THE ORGANIZATIONAL CULTURE OF THE FUTURE
(continued)

Information Flow
- Information needed for safety is communicated reliably and on time. Positive feedback is given that key information is received and understood. The concept of a dialogue between senders and receivers replaces one-way information transmission.

- Communication is made in clear and standard language, free of jargon.

- All crews are reachable by radio.

- Checklists are used to ensure completeness of safety-related information.

- Effective crew briefings and debriefings are held.

Equipment
- All firefighters at federal wildland fires are equipped with the right personal protective equipment and other equipment needed to do the job safely.

Transportation
- Firefighters are transported safely, including on the final leg to the fire (that is also a fatigue mitigation measure).

Seasonals
- Attention is given to retention and training of seasonal employees as well as the militia.

Gender and Ethnic Group Equality
- All goals are applied equally to all firefighters.

LEADERSHIP

Fire Strategy
- Firefighting goals are chosen to be commensurate with the available resources, and with regard to firefighter safety. This is done both for deciding which fires to fight, and for choosing a strategy on how to fight a particular fire.

- Fires are not fought in a more dangerous way than the values to be protected merit.

Leadership Selection
- Candidates for each level of supervision are screened for leadership capability at that level and their past accountability record, as well as their technical ability and experience.

Leadership Qualifications
- Realistic and valid qualifications exist for each fire-related supervisory position (especially crew supervisor, division supervisor, FMO, IC, and Agency Administrator).

HIGHLIGHTS OF THE ORGANIZATIONAL CULTURE OF THE FUTURE
(continued)

Leadership Training	• Realistic and effective training of supervisors to prepare them for managing people, making decisions under stress, maintaining situational awareness, and conducting on-the-job training and mentoring.
Use of Crews	• Ratings are provided that quickly describe each crew's capability, so that appropriate assignments can be made.
	• The capability and status of each crew at the time of assignment is taken into account. The status includes fatigue level, cohesion, experience, training, and equipment. Assignments recognize the variation between crews, and of a given crew from day to day.
Transitions	• Special attention is given to safety during transitions from initial attack to extended fire, and to project fires.

HUMAN FACTORS

Decision Making Under Stress	• Individual firefighters are trained to prepare for operating under stress and being ready to respond to emergencies (e.g., dropping tools and running, or deploying a shelter when necessary).
	• Leaders are trained in decision-making under stress, using ideas from the military and other industries (e.g., naturalistic decision making, recognition primed decision making, etc.)
	• The safety culture encourages people to think rather than just obey pre-ordained rules.
Situational Awareness	• Each position including the individual firefighter, knows how to maintain good situational awareness, based on training and good information flow.
Fatigue	• Fatigue levels of crew members and IMT are routinely monitored, and actions are taken to mitigate and prevent fatigue.
Physical Fitness	• Firefighters (and supervisors) maintain physical fitness, and have valid, widely accepted periodic testing of their fitness.

COPING WITH EXTERNAL FACTORS

Forest Health	• Measures to improve forest health (including prescribed burns and mechanical removal) are considered a component of firefighter safety as well as of resource management.

HIGHLIGHTS OF THE ORGANIZATIONAL CULTURE OF THE FUTURE
(continued)

Public Awareness

- The public is made aware of the limitations of wildland firefighting. Public and political decision makers are aware that, as with sandbagging against floods, at some point firefighting efforts may have to switch to evacuation.

- The public is knowledgeable about what they can do to prevent and mitigate fire losses (including placement, construction, and landscaping considerations for homes in the wildland/urban interface).

- The public is supportive of measures to improve forest health.

A more complete narrative version of the vision for the future is presented in Chapter 8. How to measure whether the proposed vision is being implemented, and whether it is having effect, is discussed in Chapter 9.

This information and review of other ideas from the survey led to the formulation in Phase II of over 60 goal statements at various levels of detail. Figure 1 shows a portion of a "wiring diagram" showing how goals at different levels fit together. A complete set of these goal hierarchies is presented in Chapter 8.

Wiring diagram from Chapter 8

ACKNOWLEDGMENTS

Project Team

TriData Corporation of Arlington, Virginia was the prime contractor for this project. It was assisted by Klein and Associates and several independent consultants. The key team members for Phase II are listed below.

TriData Corporation   *Klein Associates Inc.*

Philip Schaenman, Project Manager   Gary Klein
Roy Hodges, Assistant Project Manager   Marvin Thordsen
Charlene Cullen
Katherine Thiel
Sonya Hayes

Principal Consultants

Dr. Jason Greenlee
Michael DeGrosky
Nancy Moore-Hope
Robert Mutch
Dr. Kenneth Perkins
Dr. Charles Perrow

CHAPTER 1. INTRODUCTION

The issue of wildland firefighter safety is of paramount concern to the five federal agencies that are responsible for wildland firefighting: the Forest Service (FS), National Park Service (NPS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), and the Fish and Wildlife Service (FWS).

Following the soul searching, multiple-agency investigations, and special conferences on safety stimulated by the 1994 South Canyon incident that killed 14 firefighters, a new idea arose: that the usual things sought in fatality investigations were not sufficient. There were likely to be organizational cultural problems, leadership issues, human factors problems, and possibly other issues that were underlying the firefighter safety problems. Ted Putnam, of the Forest Service, articulated this need in a landmark paper (Putnam, 1995).

The five Federal agencies directly involved in wildland firefighting decided to pool support for an examination of the wildland firefighting safety problem in greater depth, and from the perspective of organizational culture, leadership and human factors as opposed to tactics and equipment failure. These agencies work together regularly in the interagency attack on wildland fires, including the provision of personnel, support services, and fire management. There were deep concerns about safety from their firefighters to their crew supervisors, to forest supervisors, refuge managers, and park superintendents, to their fire directors, and up through the Secretaries of the Departments.

In 1994-1995, an interagency committee met to formulate what became the concept for this study. An outside contractor was to be selected to study the safety awareness, organizational culture, leadership, accountability, human factors and other issues that affected the safety of wildland firefighters. The contractor would use not only experts in wildland firefighting, but also experts in psychology, sociology, interviewing, human resources, and data analysis. This ensures a multi-disciplinary, independent viewpoint, and goes beyond the typical findings of fire investigations.

In August 1995, TriData Corporation of Arlington, Virginia and a team of affiliated consultants was selected to undertake the project. This report presents the results of Phase II of this project.

Study Goals and Phases

The intent of this study was very clear: to contribute to a reduction in fatalities and injuries associated with wildland firefighting. To help achieve this, the study, which was planned by a multi-agency committee, had four phases, each with its own goals:

Phase I – Identification of Existing Culture. The goals of Phase I were to define the organizational culture, human factors, leadership, accountability, and other issues underlying safety problems, by collecting the insights from a broad and deep sample of the fire community across all five federal agencies. This information was to be blended with information from the literature and from experts within and outside the agencies to form a diagnosis of the problem, and an articulation of the issues, especially as perceived by the firefighters. The Phase I report described the results of that effort in detail.

Phase II – Formulate the Desired Organizational Culture/Safety Environment. The goals of Phase II were to identify the desired future culture and the environment needed to improve wildland firefighter safety in the five federal agencies – what changes are needed in organizational culture, leadership goals, human factors, and fire protection policy in the five agencies. This phase addressed the problems identified in Phase I by defining goals in response to those problems as well as the underlying character of the culture that contributes to the problems. This phase also identified performance measures that can be used to measure progress toward these goals.

Phase III – Develop an Implementation Plan. The goal of this phase will be to define how to move from the current safety environment identified in Phase I, to the desired environment articulated in Phase II. It will draw on recommendations from firefighters, fire managers, and agency administrators.

Phase IV – Assisting, Monitoring and Evaluating Implementation. The goal of this phase will be to see whether the changes proposed in Phases II and III are implemented, and to identify road blocks and help find alternative paths around them.

Scope of Phase II

In Phase I, over 1,000 firefighters' views were solicited on safety issues, both through interviews and a national survey. In addition, an extensive literature search was made and many experts were consulted.

Using the Phase I information as a starting point, the focus of Phase II was to identify changes in goals needed in the federal wildland firefighting agencies' organizational culture, in order to change the underlying factors that affect wildland firefighter safety. This phase focused solely on setting goals; Phase III will focus on the implementation steps needed to move from the current culture to the desired culture. Phase II is intended to be a comprehensive statement of realistic goals. It was understood that the set of goals developed in Phase II might have to be revised in the light of more information on the feasibility of their implementation, which will be the focus of Phase III.

This Phase II report is organized generally along the lines of the Phase I report. The goals presented are not in priority order. There is some arbitrariness in defining what is a goal versus what is an implementation step toward the goal versus what is a "higher level principle." There also is a hierarchy of goals to consider. Though the focus of Phase II was goal-setting, we include some ideas on potential implementation of the goals, in some cases to clarify the goal and in some cases to save ideas that might be useful in Phase III.

This report is a consultant's report to the five federal wildland firefighting agencies, and does not necessarily represent a consensus of the agencies. It is intended to serve as input to the agencies own deliberations on their goals and policy statements. Ideas have been solicited from managers in all five agencies, as well as from the firefighters who were interviewed or surveyed in Phase I, as well as various experts and the literature.

Organization of this Report

Chapter 2 discusses the approach used in Phase II to identify goals and performance measures. Chapter 3 presents an analysis of the survey data on firefighters

evaluation of the likely impact of various proposed solutions to safety problems. Questions on the solutions were included in the National Wildland Firefighter Safety Survey in Phase I, but not previously analyzed. Chapters 4-7 present goals that were derived from an analysis of the findings in the corresponding chapters of the Phase I report. Chapter 8 summarizes the findings and goals, and presents a set of goal linkage diagrams. Chapter 9 presents a set of effectiveness measures that can be used to track progress toward meeting the goals.

Appendix A presents the questionnaire used in the national wildland firefighter safety survey and the statistical results of the part of the survey that related to solutions. (The rest of the survey was analyzed in Phase I.)

Appendix B discusses the ratings of the various suggestions on the survey by subgroups of the respondent population, including agency, geographic area, position, experience, gender, ethnic group, age, and whether injured.

CHAPTER 2. APPROACH

Several different approaches were used to develop a set of goals for organizational culture, leadership, accountability, human factors and external strategic influences on safety.

First, the 119 questions on the wildland firefighter national survey were analyzed to see which solutions firefighters thought were best. A set of goals was inferred from these findings. Second, all of the findings of Phase I from the interviews, survey, and literature review were reviewed to identify potential goals that would preserve the strengths and correct the problems identified.

Combining the results of these two approaches, a rough first pass was made at the set of goals. This was discussed in mid-December 1996 at a meeting in Boise, with the FFAST (Federal Fire and Aviation Safety Team) committee. The meeting also was attended by the Fire Director of the Fish and Wildlife Service as a representative of the fire directors, and by the Chairman of this project's Steering Committee.

Potential goals also were discussed with various experts on the project team from the fields of sociology, psychology, wildland firefighting, human resources, and firefighter casualty investigations.

After an initial cut was made at the goals, several different analyses were conducted. An attempt was made to develop interconnectivity diagrams relating the different levels of goals. An attempt was also made to amalgamate some goals into higher level goals.

Level of Goals

Goal statements can be developed with various levels of detail and breadth. At the highest level, the goals are most important and are called "principles," but are not very specific. At this level, the principles could apply to virtually all organizations. They provide little concrete guidance. For example, at the highest level are goals such as "have adequate equipment for doing the job safely" or "provide training necessary to do the job

5

safely." The majority of the goals are more targeted to particular issues and lend support to these broader principles.

Statistical Survey of Firefighters

A random sample survey of 700 federal wildland firefighters from the five participating agencies in this project was undertaken in Phase I of this project. The survey solicited their perceptions about safety problems and proposed solutions. The "solutions" that appeared on the survey were largely based on ideas raised by the 300 firefighters interviewed individually or in focus groups in Phase I of the project. The "solutions set" presented on the questionnaire had been screened for plausibility by the project team, reviewers on the FFAST committee, the ad hoc project review committee, and the government COR. Other ideas were solicited from the survey respondents in open-ended questions on the survey form.

The statistical analysis issues relating to the survey's representativeness, the confidence limits on the answers, the tests of statistical significance between sample on the responses of different subgroups to a question, and the significance of differences in rankings among questions, were all discussed in the Phase I report, Chapter 2 (Methodology) and Appendix C. Some additional analysis issues pertaining to the "solutions" data are discussed below.

The respondents to the survey were asked to rate each proposed solution as to whether it would have a) much positive impact on safety, b) some positive impact, c) little or no impact, d) negative impact, e) already is done or f) can't say. The possible answers were structured to show the respondents' perceived impact from the current state of safety. Thus, the likely impact of a proposed solution as measured by the percent of respondents who said it would have a positive impact was lowered if there were many respondents who said the solution was already being implemented.

Completeness – The firefighters who responded to the survey appeared to give excellent attention to the last half of the survey, which contained the solution questions. After responding to 241 questions on safety problems, they continued on into the solutions section. Only about 3 percent did not respond to the solutions questions, out of the 716 respondents whose answer sheets were received in time to be scanned.

Treatment of "can't says"–In developing the survey scores of "positive impact for each purpose solution," we did not make any adjustment for those who gave "can't say" as their answer. This does not have much impact on the rank ordering because the "can't say" scores were generally very low, on the order of less than four percent. Even on the few questions where they were not low, going up to 20-30 percent on a few question, they also would not have a major impact. There was another thought behind disregarding "can't says" : that it was important to identify those solutions where there was a large absolute consensus.

The highest numbers of "can't say" responses were given for the proposed use of single engine tankers (18 percent), reduction of student-teacher ratios in EFF courses (24 percent), language skills for EFF personnel (22 percent), and providing special training and motivation to supervisors of inmate crews (30 percent). These are all areas where people not familiar with the particular technology or the use of EFF crews would plausibly not be able to answer. There were no large numbers of "can't says" on any question for which most respondents should have had adequate knowledge to form an opinion.

Limitations of Solutions Questions – As mentioned earlier, the set of solutions used in questions S1-S116 was gleaned primarily from solutions raised by firefighters in the in-depth interviews in Phase I. To reduce redundancy, we eliminated many suggestions that were essentially the converse of the problems included in questions 1-238 earlier in the survey. For example, if a problem was stated "as firefighters work too many consecutive hours" and the proposed solution was "don't allow firefighters to work too many consecutive hours," we did not include it in the solutions set on the survey, because the solution was directly implied by the question in the problems set. We tried to keep in as many solution questions as we could, especially when they offered a specific non-obvious twist, but the survey was very long, and many were dropped.

Also, the "solutions" proposed by the firefighters during the interviews and focus groups did not arise from a systematic analysis of the problems, but rather were a collection of individuals' feelings about their most important one to three ideas for improvements. Together, the sets of problems and solutions turn out to be remarkably comprehensive. There were few issues for which solutions weren't raised by someone. However, we did not depend on the logical completeness of the solutions proposed on the

survey alone. Rather, we methodically considered each finding on the survey, drawing on all of the work of Phase I, then fitting the pieces into "systems diagrams" showing the logical interconnection and the hierarchy of goals.

Bias Toward Agreement – Scanning the results of the responses to the proposed solutions quickly shows that a majority of respondents were favorably disposed towards almost every solution proposed. This should not be too surprising, since the items on the survey came almost entirely from interviews with a broad sample of 300 firefighters, and the survey respondents knew that. However, the major purpose for including the solution ideas on the survey was to rank the various good ideas; that is, to identify which solutions were thought to be the most important, and which had the broadest consensus for achieving positive results.

Some respondents appeared to be "easy graders" or very positive thinkers, and rated most solutions as having "much positive impact". There were others with more stringent standards who were harder to please or negative thinkers. Both groups rated most solutions as having at least some positive impact. But on some questions, the majority clearly felt much more strongly than on others: the "much positive impact" rating varied from 9 percent to 60 percent of the respondents, a wide range. This suggests that there was indeed considerable discrimination made among the solutions.

No one solution had a majority rate it as likely to have negative impact. In fact, even when the "negative impact" and "little or no impact" scores were combined, no solution received a combined "negative/no impact" score of over 50 percent combined. Almost all of the proposed solutions were considered good ideas by the majority of respondents. The interest is in which were the very highest choices, and how the choices varied by subgroups of the wildland firefighter population. The survey findings are discussed in the next chapter.

Treatment of "Already Being Done" Answers – Some proposed solutions are already being implemented. They were included on the survey because they are not being done everywhere, because some felt they were not implemented enough or in the right way, or because some did not know they were being implemented.

        The main objective was to improve safety from the current baseline, so the
greatest attention was given to solutions that respondents implied would have impact over
the current (baseline) situation. In practice, that meant we did not add the responses of
"already being done" to the responses of "would have positive impact" in assessing the
highest ranked solutions. We did look to see if rankings of a solution were especially
high or low in a particular region or agency to see if there was evidence of solutions being
done more in one place than another.[1]

---

[1] The data from the survey is presented in Appendix A; those who might prefer a different way of handling
the "already being done" responses can do so.

CHAPTER 3. SOLUTIONS FROM FIREFIGHTER SURVEY

There were on the survey from Phase I of this project 116 proposed solutions presented to the firefighters. All but 7 of the 116 proposed solutions received a positive impact rating by a majority of the 700 federal wildland firefighters surveyed.[2] Fifteen of the proposed solutions stood out because they received such high ratings of "likely to have much having a positive impact on safety." More precisely, those 15 questions received a rating of "much positive impact" by a simple majority (50 percent or more) of those who answered the questions (over 97 percent of the respondents.) Table 3-1 presents the survey question number, the issue addressed, the proposed solution and the score of "much positive impact", and the combined score of much or some positive impact.

Table 3-1
Solutions with Highest Score of "Much Positive Impact"
(Over 50 percent of respondents indicating much positive impact.)

Survey Question Number	Issue	Solution	Much Positive Impact	Much or Some Positive Impact
S52	Fire Protection Strategy	Implement a large scale, long range program of hazard fuel reduction	60%	86%
S14	Training	Improve firefighter & crew training on situational awareness	59	91
S38	Certification	Don't certify people for next supervisory command position if they don't have the skills or temperament	55	85
S79	Decision Making	Develop a safety culture that encourages people to think rather than just obey the rules	53	85

---

[2]2Questions that received high negative ratings are discussed later in this chapter.

Survey Question Number	Issue	Solution	Much Positive Impact	Much or Some Positive Impact
S60	Training	If you can't give satisfactory experience and training to all, ensure the competency and experience of FMOs and crew supervisors	53	84
S67	Experience	Require or encourage agency administrators to release experienced fire personnel for fire duty, without any career penalty	53	81
S54	Fire Protection Strategy	Pull crews back and let fires get larger when lack of experience threatens their safety	53	78
S51	Fire Protection Strategy	Better educate public and media on risks of urban-wildland interface, and the limitations of wildland firefighting (i.e., lower expectations, increase budgets or increase acceptance of losses.)	52	85
S28	Training	Lengthen seasonals' work tour; bring in before start of season for training	52	83
S41	Physical Fitness	Allow fire personnel to exercise an hour a day on the job	52	75
S4	Accountability	Don't redispatch a crew or firefighter sent home for a safety violation without some interval or corrective action	51	85
S55	Fire Protection Strategy	Encourage insurance companies to rate structures on their safety features and not just location (to encourage owners to reduce hazards)	51	79
S23	Training	Put more hands-on practice and field exercises into training courses	50	91
S53	Fire Protection Strategy	Educate or require the public to better mitigate the urban/wildland interface problem	50	82

Survey Question Number	Issue	Solution	Much Positive Impact	Much or Some Positive Impact
S9	Information Flow	Improve distribution of radios to crews (at least one per squad boss)	50	79

Table 3-2 shows the next highest rated set of solutions. Here the criterion was all solutions that reviewed a combined rating greater than 75 percent but did not have a "much positive impact " score above 50 percent; i.e., the high scores not included in Table 3-1 above. Note that a few of the questions in Table 3-2 had higher cumulative positive impact scores than some questions, in Table 3-1. For example, 89 percent thought that S34, using realistic scenarios in management training, would have much or some positive impact, but less than 50 percent (43 percent) thought it would have much impact, and therefore it was not put in Table 3-1. Contrast that with S41 in Table 3-1, for which 52 percent thought it would have much positive impact, but only 75 percent rated it as having much or some positive impact. The first solution is in Table 3-2, the second in Table 3-1.

All solutions that had at least 75 percent positive appeal are in one table or the other.

To reiterate, all of the solutions but seven out of 116 had a majority positive rating, so those in Table 3-1 and 3-2 are just the best rated ones in the survey. Other good ideas can be found throughout the solutions listed in S1-S117. (Appendix A contains the frequency tables for the solution set.)

Table 3-2
Other Highly Rated Solutions
(Over 75 percent cumulative positive impact ratings)

Question Number	Issue	Solution	Much Positive Impact	Much or Some Positive Impact
S34	Management Training	Use realistic scenarios to practice go/no go decisions on fighting fires.	43%	89%
S35	Management Training	Use realistic scenarios to practice real-time decisions for each IMT position.	39	87
S13	Training	Get crews to practice responses to safety emergencies.	41	86
S108	Human Factors	Teach critical thinking - how to handle large amounts of information under stress.	48	85
S29	Experience	Detail employees from areas with low fire rates to areas with high rates	41	85
S48	Information flow	Provide more information to crews on the specific site they are working.	45	83
S102	Fatigue	Reduce daytime noise around sleeping crews.	45	83
S61	Experience	Increase fire experience and requirements for FMOs.	44	83
S18	Training	Add realism and relevance to training, e.g., by adding critiques from real fires.	35	83
S33	Training	Give Type 2 and EFF crew supervisors more training in supervision and leadership	34	82
S15	Training	Don't waste training slots: require those who take training to be available when called.	48	81
S25	Training	Emphasize refresher and on-the-job training.	37	81
S111	Training	Use examples from successful incidents to reinforce safe behavior.	37	81

Question Number	Issue	Solution	Much Positive Impact	Much or Some Positive Impact
S3	Accountability	Hold everyone accountable for their decisions affecting safety.	47	80
S75	Experience	Provide step increases for seasonals to improve retention	45	80
S20	Training	Simulate fire entrapments for all firefighters	36	80
S68	Experience	Offer experienced firefighters and managers permanent positions	48	79
S47	Information Flow	Brief crews on big picture enroute to or on arrival at an incident.	46	79
S36	Management Training	Add more strategy and tactics to management courses	37	79
S106	Human Factors	Teach people how to mentally reload under stress.	32	79
S40	Physical Fitness	Increase physical fitness training and requirements for Type 2 crews.	44	78
S107	Human Factors	Teach how to check whether we are causing a problem ourselves.	31	78
S105	Psychological Preparation	Teach people not to hesitate to back off.	39	77
S109	Human Factors	Teach people how to stay focused in spite of fatigue, carbon monoxide buildup and the inexperienced staff.	38	76
S57	Information Flow	Develop pre-fire plans for wildland firefighting around subdivisions.	36	76
S43	Information Flow	Give special attention to hand-off of plans and briefings at shift changes.	30	76
S85	Information Flow	Require division/group supervisors to periodically walk the line.	45	75

Goals

The set of goals inferred from highest rated solutions shown in Table 3-1 and 3-2 are listed in Table 3-3. Those shown in bold were based on the highest rated solutions (from Table 3-1.)

These goals will be used as one of several inputs in the more systematic formation of goals, discussed in Chapters 4-7. If one went no further with the analysis, this set of goals would be a quite admirable starting point for improving the organizational culture of the wildland fire service.

Table 3-3

Goals Inferred from Top Solution Choices

Note: Goals in bold were based on the highest rated 15 solutions

Issue	Goals
Fire Protection Strategy	• **Reduce hazardous fuels (by prescribed burning and mechanical thinning)** • **Get public to understand risks and limitations of wildland firefighting; reduce public pressures for unachievable goals** • **Educate and motivate public to mitigate risks of the urban wildland interface** • **Match strategy to resources; don't use crews beyond their capabilities** • Develop plans for firefighting around subdivisions
Accountability	• **Hold everyone accountable for safety decisions** • **Put teeth in accountability**
Experience	• **Make use of the most experienced "militia" personnel available** • Increase experience levels of militia • Increase experience and requirements of FMOs and crew supervisors • Increase retention and experience of seasonals

Issue	Goals
Physical Fitness	• **Ensure physical fitness of all federal firefighters, including Type 2 crews and the "militia."**
Leadership	• **Screen candidates for supervisory positions for their suitability as leaders as well as for their technical skills** • Improve leadership and supervision skills of Type 2 and EFF crew supervisors • Keep senior management (including agency administrators) versed in strategy and tactics concepts
Information Flow	• **Make sure all crews and squads are reachable by a clear, reliable radio system.** • Provide crews with adequate information on the site and situation they are going to • Expect division supervisors to be aware of the crews' situations
Decision-making	• **Develop a safety culture that encourages people to think rather than just obey rules (including decision-making under stress)** • **Teach people how to stay focused and deal with a potential information overload**
Training	• **Make training realistic for firefighters, leadership, IMT** • **Develop situational awareness skills for firefighters and crews** • **Give seasonals better focused hands-on training** • **Give priority to FMO and crew supervisor training** • Give crews practice in responding to safety emergencies • Give priority of training to those willing and available to take fire assignments • Provide refresher training (courses, on-the-job)
Fatigue	• Improve rest and reduce fatigue of night shift crews
Human and Psychological Factors	• Train people to recognize unsafe situations and how to mitigate the danger or back off • Use positive reinforcement with examples of successes

Validity Check: The Top Solutions in Retrospect

After rating each of the 116 proposed solutions on the national federal wildland firefighter safety survey, the respondents were asked to go back and select up to five solutions they thought were the most important for improving fire safety (S117). They also were asked to write in any other ideas for improving safety (S119).

Not all respondents responded to this question, and a few selected more than five solutions. Almost every solution received at least one vote as one of the five most important ideas.   On the other hand, the most "votes" any solution received was 91. Only three solutions were selected as among the most important by over 10 percent of the respondents, showing the diversity of opinions and difficulty in making a ranking.

Table 3-4 shows the 15 solutions that received the most votes. Of the 15 solutions, 12 were among those that had received the highest scores individually (see Table 3-1 and 3-2). The top four vote getters were among the highest on the previous tables. The three issues that were among the top 15 here but did not make the two previous "highest" lists were the need to distinguish high capability Type 2 crews from others (S92), the potential of portal-to-portal pay (Q65) and the desirability of opening up prescribed burns to interagency participation (S112). The latter two are surprising; portal-to-portal pay was one of the lowest rated solutions overall, yet many chose it as one of the most important ideas. Opening up prescribed burns to other agencies to gain experience opportunities is consistent with the high importance given to increasing experience, but was not a high-rated question itself.

Overall, the top 5 choices here validate the ratings of the individual questions, and also show the spread of opinions on priorities. Figure 3-1 shows how the votes spread across different question and question areas. Figure 3-1 further shows that the feelings about which suggestions were the most important were quite spread out. There is no one dominant cluster. Each "voter"/respondent had only five votes. More votes went to firefighter training issues than management training, which suggested that there was little interest in passing the buck upward. There was great discrimination from question to

question; some of the highest vote-getting solutions were adjacent on the questionnaire to very low vote-getting solutions. The results suggest that it is not just general groups of solutions that were perceived to be important but rather very specific solutions.

Table 3-4
Top 15 Solutions as Chosen
in Retrospect by Survey Respondents (S117)

Question	Topic	Number of Votes
S79	Develop safety culture that thinks rather than just obeys rules	91
S52	Implement large scale fuel reduction	88
S108	Teach critical thinking	83
S3	Hold everyone accountable for safety decisions	57
S14	Improve training on situational awareness	51
S92*	Distinguish high capability Type 2 crews from others	50
S40	Increase physical fitness for Type 2 crews	49
S51	Educate public on risks of urban-wildland interface	49
S68	Offer experienced firefighters and managers permanent positions	49
S105	Teach people not to hesitate to back off	48
S67	Require agency administrators to release experienced personnel for duty	47
S65*	Consider use of portal-to-portal pay	47
S112*	Open up prescribed burns to interagency participation	47
S28	Lengthen seasonals work tours to increase training	45
S41	Allow fire personnel to exercise an hour each day	44

Asterisks are the solutions rated among the highest here but not in Table 3-1 and 3-2.

This page is for Figure 3-1

This is for (page 2 of) Figure 3-1

Lowest Rated Solutions

It was thought to be of some interest to see which solutions received the most negative impact ratings. For a firefighter to rate something as negative here probably indicated a very strong personal feeling about the idea.

Only six solutions received negative ratings of over 20 percent of the respondents (one in five).

The highest negative rating went to the idea of limiting tours of duty for Type 2 firefighters for two weeks. Ironically, this is perhaps the solution with the strongest statistical evidence that it would make a significant impact on safety! The BIA Fire Director reported a BIA study which showed that approximately 85 percent of their injuries occurred in the third week out. That was the motivation for including this solution on the survey. It is quite possible that most respondents are not aware of that fact, and were reacting to either the improved experience and cohesiveness of teams after a few weeks working together in the field, or that they did not want to lose the third week's pay.

The second most negatively rated idea on the list, limiting use of night operations, probably was negatively rated by some because it was not properly qualified. During interviews with firefighters, many felt that night operations in certain types of terrain and conditions were hazardous, especially where crews had not seen the terrain in daylight. Others felt that increased use of night operations would <u>add</u> to safety in the right kinds of fires and terrain. Respondents might reasonably support greater use of night operations in one terrain type and strongly oppose it in another.

Table 3-5

"Lowest" Rated Solutions

(Over 20 percent negative or 30 percent negative plus little/no impact rating.)

Question Number	Solution *The first five proposed solutions below had negative ratings of over 20%*	Negative Impact	Negative or Little/ No Impact
S99	Limit tours of duty for Type 2 firefighters to two weeks	24%	54%
S98	Limit use of night operations	23	46
S64*	Base fire pay on level of responsibility at fires (and not one's home assignments)	23	37
S96	Request agencies to hold back some experienced firefighters to provide an experience cadre on later fires	22	42
S6*	Reduce red card qualification level as a penalty for poor safety performance	21	35

Question Number	Solution *The seven solutions below had cumulative ratings of negative or little/no impact of over 30%*	Negative Impact	Negative or Little/ No Impact
S17*	Require annual test of safety knowledge	7	40
S11*	Ability to send video between crews and IMT	3	37
S8*	Modernize tools	3	37
S100*	Use "fresh crew" rule; if not in by 11 p.m., do not use on next operational period	17	33
S77*	Provide support system for families of crews	2	33
S56*	Create a single unified federal wildland firefighting agency	16	32
S65	Use portal-to-portal pay or 24 hour pay rather than overtime	18	30

* The majority of respondents thought this was a good idea (it had over 50% rating of "much or some positive impact"), even though it had a high negative or high combined negative and little/no impact rating.

The strong negative response to S64, base fire pay on level of responsibility at fires and not on one's home assignment, was based on an inaccurately stated question. It was meant to apply only to employees whose relatively low GS ratings did not provide a salary level commensurate with their high level of responsibility at fires. It was not intended to suggest that higher grade militia be paid less because they had less responsibility at a fire. But even with the literal interpretation as worded, it is likely that people responded to the pay inequity when they identified it as a negatively impacting idea, unless they thought it would strongly affect retention and enhance experience.

Question S96, holding back some experienced firefighters to provide an experienced cadre for later crews, was a suggestion for overcoming the danger of sending out highly inexperienced crews late in the season, after the experienced members had been used up. The idea was to hold back a few to act as a seasoned cadre. Working against that idea was the desirability of using the most experienced people one had, under the principle "fight the fires you have."

The fifth solution with a greater than 20 percent negative impact was reducing red card qualification levels as a penalty for poor safety performance. This was a somewhat surprising reaction. There had been a very strong vote for increasing accountability, and for not allowing people who had violated safety to come back on another fire without an appropriate pause. The penalty of reduced qualification levels may have been seen as too severe, or the message may have been the opposite - don't just reduce their level, don't let them fight fires again. The implication here is unclear.

The next seven solutions shown in Table 3-5 might be interpreted as those with the lowest consensus ratings, rather than high negative ratings. They were the ideas for which about a third or so of the respondents did not think they would have a significant positive impact in safety. It seems understandable that requiring an annual safety test of knowledge, sending video of the fire between crews and IMTs, modernizing tools, and creating a support system for families of crews would not receive as high ratings as other items, although all of these "solutions" received a majority positive vote. Less clear is why the "fresh crew" rule and use of portal-to-portal pay or 24 hour pay would not be received more enthusiastically. They might have been considered pay issues, or that they

would not have the intended effect of reducing motivation to work long hours. Perhaps some considered them an incentive to work long hours.

The concept of a single unified federal wildland firefighting agency was thought not likely to have much impact by a third of the respondents, but a majority of the respondents did think it would have at least some positive impact. It was not high on the priority list of having significant impact, but it was interesting to note that approximately two thirds of the respondents did not reject the concept out of hand, and that a majority were in favor of it.

The next chapter starts the more systematic discussions of goals derived from the issues raised in Phase I.

CHAPTER 4. ORGANIZATIONAL CULTURE

Chapters 4-7 present a set of goals for the federal wildland culture of the future. They are based on goals from Chapter 3 plus, an analysis of all of the data collected in Phase I, including ideas for goals from the literature survey. This chapter addresses many of the topics ordinarily considered as part of an organization's culture, including values, beliefs, attitudes, information flow, technology, credentials for membership in the group and some other topics. Chapter 5 deals with leadership issues, Chapter 6 with human factors and training, and Chapter 7 with external influences on the culture. Many topics could have been placed in more than one chapter.

For organizational consistency and to assist the reader who may have read the Phase I report, we have presented most of the goals in the same chapters as the corresponding issues in Phase I.

The term "goals" is used here to describe various aspects of the desired future culture. Some of the "goals" might be more properly called principles. We have tried not to become bogged down in a complex hierarchy of labels.

Preserving Strengths

The vast majority of federal wildland firefighters believe the current system is good, and that there are many strengths that should be preserved. The strengths were listed in Table 3-1 of the Phase I report.

Any ideas for changing goals, and any ideas for implementation of solutions, should be tested against the list of strengths to see if they will contribute to or potentially degrade existing strengths. The general philosophy in going forward to change the organizational culture should consider the Hippocratic oath - that the physician should above all do no harm. This leads to the first goal statement, which might even be considered a highest level goal or a "principle."

Goal 1: The existing strengths of the federal wildland firefighting system should be preserved and built upon.

It is imperative that the strengths of the current system be recognized, reinforced and built upon. Some of the goals identified in this report are similar or identical to goals already identified in previous studies of wildland firefighter safety. They are restated here because of their importance and the need to recommit to the goal or expand efforts already underway. Additionally, while management may believe a previous goal has been met, the identification of it as an ongoing issue by the respondents may indicate a need for management to revisit it.

Safety Attitudes

A good attitude about safety does not guarantee appropriate behavior, but there is unlikely to be appropriate safety behavior without a good attitude. The Phase I study found that present attitudes towards safety were quite good in general. Most survey respondents and interviewers believed their supervisor and colleagues genuinely cared about safety. A significant minority felt they were given mixed messages about safety vs. the need for achievement.

There were strong feelings expressed by firefighters in Phase I that what matters most in safety was safe behaviors rather than safety attitudes. In particular, there was much sensitivity among firefighters against relying on slogans about safety that do not necessarily change behaviors. The respondents' sensitivity to "sloganeering" was so great than we do not recommend an increase in slogans and messages about safety.

We even question whether it would be useful to have a goal dealing with attitudes toward safety; there is the risk that it might be interpreted as a slogan-like truism. Rather, we propose tracking attitudes as an intermediate effectiveness measure (See Chapter 8).

Employee Rights and Obligations as Professionals – The attitude that seemed most important to foster was a willingness on the part of all members of the firefighting community to speak up about safety, and a willingness of supervisors to listen. Not only should an employee be granted the right to speak up about an observed safety violation, hazard, or safety improvement, but it should be his or her professional obligation to do so.

At present, some employees feel uncomfortable in being the first to raise a safety issue. (The survey showed that almost one fifth of the employees feel that their supervisors did not listen to them when they raised safety issues.) There also were many who are concerned that there will be reprisals of some sort against them for raising safety issues. Female firefighters and minority firefighters are concerned that, after having won respect for their firefighting expertise, they will lose respect if they are the first to point out a safety problem. That should change; ideally, everyone should feel comfortable raising safety issues with their supervisors. The employees must understand that they have this right and obligation, and supervisors must understand that they are expected to listen. This leads to the second goal or aspect of the organizational culture:

Goal 2: A "Code of Conduct" should be established in which employees should have both the right and obligation to report safety problems, and to contribute ideas on safety to their supervisors. The supervisors are expected to give the concerns and ideas serious consideration.

Goals 2-6 and selected others may be considered part of a tacit or explicit "Code of Conduct" that governs a firefighter's rights and obligations. Because they are so important, each element of the "code" is addressed here as a separate goal. There is no question that an employee should be granted the right to point out safety problems, but beyond that, there is a need for employees to internalize this "right" into a sense of professional obligation.

In the "crew resource management (CRM)" system used in air operations, everyone from co-pilots to passengers in an aircraft are expected to point out safety problems such as observed flames emitting from an engine. Might all wildland firefighters be incorporated into a CRM system for wildland fire operations? The adoption of a CRM-like approach would require training in how to raise safety issues

respectfully and how to listen respectfully as well. We believe implementation would be challenging but rewarding. Taking on the CRM approach is one of the most important cultural changes to consider.[3]

Employees should be encouraged to raise solutions, as well as problems. But not knowing a solution should not stop someone from pointing out the problem. It is up to the supervisors or their management to make the decision as to what is safe or not safe. It is extremely important in emergency situations to avoid anarchy. However, supervisors and managers must explain what is being done, or why a concern raised by an employee is not being heeded. Of course there are times of extreme emergency when there is no time for full explanation, but there usually is time for some response.

A principle related to Goal 2 is the desire to have an organizational culture in which there is open sharing of information on safety incidents. The culture needs to encourage reporting for the purpose of learning, correcting, improving, and preventing safety problems, and not for the purpose of blaming. This leads to Goal 3:

Goal 3: Every employee is expected to report a) injuries, b) entrapments/shelter deployments/burnovers, and c) near misses.

Safety problems generally should be reported in light of, or with reference to, established safe practices, procedures and standards.

Reporting can be facilitated by providing appropriate forms and reporting protocols that define what constitutes a reportable incident and how to report it. The basic goal is that the employee should be allowed and encouraged to report these safety problems, one way or another. There should be absolutely no reprisals against anyone reporting such information; there should be severe penalties for anyone interfering with an employee's reporting of safety incidents. On the other hand, the culture also should not foster character assassination, which is especially easy with E-mail broadcast capabilities. We heard several times of E-mail used for public condemnation of an

---

[3] Adopting the crew resource management system approach would also contribute toward the crew dynamics and communications goals discussed later.

individual after a fire. This indicates the need for a formal, effective system. Protocols must be observed; there should be penalties considered for slander and not going through channels with safety reports.

"Due process" must be built into the reporting process. That is to say, when a person is identified as having committed a safety violation, he or she should have the opportunity to respond to the report and explain what was done and why. The intent of the process would be to maximize learning by the organization and the individual, based on a reasoned review of the situation.

Some people may not report problems because of the inconvenience of reporting, or the perception that the report will not be acted on. Those issues need to be addressed in the implementation of the goal.

Changing the culture to encourage reporting and make it an obligation is not useful unless there is another goal to develop a clear picture of safety problems. Hence:

Goal 4: The five agencies should strive to obtain a clear quantitative picture of the pattern of safety incidents, their causes, trends, and the lessons learned; and to identify potential problems at the earliest.

Looking at statistics can help reveal whether safety problems are increasing or decreasing. Considering near misses can give insights into potential problems before they become dire problems. The information also is needed for accountability.

The agencies need to refine the system for collecting and analyzing injury, deployment, entrapment and especially near miss data. Near misses need to be defined, and reviewed. Should they be treated like air traffic near misses, or will they be so numerous that it is not practical?

The agencies need to refine firefighter fatality investigation, protocols, and the method of implementing them; likewise, protocols are needed for investigations of serious injuries, entrapments, near misses: when and how to investigate.

Goal 5: All wildland firefighter fatalities should be investigated in a consistent manner to glean lessons for averting future fatalities.

All federal wildland firefighter fatalities are investigated today, but not always with a common protocol. Most multiple firefighter fatality incidents that are not investigated by other agencies (e.g., OSHA) are investigated by the U.S. Fire Administration's Major Fires Program. It investigates fires with three or more firefighter fatalities, and may investigate fires with one or two firefighter fatalities, or 10 or more serious firefighter injuries if the incidents are deemed likely to have lessons for the future.

Based on the new insights gained in this study, a wildland firefighter fatality investigation should include not only the immediate circumstances and what went wrong at the end of a chain of events, but also any insights into the underlying factors of organizational culture, leadership, or human factors that contributed to the fatality. It also would be informative to analyze wildland firefighter fatalities over several years to see if there are underlying patterns. This might include looking at psychological profiles and work histories of the victims, if possible. The firefighter fatality protocol might include the autopsy protocol developed by the U.S. Fire Administration.

Investigations also should be conducted for near fatal injuries, or incidents where multiple firefighters have significant injuries. Often the difference between a serious injury, a near miss, and a fatality is chance. These other situations can provide insights, too.

Investigations must go beyond the success or failure of technology and tactics to address human factors, decision-making under stress, and other components of every near miss and fatality.

Refusal if Situation Perceived As Unsafe – Much more controversial than pointing out problems is whether every employee should have the right to refuse an assignment or an action or a location because he or she perceives it to be unsafe.

All federal wildland firefighters currently have "a right to a safe assignment," though that leaves much to be interpreted, since there is risk involved in every fire.

The organizational culture and Standard Operating Procedures (SOPs) should allow an employee to refuse an assignment as an individual, or a supervisor to refuse an assignment or pull a crew off the line when an unsafe situation exists. In one example, a Hotshot superintendent was repeatedly told that drinking water would be "longlined" by helicopter to her crew shortly. She became quite concerned about her dehydrated crew. After several hours of delay she informed the division supervisor that the crew would cease cutting line until drinking water was available. Shortly thereafter a helicopter was diverted from bucket work and water was lowered to the waiting crew.

Goal 6: An individual or crew supervisor should have the right of refusal to pull themselves or their crew out of what they perceive as undue danger.

Before any action is taken on one's own (unless it is an immediate emergency), the employee should discuss his or her concern with the next level supervisor, who may explain why the danger is not as great as they perceive, or how it is to be mitigated. If the next level supervisor does not concur with the employee, the employee should have the right and obligation to go one more level up the organization (time permitting).

It would be far more desirable for the culture to approach these and other sensitive issues in a collaborative spirit than in a confrontational, "my right vs. your right" environment. But there does need to be a formal approach when simple good will and collaborative efforts fail.

Wildland firefighting is a quasi-military situation but not a real military situation. In the final analysis, one cannot be ordered to stay in place, even if leaving means losing the line. There also is no right to be a firefighter, or to be paid if you do not work. Judgment will be needed by human resources departments and the law as to what constitutes reasonable safety behavior. The culture has to reflect the fact that it is ultimately a civilian operation and not a military organization.

Crew supervisors have the right to refuse assignments that they think are beyond the capabilities of their crew or that would endanger their crews unduly. Refusal to a fireline assignment generally should be based on a violation without adequate mitigation of the established safe practices, procedures or standards (e.g. the 10 standard orders, standards for downhill line construction, etc.)

A key question is how often these refusals would occur, and whether they would endanger others. If a crew refuses to dig a portion of a fireline and there is no substitute crew, that hole in the line could endanger adjacent crews. If an individual with a key skill (e.g. a bulldozer operator) refuses to continue to work, that too can endanger others. Also, how often can someone refuse assignments and still be considered a firefighter? In the extreme, suppose someone always refuses an assignment, should they still be paid? Further thought is needed on how to allow people the right to refuse an assignment without leading to anarchy or ridiculous situations where masses of people refuse work but are required to be paid.

Setting a new goal or practice in place does not mean it is unchangeable forever. There should be monitoring of how often people are quitting the line, refusing to take an assignment for their crews, etc. That feedback can be used to regulate the practice. If it is rare that out and out refusals occur, and they seem to be in reasonable situations, the new rule can be tolerated; otherwise, it would need to be revisited and reformulated.

All Firefighters Covered – The "code of conduct" relating to safety should apply to all firefighters working on federally controlled wildland fires, not just the federal employees themselves. That means state and local crews, inmate crews, military crews, and contract crews should be protected by the same rules if there is no legal conflict. Thus:

Goal 7: The safety goals and rules should apply to all firefighters working at a wildland fire which is a federal worksite.

The OSHA citations from the South Canyon fire paid little attention to jurisdictional responsibilities, and focused instead on the quality of training and supervision of firefighters regardless of the organization they came from.

Agency policies and OSHA rules currently require that all firefighters on federally managed fires be equipped with appropriate personal protected equipment. That requirement should be reinforced and broadened to encompass the goals set forth here. Anyone working in a "federal workplace" fireline should be under the same philosophy unless precluded by non-federal law that supersedes this rule. This includes state and local, contract, inmate and military crews.

The existing policy complies with this goal, but there appears to be a need to reinforce importance of the safety standards being applied to everyone.

Accountability

Perhaps the strongest feelings on the survey of firefighters regarded the need to hold people accountable for the safety decisions they make. This leads to the following principle:

Goal 8: Individuals at all levels should be held accountable for safety violations.

Accountability was one of the values deemed most in need of change by the firefighters interviewed in the survey.

There is a need to follow up with individuals who make or cause serious safety violations, even if they return to their home base after the fire. It would be desirable to retrain the individuals involved, and save them in the system, but it may be necessary to stand down some of the people who commit serious violations, either for a period of time or for the rest of their career (like a suspension or a lifetime ban in professional sports). A fair system is needed, so that people do not have their reputation damaged unfairly by another agency employee. But there should be the ability to remove someone from fire responsibilities, and still allow them to work in their main job, until a hearing or other action determines culpability.

To help ensure fairness, it might be desirable to establish standards for gauging fire management performance at the administrator, manager and supervisor levels. It also might be desirable or even necessary to establish adverse action protocols for dealing with performance deficiencies in a consistent manner.

Composition of the Firefighting Workforce

There were major concerns raised in Phase I about the decrease in experience of the workforce and how that affects judgments about planning and, perhaps most importantly, decision-making under stress. There also were concerns that the workforce – the available pool of federal employees willing and able to fight fires – has decreased in size because fewer people are volunteering for firefighting, because of fewer numbers of federal employees, and because management is not releasing some firefighters for fire duty. An additional concern about federal workforce composition was over the types of people who were joining the agencies and becoming firefighters: more scientists, fewer woods folk, less outdoors types. There is another, more subtle concern, not so much the lack of "woodsiness" as the toleration of more and more people who have no interest in fire and are allowed by the culture to do their own thing, and to abstain from pitching in to help in some way on fires. This puts more burden on the others who volunteer to be firefighters or play a support role.

The real issue is assuring the safety and competency of firefighters, rather than the personal background, experience or even the desire of the individuals involved. Performance counts and is the ultimate test, not theories about whether city people are dangerous in the woods.

There is no question that the organizational composition and culture has changed from the past. However, it is not appropriate to set a goal for the types of people in the workforce with respect to their "outdoorsiness" or their "practical" vs. scientific backgrounds – unless it could be shown that the militia concept is failing with the current types of people and they could not be trained. While a new employee's lack of "woods" experience might require that the employee receive additional basic training, there is no indication that that background implies an inability to learn the skills required to be an excellent firefighter. If it could be shown that one could not field adequate numbers of people to serve on IMTs with the current workforce, then one might consider a goal or requirement for certain backgrounds. At present, there is no proof that one cannot train the current workforce to do an excellent job, and so no goal is recommended here even though the organizational composition has changed.

With respect to the background of individuals, it would seem difficult in this day and age to require a larger percentage of the workforce to be woods folk. The changes in the workforce that have come about to meet requirements for more scientific background and to have a national competition for positions, rather than selecting local or regional people to serve in nearby parks, forests, or areas, may not make it practical or proper to set a goal for the "woodsiness" of the overall workforce. Perhaps there needs to be a goal that a minimum number of the workforce be physically competent and qualified to fight fires and be willing to do so. This goal might be based on a ten-year average personnel deployment at the peak of season each year.

There is little question that as experienced federal wildland firefighters retire or withdraw from firefighting, they are not being replaced by equal numbers of experienced people coming up behind them. There is a question as to whether the average experience levels of those still in firefighting is increasing or decreasing – fewer people are available for an increased number of fires, but the perception is that experience levels are dropping. This should be resolvable by a small study.

A related aspect of the organizational culture is that experience qualifications have been dropped or removed for some positions, especially noteworthy for Fire Management Officers, who do not have to have any fire background. And where fire experience may never have been required but was once assumed to exist, especially for agency administrators, a background that includes fire experience can no longer be taken for granted.

Experience Levels

A competent workforce is another basic principle of safety. Competence requires training and experience of the right kinds for all levels of the workforce. The desire to improve experience levels allows leads to defining some clear goals: (Training will be addressed in Chapter 6.)

Goal 9: Adequate experience levels are needed for crew supervisors and higher positions. A minimum cadre of experienced personnel is needed at each supervisory level of the fire program.

Each agency should be aware of the experience profile of their firefighting workforce at each level, and insure that enough people are in the pipeline for each level to assure continuity of experience (and competency). This requires the ability to monitor experience in the workforce; provide incentives to maintain experience; and increase opportunities to obtain experience (e.g. prescribed fires, assistance to state and local jurisdictions). It also would be useful to find more effective ways of mentoring people, to speed up the transfer of experience from one generation to the next. The current trainee system is effective but there may be a better ways to imparting knowledge. The Marines, for one, are currently doing research on how to improve mentoring and on-the-job-training to share experiences and to accelerate the benefits of having experience.

It is not clear whether experience should be expressed in terms of number of years of firefighting experience or number of seasons at a given position level, or in terms of the number of fires fought at different position levels. Experience most often seems to be discussed in terms of total years involved in firefighting, rather than years spent at a particular position level or the number of fires fought. If someone's total experience is

one fire a year for ten years, how does that compare to someone who has been to fifty fires in five years? What about the size and complexity of the fires, and ones position at them? Should experience be recorded in terms of numbers of fires by size or complexity level?

For an individual, the number of fires at each level of responsibility is a reasonable way to define experience, but the best metric for the experience of the entire group of firefighters available at each position level remains to be identified.[4]

Training as Substitute for Experience – It seems reasonable to substitute an "equivalent training level" for some of the experience requirements. However, there is a serious question as to whether any training can be shown to be a satisfactory substitute for experience. Training has to be highly realistic, or with proven carryover to actual experience, to be counted as even roughly equivalent. There is a great deal of information on this with respect to flight simulators, which are used to augment but not totally replace actual flying experience. Command of a fire, membership on an IMT, and certainly being a crew supervisor are more complex to simulate than flying. A flight simulator is simulating a physical situation; commanding fire strategy and tactics can to be simulated, but the leadership aspect is much more difficult. Nevertheless, we need to explore whether any training equivalency for experience can be established; e.g., success in a leadership training course is equivalent to one year experience.

Certain kinds of training on simulations can provide experience that could not be learned in the field without putting people at risk. That is, some types of training may provide even better "experience" than a benign set of fires. (The analogy is flight simulations of near crashes or radical flying maneuvers.) On the other hand, experience at even one fire gives a sense of reality that today's simulations may not be able to match (the importance of feeling windshift, or a drop in humidity, or the effects of carbon monoxide inhalation, for example). In light of the above discussion, we suggest adding the following goal. It might be considered part of the implementation process for

---

[4]4 This will be addressed further in Phase III

maintaining or improving experience levels, but is a critical need for the future as the workforce shrinks, and therefore is given special attention.

Goal 10: Develop ways to use training of various types to compensate for lack of experience.

This requires being able to identify what types of realistic field training, simulations, or other approaches work. The U.S. Air Force and other service branches have gone to great lengths to provide these types of substitutes for actual combat, and their lessons should be sought out. The expense of realistic training also has to be considered. The potential for virtual reality simulations is intriguing, but still just a potential. This will be explored more in Phase III.

Out-of-Region Experience – Firefighters and fire managers interviewed in Phase I raised concern about crews that were transported from one geographic area to another, and that were inexperienced with respect to the local fuels and terrain. Rather than state as a goal that crews have to be experienced in local fuel and terrain, it makes more sense to put these requirements under information flow and under training. The training of crews should cover the variety of terrains and fuels they are likely to encounter. Briefings should include specifics on the safety aspects of the fuel and terrain at the particular site to which the crew is assigned.

A related concern is the transport of crews from a low fire incidence area to a complex fire. It is very possible that they have not experienced a range of fire behaviors that span the type of situations to which they are sent. Firefighters need a framework in which they can place their experience and the situation they are facing rather than depending on limited experience. That leads to the following goal:

Goal 11: Ensure that individuals and crews in low fire incidence areas have the opportunities for experience in other areas, and/or have adequate oversight when sent to a different or complex situation.

That is, provide individuals and crews with opportunities for experience in higher fire incidence units. When needed, import higher level fire managers with the skills to augment local capabilities. There might even be a fire danger threshold that can be used to trigger the augmentation, or at least trigger considering the need for the augmented management.

FMOs as well as crews and crew supervisors should be considered for spending time in high fire incidence areas, backfilling their home agency positions as necessary. This policy would increase experience levels of those with the lowest experience, and also be fair in balancing risk and workload among individuals. It will, however, cost more in transportation, and increases the number of times when people will fight fires in unfamiliar terrain.

Certification

There were three principle concerns about certification of experience and training: that some certifications were too easy, that some certifications were given without the requirements being met, and that certifications were not always checked in the field.

Goal 12: Certifications (e.g. red cards) should be meaningful indications that a person is ready to take on the requirements of the job they are certified for.

There is a need to take a new look at what experience is required for each position, and make sure it is enough but not unreasonable, so that certifications do not allow unprepared people into key decision-making positions that affect safety (or any firefighting position for that matter). The position whose certification raised the most question marks during the interviews of Phase I was division supervisors. The adequacy of the selection and training of the crew supervisors and agency administrators also were

frequently questioned. These and each other position in the red card system need to have their requirements review. [5]

A particular concern is that a narrow type of experience is being accepted to certify people to command in situations that require much broader experience. A fire manager gave as an example a person who was certified as a division supervisor after commanding two crews on a grass fire, and then had to command six crews at a forest fire which he was not really prepared to do yet. The current system of certification was designed to handle this problem, but the culture is such that the system is not always used as intended.

The organizational culture must have respect for certification. The red cards should be a strong positive symbol that a rite of passage has been completed. It also is important to the culture that the red card system not be considered corrupt, and that the red card is a meaningful status symbol. To that end:

Goal 13: Signing off on red card credentials without reasonable evidence that the person has met the requirements (training, experience, and performance competency) should be a punishable offense.

There are two levels of sign-off problems. The first is the person who initially signs off on the task book - specified experience required for the red card certification. The second is the qualification certification committee, which reviews the task book and approves the new position. It must have good criteria to work with on what constitutes adequate experience and demonstrated competency.

Anyone who accepts the qualifications of a friend or who does not bother to check that qualifications are adequate before signing off on a person as competent to assume the next position can be jeopardizing many lives.

---

[5] The red card system is a performance-based system. Each fire position has a task book that lists all the tasks required of that position. Before anyone can qualify for the position they must successfully complete the tasks under the supervision of a qualified evaluator, and than have their book and other credentials reviewed by a certification panel.

Goal 14: Credentials should be reviewed for all resources before they are used.

In particular, red card qualifications should be reviewed when forming crews and when the crew arrives at the incident. This review already is supposed to be done, but too often is not. This review could be part of a more comprehensive check-in process that includes checking fatigue, injury status, and experience before putting a crew on the line. It is necessary to validate that the person holding the red card is the person it refers to (like airlines checking IDs for ticket holders.) The process should be expanded to smaller fires, not just Type 1 and Type 2 incidents. It might be even better to remedy this problem at the source rather then in the field, and not dispatch anyone who does not have the appropriate credentials.

Procedures also are needed to review red card certifications of more senior officials, including all IMT members, and their last date of service. There is technology being developed that can facilitate these check-ins, using personal identification cards with built in microchips to carry "permanent" and updated information.

Credentials also need to be checked for re-assigned or previously assigned resources (e.g. at transition incidents) to see they are qualified for their new assignments. Of special concern are A-D employees, contractors and local private forces.[6]

Symbols and Insignia

There were mixed feelings about whether adding insignia to wildland firefighters' uniforms showing rank and special skills would be helpful to safety. Insignia may help in delegating orders and identifying leaders, but it can also be detrimental in that it emphasizes distinctions and promotes elitism. The California Department of Forestry was held up as a model of the good use of insignias.

---

[6] 6 One senior fire manager suggested that even contractors and local private forces be required to have an annually signed Red Card as the only acceptable credential.

We did not see a persuasive case for setting a goal in this area, though further thought might be given as to whether the use of symbols and insignia would be useful.

Information Flow

Information flow is one of the most important areas needing new goals and directions. It has one of the most direct practical links to safety.

We need to change behavior and attitudes about the nature of communications in the wildland firefighting system. The way we think about and model the communication process at present does not serve well for improving safety practices.

The traditional view of wildland fire communications is that of "sending messages" or "telling someone." Unfortunately, this one-way, authoritative concept does not consider whether the message gets delivered, to whom it is delivered, and whether it is understood. The unofficial motto of "message sending" communication is: once sent, out of mind. In many cases, as in safety slogans intended to promote good attitudes about safety, the message is a one-size-fits-all directive, a declarative command.

A more productive concept of communication is one that views the process as an interactive dialogue, and incorporates questions or message confirmations as a major part of the communication process. Questions are asked to see if information is received by the intended party, whether it is understood, and if it fits the situation at hand (all of which are untested assumptions in a one-way safety message-sending concept.)

An interactive, dialogue-based concept of communication not only recognizes the possible causes of "different understandings" but also creates a different set of relations between speaker and listener. The dialogue relationship is more conducive to a respectful interaction between the parties, instead of the giving and receiving of orders and commands.

When considering that emergency operations always occur under conditions of great uncertainty, a model of communication that explicitly incorporates question-based dialogue also is more conducive to safe operations than is a one-way command-based, instruction-sending approach.

A variation on the dialog concept is to use a process in which orders or strong suggestions are preceded by a "reason why" statement, and then followed by the receiver of the message repeating the instruction, as in air traffic control communications, where this practice has reduced errors and misunderstandings.

This crucial change is needed in the culture, moving from one-way transmission of information to the concept of a dialogue, with the need to verify that information is received and understood as a responsibility of both the sender and receiver. In simple language, the sender should ask questions to check that information is received, and the receiver should ask questions if he or she does not understand it or did not receive it.

The organizational culture must change from one-way to two-way dialogue, and must train and encourage its use by all personnel. Everyone from firefighter on up must have the information needed to keep safe and to feel confident that they are informed. Corners should not be cut when it comes to information needed for situational awareness.

Goal 15: One-way communication should be replaced by a two-way dialog. People at each level of the fire hierarchy should be comfortable with requesting clarification of information, or requesting additional information. There should be no stigma attached to requesting clarification; it should be considered professional to do so.

Meeting this goal requires a change in the existing culture. Many firefighters are hesitant to ask for information they have not received, or to ask for clarifications of garbled information on the radio (over one-third of the surveyed firefighters said this happened on most fires). Some consider it " bad form" or not macho to request repeats of information that may be garbled by poor radio communications, unclear speakers, or unclear instructions. A good dispatcher would not hesitate to say "repeat" as often as needed; firefighters should, too.

Weather information is a critical type of information that often needs clarification. At the South Canyon fire, it was reported that some crews thought the weather front that had been expected had passed when they felt a change in the winds, but in fact that was a small advance change, and the major change that sharply changed the fire situation had yet to come. They were caught off guard. A dialog in which an uncertain crew supervisor asks his supervisor or the IMT whether that was the front should be considered a perfectly normal request, and encouraged.

Unnecessary requests for information can do harm by clogging channels and increasing information overload. The right expressed in the goal must be exercised judiciously. There is already at times a problem of information clutter on radio channels, and one must be careful about encouraging any increase in the use of radio communications without making sure that the capacity is there, and that truly important information will not be lost while people check relatively unimportant information. Training must be given on the proper use of communication systems.

The concept of "respectful communication" needs to be applied to radio communications and to clarifying information. Organizational resiliency in emergencies also will improve if communications are encouraged to be clearer and fail safe.

Common sense cannot be the only guide as to what information should be sent and how frequently. For example, there should be protocols about the frequency with which weather information is passed on to the crew and the timeliness of weather updates when there is a change in weather. The quality of briefings was often raised as an example of poor information flow. Large groups trying to hear speakers over the sounds of generators and other camp noise are unlikely to receive all of the information being presented. There also appears to be limited transfer of knowledge from the line back to the incident management team at the end of each operational period.

Goal 16: Information needed for safe operations and warnings should be transmitted up, down and laterally within the organization at an incident, with positive feedback that the information is received and understood.

One approach to accomplishing this goal is to establish checklists and protocols for the types of information and the timing of that information that must be sent to various levels, most especially crews. The Forest Service response to the OSHA report on the South Canyon 14-fatality fire provided a seven item checklist for briefing personnel assigned to fires, as part of the proposed risk abatement plan.

Checklists are needed for:
- Size-up
- Briefing of crew supervisors and others during incidents
- Briefings of crews enroute and/or upon arrival
- Updates and briefings of crews during an incident
- Information exchange during crew changes between operational periods (singled out as the worst information flow problem, probably because of the fatigue of the outgoing crew.)
- Dispatchers shift change
- And possibly others

Some of these already exist. All should be reviewed for clarity and completeness and whether there are unnecessary or unuseful elements in them.

Another critical type of information to communicate is whether two crews or other units are operating one above another on a slope, with the potential for the higher one dislodging rocks, fire brands, etc., on those below. Several interviewees gave examples of injuries or near misses caused by lack of this communication.

The types of information that must be communicated with high reliability include:

- weather
- predicted fire behavior
- fuel condition
- special hazards or situations
- tactics and strategy being used
- who is in charge
- escape routes and safety zones
- specific assignment and objectives for the operational period
- when requested resources will be available (or whether they will be diverted)
- where nearby crews are operating (e.g., whether two crews or other units are operating one above another on a slope).

This information may all be obvious and part of current firefighter training but it is not to be taken for granted that it is communicated to whom it should be and when it should it be.

Some of this information is one-time (e.g., fuel type and condition), others require updates (e.g., weather, predicted fire behavior).

Also, goals need to be set on whether crews should have the training and ability to interpret the raw weather information or weather digests, or whether advisories should be transmitted with instructions as to their implications and what to do. It is the difference between saying a) that winds are expected to pick up to 35 mph leaving it to the crew to interpret, or saying b) that winds are expected to pick up to 35 mph and that in 30 minutes you may have to retreat from your section of the line. How much more burden do we want to put on crew supervisors?

The checklists suggested above might be used by two people together, either in person or at each end of a radio link. For example, the size-up of a fire might be conducted in a way similar to a cockpit check by a pilot in dialog with the co-pilot, using

a written checklist of the items to be covered and two people confirming that they all have been covered.

People should be obliged to request clarification if they did not understand something. It should be an obligation of crew supervisors to make sure they have received all the types of information they are supposed to be sent. It should be the obligation of the division supervisor or IMT to make sure that the information is sent and that people are receiving and processing the information they need from above and below.[7]

Dispatchers

Dispatchers are the gate-keepers in the information flow and in practice make some key decisions on resource allocation. Some problems with dispatching need to be addressed as part of the previously cited information flow problems. Specifically, dispatchers must keep crews and IMTs informed of the availability of resources that have been requested, and any changes the dispatchers propose to make on the requests for assistance or information.

The dispatchers play a crucial role in situational awareness. Dispatchers need accurate information to pass along and to make effective decisions for themselves. They need to relay the information they have in a timely manner.

It is not clear whether there should be specific "dispatcher" goals any more than there should be specific goals for any other level with respect to information transfer. However, some reviewers felt the dispatch function was too important not to be represented at the goal level, so the following goal is suggested:

---

[7] Another communication idea offered by a senior fire management officer was to make the Fire Behavior Analyst (FBAN) a permanently assigned member of the command staff (vs. the general staff), to get vital fire behavior information directly to the IC and also the operations side of the ICS.

Goal 17: Dispatchers are key nodes in the communication system and must be well-trained, well-informed during an incident, and not exceed their authority.

The dispatchers also play a key role in facilitating "respectful interaction", and in notifying other IMT members when a potentially dangerous situation is brewing.

Equipment and Personal Protective Gear

The overall guiding principle regarding equipment is that all wildland firefighters and fire managers should be provided the equipment needed to do the job safety. That applies to any profession.

A related general principle is that new and affordable technology should be considered for improving firefighter safety, such as automated robot aircraft for reconnaissance and better ground-air-ground communications. More specific goals are addressed below.

Goal 18: All firefighters must be equipped with the personal protective equipment needed for their job.

This has been less of a problem on large fires than on initial attack or extended attack. Type 2 crews are less likely to have adequate equipment than Type 1 crews. Even worse, local volunteer and career fire departments may not have adequate equipment, especially the earliest arriving units.

Another general principle, part communications policy and part equipment policy, is that communications must be possible in real time with every crew and every squad at a fire. They must be able to be told about imminent or potential danger in time to avoid it. To that end:

Goal 19: Every crew should have a continual communications link to incident management and to nearby crews; this means having at least two radios in good working condition per crew.

Because it is important to stress radio contact and not just contact by runners or line of sight, the goal was written with the minimum implementation of two radios included.

The two radios per crew is currently met most, but not all of the time. Some crews have no radios (said to happen more with Type II and EFF crews than others). The change in organizational culture here is in demanding a "zero defects" policy with respect to communicability – crews must be reachable by radios, and must be able to reach others.

The minimum of two radios per crew might be used by a crew supervisor and a lookout, or by two squads operating out of sight of each other, or in some other way. Fires used to be fought without radios, using runners, but strategies are different today, and radios are essential for safety and efficiency. Radios are essential for command and control, and safety. There cannot be a communications loop without having the communications hardware.

Consideration might be given to an even more stringent goal, e.g., each squad should have a radio, or each unit below a full crew operating on its own, e.g., several people sent somewhere on a special assignment. There also might be a goal that each bulldozer have radio communications, if not working alongside other units that have radio communications.

There is a risk that a goal such as this can be turned into a safety negative. There are many situations where two radios would not be enough for a crew to work safety. A minimum requirement should not be misinterpreted as a statement that two radios are adequate for safety at all times and all situations.

Goal 20: The communications system used at fires needs to provide adequate channels, adequate clarity, and adequate reliability for communicating with all ground troops, aircraft and IMTs.

Achieving this goal may require a combination of good communication systems, good communications protocols, and good training that minimize the waste of channels and channel space. The proliferation of radios can overwhelm channels and the ability to communicate if there is not good radio discipline and protocols. The ability to communicate with aircraft is essential. There also needs to be an emergency frequency. Again, it is a question of degree.

Goal 21: There should be accountability for keeping equipment well-maintained.

Accountability for equipment maintenance lies both with those responsible for maintaining the equipment <u>and</u> those who use it. Crews have the responsibility to take care of the equipment, inspect and note problems with it, and take action when there are shortages. They also must help in packing equipment to send back to caches, and realize that other firefighters are going to be using it again.

The frequency of situations with shortage of replacements parts as mundane as batteries for radios needs to be decreased further (18 percent of survey respondents said it was a problem that occurs often in their experience, which is much too high a problem rate.)

Goal 22: Situational awareness should be improved by improving the ability of crew supervisors, IMTs, incident commanders and above to obtain overhead views of the fire, including data from IR and possibly other sensors.

Situational awareness and command and control can be enhanced if all levels have better information on where the fire is, how it is advancing, where escape routes and safety zones lie, where the crews are in relation to the above, etc.[8]

---

[8] 8 Situational awareness in regards to human factors is discussed more in Chapter 6; only the equipment-related part of situational awareness is discussed here.

There is a good deal of information obtained live by flying over the scene and by the use of remote sensing technology (including IR). Technology has advanced so that realistic, affordable goals can be considered to enhance imagery, if not now then in the near future. Military intelligence R&D has paved the way, and paid for the development costs.

A significant question, however, is what types of visual information to provide to different levels. Might crew supervisors be overloaded if they received too much more? Or would that simplify their ability to lead? Pictorial information also can be used to help persuade managers to release resources, or to show that additional resources are not necessary. Pictorial information can be a two-edged sword in dealing with the media and political leaders at local, state, and national levels. Pictures of fires often bring pressures to do something about them. But being able to compare different situations within a geographic area or even nationally might assist in resource allocation, and in convincing leaders of the importance of a given strategy. Although not rated among the higher solutions on the survey the project team felt that there should be some experimentation with new technology to see if it is of value; it is difficult to obtain opinions on a survey when the reality may be hard to visualize by the respondent.

Transportation

Transportation includes moving of crews or single resources from one area to another, and local transportation up to the site of the fire. There are safety, cost and fatigue tradeoffs. Helicopter operations reduce having to walk in, but raise costs and increase risks associated with their use. Net benefit considering all factors needs to be considered.

As the "army" of federal firefighters gets smaller, it may become more important to increase their mobility, both to make the most out of the available personnel and to reduce their fatigue.

Goal 23: Crews, teams, and individuals should be transported where needed with attention to net risk reduction and with consideration of reducing fatigue.

There were a number of people interviewed or surveyed in Phase I who had concerns about the bus drivers who were responsible for transporting crews to fires on mountain roads, sometimes at night, but who did not have experience in such conditions, and often were fatigued. Firefighters should not have to worry about safe transportation to an incident. The problem with drivers was mentioned enough times to merit an explicit goal.

Goal 24: All transportation drivers should have adequate experience and training.

Making sure this happens is the responsibility of incident management or transportation function management, as well as the obligation of the person assigned to drive. Anyone assigned to drive should have the obligation to speak up if they do not have the appropriate experience or training, or are not in condition to drive.

Rescue

Problems with rescuing injured firefighters were one of the lowest rated issues on the survey in Phase I, but the promptness of rescue was raised by some of those interviewed. This leads to a goal that may well already be in effect and has to be met more of the time:

Goal 25: Injured firefighters should be speedily rescued.

Planning for any fire should include planning for rescue and medical treatment of injured firefighters. In general, that seems to be done, and simply needs being reaffirmed.

Equity Considerations

All of the recommended changes in goals throughout this report should be applied to all federal wildland firefighters, regardless of race, gender or ethnicity. There may be some problems of discrimination, though the Phase I report found a remarkable consensus across all groups on safety issues, and relatively few specific complaints by minorities and females, even on the communication, equipment, and physical conditioning issues that were specifically raised with respect to perceived discrimination. This leads to one goal:

Goal 26: The rights and responsibilities of wildland firefighters should apply to all, regardless of race, gender, or ethnic affiliation.

The overall goals should be the same for all members of the wildland firefighting community. However, it may take some special efforts or offering of special help to get all groups and individuals to reach the goals. For example, there may need to be extra efforts to assure that radios are provided to all Type 2 crews, especially EFF crews. Women or Native Americans may need extra encouragement to speak up on safety issues they observe. Some ethnic firefighters (and others for that matter) may need assistance with language skills, especially to prepare for higher levels of leadership. Appendix B shows how subgroupings of wildland firefighters by age, ethnic group and gender felt about various recommendations for improving safety.

CHAPTER 5. LEADERSHIP AND FIRE MANAGEMENT

Wildland fire leadership here is defined to include all ranks above squad boss −
crew supervisors, division supervisors, operations chiefs, other incident management
team members, incident commanders, fire management officers, etc., up to agency
administrators and fire directors. This chapter discusses goals related to the leadership or
management of firefighting that were not covered under organizational culture. It
addresses leadership in the sense of the group of leaders, and leadership in the sense of
leading people. The overall level of resources allocated to fire programs is affected by
leadership of fire programs but is largely determined by others outside the fire program,
and is therefore discussed as part of the external environment of the wildland firefighting
culture in Chapter 7. Resource management within the fire programs is considered here,
as part of the leadership responsibility.

An organization's culture is determined in many ways by its leadership, and the
leadership in turn is shaped by the culture. The leadership must set the tone for safety by
example and by emphasizing safety policies. The leadership must have the training and
experience to lead and to make wise decisions at fires. The leadership must be able to
continue to function effectively when under stress. The leadership must provide a
professional role model of what can be attained through training and experience.

What exactly is the concept of leadership as opposed to the group of people who
are the leaders? There are many definitions:

> *Leadership* is the process of influencing individual and group motivation.[9]

> *Leadership* is the activity of influencing people to strive willingly for a
> group of objectives.

---

[9] Higgins, James M. & Vincze, Julian, W. *Strategic Management - Test and Cases 5th Ed.,* Harcourt
Brace Jovanovich College Publishers, 1993

> *Leadership* is interpersonal influence exercised in a situation and directed
>   through the communication process, toward the attainment of a
> specialized   goal or goals.[10]

One fire leader defined leadership as "getting people to do the right thing."

Leadership also can be thought of as being of three broad types. The first type is "organizational" leadership, the need for leadership on the direction of the components of an organization. This type of leadership is reflected in the assumption that people of a given position will provide goals and objectives to the organizational components under them because of their defined role within the organization. A second type of leadership is "hierarchical;" individuals in a given position are expected to provide leadership to those people in positions "below" them within the hierarchical structure of the organization. For example, a crew leader commanding his or her crew on the fireline or the operations chief lining out the responsibilities of each division supervisor. The third type of leadership is that displayed on an "individual" level. This kind of leadership describes people making the right choices, regardless of their level within the organization. It is leadership by example, one might say. This level of leadership applies not only to management activities but also to firefighters of any level.

Any leader in an official position of leadership has two sources of authority: positional authority, by way of his or her rank in the organization, and personal authority. Personal authority is based on personal traits perceived by subordinates like expertise, fairness, integrity, good character, openness and team orientation. Both types of authority interact. In some cases, leaders may not understand that getting their subordinates into the habit of "doing the right thing at the right time" is conditioned by how well subordinates respect the personal authority of the leader. Personal authority is like a perishable commodity and must be attended to by the leader. Favoritism, discrimination, and even being a poor listener can erode personal integrity and compromise personal authority.

---

[10] Hersey, Paul; Blanchard, K. *Management of Organizational Behavior - Utilizing Human Resources 5th Ed.,* Prentice Hall, 1988

The leadership issues discussed here cover a wide range of topics, including fire management policy, misuse of crews, strategy and tactics, leadership experience, leadership training, briefing and plans, accountability and crisis leadership. Many of the issues discussed in this chapter could be placed in the chapters on organizational culture or human factors as well. Decision making under stress is discussed in the human factors chapter. Most of the discussion on response to political pressure is discussed in the external factors chapter.

Fire Management Policy

One of the greatest dangers to firefighters arises from trying to do too much using inadequate resources. Downsizing and multiple simultaneous fires create pressures to do more with less.

Goal 1: Set firefighting goals commensurate with available resources.

Firefighter safety should be first and foremost when setting priorities among fires to be fought in light of available resources.   After the initial fires or several fires in a season, there may not be adequate resources to fight all fires all out. In prioritizing among fires, leadership should consider the risk to which firefighters will be put in fighting a fire. This leads to the closely related second goal:

Goal 2: Do not fight fires in a way that will endanger firefighters, regardless of the values to be protected.

Of course all firefighting has an element of risk. The goal is not meant to say "stop firefighting." However, even when there are enough crews available, leadership may choose not to risk personnel to protect land where a fire will not do much harm or may benefit the ecology, and has little chance of escape to other more valued resources. Firefighters' lives should not be risked except perhaps to save others, and even then not when the risk is excessive.

Firefighting tactics and strategy should consider ecological impact, but firefighters should not be put in a position of danger as a result of these limitations. Either they have to pull back, and let nature take its course, or fight a fire from sound firefighting practices and safely. "Light on the land" and "MIST" policies can be used so long as firefighters have good escape routes and safety zones, and are not overly endangered by modified tactics. There must be special concern when the Haines index is in the 5-6 range, and light on the land practices are being used.

Also, if the federal wildland firefighting policy is to stay out of direct structured fire suppression, and only protect structures from the exterior, or indirectly, there needs to be political backing of firefighters on this policy by the leadership within and outside the fire program, because the federal firefighters sometimes feel pressured to join in when a home or other structure is burning. Homeowners and local fire departments need to understand the policy, too.

In some agencies it appears that the policy regarding structures is not as cut and dry as "don't do it;" primarily wildland firefighters might have some structural responsibilities (e.g., The National Park Service is responsible for certain structures in the parks.)

In areas where there are mutual agreements between federal crews and state or local agencies, those cooperators need to understand that the federal personnel cannot be used for structural firefighting on a mutual aid call.

Goal 3: The strategy and tactics of fighting a fire must be continually flexible and periodically reconsider the available resources and the changing situation.

It is very important not to lock in on the first strategy or tactics selected, and then not change not matter what. Sometimes one may have to switch from an offensive to defensive mode, or vice versa. The strategy or tactics for a fire should not simply be stated once and for all, and then implemented as best as possible using existing resources. Changing availability of resources and failure of resources to appear as scheduled may necessitate modification of strategy and tactics. Not having enough resources may not

only doom a strategy but may also unnecessarily endanger firefighters. It is particularly important that agency administrators who do not have a fire background not unknowingly set unreasonably hazardous objectives for fighting a fire.

Appropriate Use of Various Crew Types

Phase I showed that there is great concern over the occasional misuse of Type 2 crews, contract crews, military crews, inmate crews, and EFF crews. However, the most concern was voiced for misuse of local volunteer and career fire departments that do not have adequate training or equipment for wildland firefighting.

Misuse of crews is meant here in the sense of giving crews fire assignments they do not have the capability to handle safely. "Misuse" sometimes results from a lack of awareness of the capability of the crew on the part of the Incident Commander (or other leadership positions giving the crew their assignment). The leadership might not ask about crew capability, or the crew might not be forthcoming about its fatigue level, experience or other characteristics.

Fire managers we interviewed pointed out that there is a wide range of competency of Type 2 crews, and that fatigue levels and competency change over the course of a season. Type 2 crews often do not remain as cohesive units over the course of a season, so their experience and capability can vary greatly from dispatch to dispatch. This set of circumstances leads to three goals below.

Goal 4: A method is needed to rate the capability (competency and condition) of a crew.

The rating needs to consider the training, experience, physical conditioning, work history (in terms of hours worked, time worked, weeks worked, travel time and mode of transportation to the site), level of fatigue, morale, and perhaps other factors such as cohesiveness. The rating needs to be useful for assigning roles to the crew, both complexity of the role and the physical challenge. War gaming often uses a rating of a unit's "morale," or "capability," which reflects its recent success in combat, its fatigue

58

level, its supply level, casualties, original training and equipment, and its leadership. Something similar might be considered for rating a crew, perhaps in terms of a multiplier that can be greater or less than one, and that would be applied to a base rating that reflects its training and experience.

The base rating of a Type 2 crew might be a letter grade (2-A, B, C) or a Type 3 crew might be reintroduced, as once existed.

Goal 5: The condition and competency of crews needs to be considered when making assignments.

The relative level of competency of a Type 2 crew cannot be taken for granted. A Type 2 crew may be equivalent to a Type 1 crew or may be far less experienced and qualified only for mop-up assignments. It varies with the crew, and the crew's competency and condition varies over the course of a season as its individual composition and experience change.

It would be easier to take the crew's competency and condition into account if there was a satisfactory method for rating the crews, as noted in the previous goal. Even without such ratings, the condition and quality of the crew and its leadership should be considered when giving an assignment.

Unlike a military situation, where leadership sometimes must use a less than acceptable unit to do a job, civilian firefighting may have to occasionally not get the job done rather than put a crew in over their head.

Goal 6: Crew supervisors need to accurately report the status and competency of their crews.

It should be required of crew supervisors that they accurately describe their crew's status, especially in terms of fatigue, training, length of time together, and experience when dealing with division supervisors and others who might be giving them assignments. For crew supervisors to do this effectively, and meet the spirit of the goal, a

system of reporting on the status of the crew will need to be developed. (Lying or being misleading about the condition of one's crew should be a disciplinary offense.)

Goal 7: The equipment of crews should be reviewed, and taken into consideration when giving them assignments.

This applies to the availability of radios, their protective equipment, their transportation, and other tools of the trade. It was flagged as a particular problem for local volunteer fire crews.

Strategy and Tactics

This category turned out to be a miscellany of different topics during the interviews and survey. Many of these issues are addressed under different goal headings. There are several topics that seemed important enough to single out for goals here.

Goal 8: Define adequacy of safety zones by terrain type, fuel type, and fuel condition.

An important deficiency identified by the Phase I respondents, in training for safety, has been the lack of defining what constitutes adequately-sized safety zones in different situations. There currently exists a curve showing the needed radius of a safety zone for a given flame height. This information is currently under further development. It needs to be included in training for all firefighters, and emphasized for crew supervisor positions. They need to have guidelines by terrain, fuel type and fuel condition. If it cannot be precise, it should at least give the best thinking on rules of thumb.

Goal 9: Assure that safety is adequately considered as transitions are made from initial attack to extended attack and from extended attack to Type 2 IMT, and Type 2 to Type 1 IMT.

It may seem counter-intuitive to some, especially those not experienced in wildland firefighting, to be more concerned about safety on a small fire than a large fire,

but that is partly why it is dangerous. Transitions can be times of disorder, of command change, of changes in tactics, and of miscommunication. There is a strong perception among firefighters surveyed that the risk is greater in the transitions from small to large fires rather than from larger to largest. The larger fires have incident management teams with safety officers, and more experienced commanders. During initial and extended attack there is normally one person managing the fire while all the other resources are focused on fighting it. At the point of transition the complexity of the fire has grown large enough to necessitate the transition, but the transition has not yet taken place. Added to this increased complexity of the fire is the complexity inherent in the transfer of responsibility of the fire from one group to another.

Transitions should be recognized as significant changes in complexity of the situation. They are especially dangerous because of the increase in fire behavior complexity occurring at the same time, incident management changes from "fire fighting" to managing an emergency situation.

It appears that the need for a transition to a more experienced IMT is often not recognized until the need is imminent, leaving the less experienced IMT with a fire of increasing complexity until the transition can occur. Several times we heard of experience when all-out efforts were made to "catch a fire" before a transition would be required. A concerted effort to catch a fire does not necessarily mean a violation of safety-based firefighting, but the risk is clearly there.

Goal 10: More fires should be attacked when they are small, if resources are available (and when the potential for spread and the values to be protected are a concern.)

Larger fires are very expensive and expose more people to risk. There is much sentiment in the firefighting community to reassess the cost effectiveness of attacking more fires faster, for example, with air tankers, especially the fast attack, smaller, new generation tankers that are much less expensive to operate. The change in culture would be like that in the armed forces, which now substitute firepower for manpower in many situations. Attacking a small fire from the air is less risky to people than airdropping

smokejumpers or landing helitack, but only if the fire can be contained by this action; otherwise, many more people are ultimately put at risk.

Goal 11: To prevent information overload and allow flexibility, the fire orders should periodically be screened to identify the minimum essential set, and that should be rigorously enforced.

Fire orders are orders. They are not to be violated. Their lessons have come at a high price.

Among the fire orders said to be frequently violated (according to 30-40 percent of survey respondents) were too few lookouts and not enough attention to safety zones – the L and S of the LCES. The E of LCES, attention to escape routes, was another area flagged, especially for engine crews. About 1 in 7 respondents said that downhill line/construction was fairly common. Some felt this was encouraged by the practice of using helicopters to transport people to the tops of fires (high on ridges).

There is some controversy as to whether the current set of ten orders are the right number, the right ones, well stated, etc. The LCES set (Lookouts, Communication, Escape Route, Safety Zones) was meant to simplify and focus on the very most important ideas. Whatever the consensus as to what constitutes the appropriate set, there needs to be greater enforcement of them; they need to be taken seriously by the culture.

Even more broadly, the organizational culture of wildland firefighting needs to include a risk assessment approach to firefighter safety. The fire orders and watchouts are in a real sense the key findings of past risk assessments. The risk assessment process needs to be periodically revisited. This leads to the following principle:

Goal 12: Fire safety practices should be driven by a systematic risk assessment that gets updated periodically.

The culture needs to continually re-evaluate its practices as technology changes, as resource levels change, as the urban/wildland interface grows, and as the forests and

wildlands change. This is a high enough level goal to be considered a principle. (We have not separately numbered the highest level goals or principles here, but that might be worthwhile in the future.)

>   ***Goal 13: The list of watchouts needs to be integrated into training and decision making, and their roles as warnings emphasized.***

The watchouts are warnings, not rules or orders. Their principles should be incorporated in realistic training on decision-making. The watchouts also should be considered as tools for improving situational awareness.

>   ***Goal 14: Workable spans of control should not be exceeded at any level of management, especially not by division supervisors.***

Not having too large a span -- generally no more than 5-7 people reporting to a supervisor--is a widespread management principle in most fields. The span of control issue was raised in Phase I in the context of division supervisors having too many crews to monitor and command. Not subdividing divisions fast enough was cited as a safety problem. Some would like to see re-creation of the sector boss position, which supervised 2-3 crews. That would not be necessary if division supervisors were not assigned more than 5 crews. 12-15 crews could be handled by 3 division supervisors, each with 4-5 crews. Using sector bosses, it would take 5-6 managers (4-5 sector bosses and at least 1 division supervisor). There was heavy emphasis in the interviews and survey in Phase I on the need for experience and training at the crew supervisor and division supervisor level for the current system to work better.

>   ***Goal 15: Develop and use criteria for when night operations would be safe and effective. Acknowledge that, depending on the circumstances, night operations are a tool that may enhance safety or may increase risk.***

There were complaints in two directions about operating at night. In some situations, night operations can be safer than day operations, because fire intensity lessens, winds are down, it is cooler, and the terrain is known and not too dangerous itself

with respect to falls and snags. The Canadians and Australians often prefer fighting fires at night.   However, there have been concerns about firefighting extending into nighttime periods when crews are not adequately familiar with terrain, or when the nighttime climate conditions or fire behavior is less suitable and more dangerous than in the daytime, when escape routes, safety zones and general terrain conditions are clearer.

It may be a truism but valid to say that safety can be promoted by using more night operations where appropriate, and less nighttime operations where not appropriate. The ability to identify when night operations are appropriate should be built into training. For some terrain and some areas it may be appropriate to shift the local culture toward or away from a night focus.

Specific Strategy and Tactics – It did not seem appropriate to recommend any particular strategies or tactics as part of setting goals for organizational culture or leadership. The culture and people chosen as leaders must be such that wise choices are made on strategy and culture, given adequate training, resources and information. A previous goal addressed the need to match resources to the choice of which fires to fight, which to monitor, and how to fight a particular fire.

Leadership Experience and Competence

Most of the issues of leadership experience were addressed in the discussion of goals on experience in Chapter 4. But there are several other issues peculiar to leadership experience, including the criteria for being selected as a leader. First is a major principle:

Goal 16: Fire experience and competency should be considered a critical selection factor for fire leadership and fire management positions.

Fire experience at times and in various agencies has been ranged from being a key selection factor to a weak factor to not being included (e.g., for FMOs). If it is accepted as part of the culture, then it has a major implication stated in the next goal.

Goal 17: All personnel in a given position must meet the performance requirements of that position.

This may sound like another truism, but it is not a well established part of the culture today. If accepted, it means that fast tracking, substituting, and lateral transfers of managers should not be done without adequate consideration of the level of experience and training of the individuals given management positions. Safety should not be sacrificed by having less than adequately experienced or trained people put into positions to meet human resources or other organizational goals. The desired goals can still be met by giving people preferences in obtaining experience, in getting training, and by increasing the realism of training, so that promising leaders can be fast-tracked. Managers without much experience might be given a graduated series of jobs initially, even if they have made their red card certification under the current system.

Rustiness – One can retain a red card certification level for five years without using it. Rusty command skills were thought to be a major problem by 28 percent of those surveyed in Part I. At least one state (Washington) uses a three-year rather than five year threshold. Technology and procedures change too much over five years for that to be a safe period. Thus:

Goal 18: Those in sensitive command functions should have relatively fresh or updated experience

This might be done through refresher training if not actual experience. At a minimum, those with rusty skills need to be supervised most carefully.

Goal 19: Crew supervisors should be selected not only for technical knowledge and experience, but also for their leadership skills, interpersonal communications, and ability to conduct on the job training.

The wildland firefighters interviewed and those surveyed generally felt that the majority of supervisors were very good, and a strong point of wildland firefighting. But a small but significant fraction of supervisors were felt to be unsuitable for the job, yet

were not weeded out in the current organizational culture. There was a strong consensus that a crew supervisor should not only be able to pass tests, but should also be screened in some way for suitability as a leader. It would be highly desirable if leadership and decision making under stress could be among the screening factors. Although this opens the selection to a certain amount of subjectivity, it is something that has been a component of local fire department civil service systems in many cities for decades.

Goal 20: No one should be allowed to set fire strategy or tactics for a fire or give any operational orders without having adequate fire experience, or training considered reasonably equivalent.

This goal is primarily directed to agency administrators who at present may not have much, if any, fire background but who are subject to politically-driven "missions" and may have the authority to set objectives for fires. The goal is also directed a FMOs, who play important roles in organizing the initial attacks of fires.

A manager does not necessarily have to have experience cutting a fireline for a season any more than an army general officer has to have served as a private, but you do have to understand the capabilities of the "troops," and what their capabilities are. It is not necessary to require that agency administrators have fire experience, but if they don't, and don't have adequate training in fire strategy and tactics, then they should not participate in setting fire strategy and tactics. We heard of cases where agency administrators dictated or suggested strategies that did not adequately consider firefighter safety (e.g., light on the land in situations where it was not possible without surrendering the fire or risking safety.)

Agency Administrators must look to others with the required expertise when participating in firefighting strategy sessions. Setting objectives is okay, so long as they are not stated in a way that dictates a strategy or tactic that may not be appropriate.

Goal 21: Fire management officers (FMOs) should be selected from among those with fire backgrounds.

The current qualifications that do not require fire experience should be revised. Among other capabilities all FMOs must have fire experience. The FMO is a critical position in influencing safety. FMOs (and crew supervisors) were singled out by the firefighters interviewed as the positions having the most influence on safety. In a time of agency downsizing, there may be shortages of personnel with the necessary experience. But often it is pressures of downsizing to place someone with a scientific background that leads to appointment of FMOs with no fire background.

If someone is appointed to be an FMO and does not have a fire background, it should be acquired as soon as possible by a combination of experience and training. It would be best if the job description of an FMO included qualifying selection criteria that require a fire background. At a minimum, it should be written to give preference to those with fire background.

Agency administrators need a somewhat similar goal, as follows:

Goal 22: Agency administrators should have fire background, or strategic fire training, or delegate fire responsibilities to a subordinate with those qualifications.

Fire experience should be a preferential factor in promotion to agency administrator. Another goal relating to agency administrators as follows:

Goal 23: The tone and substance of briefings by agency administrators should be conducive to and emphasize safety.

There were many concerns expressed about agency administrators paying lip service to safety, and then either directly or indirectly telling the incident commander and others to get the job done. The agency administrators must be careful not to imply a need to "stop this fire at that line at any cost."

In addition to FMOs, supervisors, and agency administrators, the one other position singled out as needing strengthening was division/group supervisor. Respondents considered about one in five division supervisors to be dangerous.

Following the principles above, there should be suitability criteria applied to promotion of any supervisor to the next level.

Safety Officers

The entire issue of the role of the safety officer needs to be re-examined, according to many senior fire managers we interviewed. The integrity of the position is one question--are the safety officers sufficiently independent and protected from retribution by those they report to at fires? Even more fundamentally, is their role adequately defined?

Goal 24: The Safety Officer position responsibilities, priorities, and independence should be clearly defined.

The safety officer needs to be respected by the culture, and have real function with clout. The culture of line firefighters now often belittles safety officers because of the perceived trivialization of their role.

Safety officers and all those responsible for firefighter safety should focus first on firefighting safety, versus on secondary safety and health issues. Safety officers sometimes focus on minor hygiene issues (e.g., wash your hands), and not on the main reasons they are there, to assist in safety from the fire, especially when people are busy.

Safety officers themselves must be properly outfitted and obey safety rules, something not always done. To maintain their objectivity, it might be desirable to draw safety officers from a rotating pool.

Goal 25: For extended attack fires (and larger), someone needs to monitor operations to ensure compliance with established safety requirements, procedures, policies and standards.

This might not necessarily be a safety officer. The safety officers are usually only associated with the larger fires, not with smaller extended attack fires. But the latter fires

have major safety problems associated with them, and may be more deadly than large fires. The objective here is to provide oversight and guidance to those that must "do" safety in real time while also fighting fire.

Ecological Considerations

Firefighters can be endangered by ecological considerations coming from two widely separated points. First, firefighters are sometimes asked to be light on the land or use "MIST" (minimum impact suppression technique), or to avoid fighting fires in the most efficient place because of ecological concerns. Firefighters are not to use bulldozers, etc., to avoid damaging ecologically valuable land even though it may raise the risk to the firefighter and make it much more difficult to control the fire. A balancing of values is needed, but there should never be a choice of a strategy that sharply increases the risk to the firefighter to achieve ecological goals. This concern has been covered under Goals 1 and 2 earlier in this chapter.

Second, firefighters may be endangered by not extinguishing fires while they are still small in areas where it is thought to be ecologically beneficial to let the fires burn. The problem comes when the small fire extends too far. This leads to the following goal:

Goal 26: Long-term fire growth assessment models should be used in making decisions on fire management strategy.

While there is danger to firefighters from fires of all sizes, one of the most dangerous times is the transition of a fire from a small one that can be fought with initial attack, to a larger one. As resources build up, and as the incident command system expands to meet greater complexity, there can be a danger period. Once a fire gets large, there are many opportunities for accidents. Therefore, predicting possible blowups and stopping them from occurring can be important to safety as well as ecology.

Ideally, fire models are used ahead of time to develop plans for fighting fires. But the suggestion was made by some senior fire managers to use the models in real time

during the fire season to make further decisions about which fires to monitor and which to fight, and whether the planned strategy will work.

Some fires give no room for options due to the values to be protected or a combination of other factors.   In times of limited capabilities, we need to be able to assess which fires need attention and how much, how fast.

This a more general principle, applicable even where there are no critical ecological concerns. The key is to focus on a realistic analysis of the probabilities that the action will be effective, and to identify the potential consequences if the action fails. The "action" may include monitoring a fire but not committing resources to fight it.

CHAPTER 6. HUMAN AND PSYCHOLOGICAL FACTORS (INCLUDING TRAINING)

This chapter primarily addresses aspects of safety that deal with the human mind and cognition – its capability to deal with pressure, information overload, relationships with others, rewards, denial – the range of psychological factors that affect safety. It also addresses training. The focus in this chapter is more at the firefighter or crew supervisor level than the senior levels of leadership, except for the discussion on leadership training.

In engineering, human factors tends to mean something entirely different – how well tools are designed to fit human hands or bodies, how well dials and meters and knobs are arranged to be convenient and safe, etc. This study did not consider design of firefighting tools at all, and we do not use human factors in that engineering sense. This chapter is more the psychologist's view, whereas the organizational culture chapter is

more the sociologist's view, though there is some overlap in the organization of the issues, which often involve a complex melange of human considerations.

Self-Image and Self-Assurance

New firefighters are often not aware of many of the dangers at a fire. More experienced firefighters sometimes become complacent after having been successful at many fires, and because they have self confidence in their ability to survive most situations. There are many examples of firefighters denying various dangers on the fireline so they can "cope" with the situation and continue fighting the fire.

There are two scales which can be used to describe firefighters perception of the dangers they face. The first scale ranges from fear of the fire and lack of confidence at one end to over-confidence or arrogance about the fire at the other. The mid-point might be described as self-confident, with a healthy respect for the fire, what Weick (1996) calls an attitude of wisdom.

The second scale describes the level of awareness of the dangers associated with the fire. This scale ranges from total lack of awareness of the risks, most likely from lack of experience, to an accurate awareness and appreciation of risks, to denial of the risks in the face of the evidence at hand. The denial end of this scale is represented by thoughts such as "I didn't even want to look at the watchout list because I knew we were violating a bunch of them." Firefighters are often caught on this end of the scale when fire behavior has changed; rather than acknowledge the risk they intuitively recognize, they choose to deny the increased danger and "push on" because "I have seen this before." It is difficult to strike the right balance, but the goal of doing so is important:

Goal 1: Firefighters need to maintain an appropriate psychological balance, avoiding the extremes of paralyzing fear of the danger, unawareness of the danger, or over-confidence/complacency/denial.

Maintaining a professional self-image may not seem like it relates directly to safety, but the majority of the respondents as well as many experts feel it does.

Professionalism creates pride, and that aids in retention of experienced firefighters, which is clearly linked to safety. A good professional self-image also encourages behaving like a professional, which includes safety precautions and responsible risk-taking that a professional considers, rather than the bravado and reckless risk-taking that an amateur might exhibit. Professional image is linked to issues such as classification of firefighters, pay levels, job titles and other personnel issues.

Professionals internalize the values defined by the "profession" as personal values or attributes, such as a concern for safety, teamwork, self motivation, and sense of obligation to others in the community.

The following goal applies to the public but also to the firefighting community itself:

Goal 2: Recognize and promote the image of the professionalism of wildland firefighters.

Based on the interviews and survey of 1,000 firefighters in Phase I, it seems essential for management to recognize and treat their people as professional wildland fighters, regardless of their classification or job title. It also is essential for the wildland firefighters to have a self-image or professionalism, and the care for safety and an arrangement that goes along with being a professional. In order for the image to be valid, it must be based on performance.

Situational Awareness

At the crew level, there tends to be good situational awareness of the immediate fire circumstance, but less awareness of the big picture and what to expect in one hour, two hours, or during the next shift. At the higher levels of the IMT organization, the command structure, there may be good information on the big picture, but poorer information on the fire situation faced at the crew level.

Personnel at each level must know the elements of situational awareness that need to be tracked, such as weather, predicted fire behavior, current overall fire situation, special hazards faced, where escape routes are, where safety zones are, etc.

Each level or position must be able to define the unique aspects of achieving situational awareness for that level, for example, the need to walk the line, obtain aerial overviews, use information from lookouts and field observers, use higher level sensors, collect information from supervisor debriefings, etc. There may well be two goals: identifying what it takes to achieve and maintain situational awareness for various job levels; and making sure each job level knows what it takes.

Besides helping each level do its job safely, identifying the key elements to maintain situational awareness for each job level may have another payoff. As experience levels decrease, it may be useful to explore the concept of a "fire grandmaster" like a chess grandmaster, collecting information on more than one fire, and running several fires or even a set of fires. This would extend the current area command concept. In the military, naval ships and even whole battle group or squadron commanders have to operate from the bowels of a ship, out of sight of what they command, receiving information from various combat centers and sensors and making decisions for a fleet.

Army field commanders have more actual sense of the environment. But at higher level headquarters, it is much the same. There is reliance on intelligence reports, personal contacts with field commanders, and various battlefield surveillance systems.

Weather is one critical element of situational awareness. Another, less obvious, is the location of crews in relation to each other.

Goal 3: Do what it takes to achieve and maintain good situational awareness at each level.

Goal 3 requires that sources be identified for each of the data elements needed to develop situational awareness. It also requires training of all positions on which elements

to look for and how to use it. Situational awareness should be part of the training of everyone from firefighter to incident commander.

Goal 4: Good communication is needed between crews working in proximity, especially one above the other.

While this goal might be subsumed under the communications goals, it is a particularly crucial element of situational awareness for safety in wildland firefighting. A crew at a higher elevation can dislodge rocks and even firebrands on the crew working below. The crew below cannot be setting backfires without making sure there is no crew above if the fire has the potential to threaten the higher level crew. Communication between crews is imperative in such situations. Both are highly dangerous situations. Knowledge of the positioning of crews above and below when working on slopes should be a key part of situational awareness. Each member of the crew, not just the supervisor, must be aware of the other crew's location. This is an example of a goal whose importance is already recognized by the wildland community. Nevertheless it was raised in the interviews and the questionnaires and therefore merits restatement.

Substance Abuse

Goal 5: Maintain zero tolerance policy for substance abuse at fires (including camps).

Respondents on the Phase I firefighter safety survey identified substance abuse as an ongoing problem, though it is not rampant. The goal would be to maintain a strict policy of no tolerance for any substance abuse, accompanied by education of all firefighters on the intent and reasons for the policy. This should be part of annual training. Alcohol and drug testing of victims should be considered for serious injuries and fatalities (it is part of the standard firefighter autopsy protocol.)

Training

Training is a key aspect of the organizational culture that needs significant change. Training design must consider human factors and psychological factors of the students and how they can best benefit from training. And training can have a profound influence on the human and psychological aspects of safety.

One function of training is to act as a vehicle to instill professionalism. The rituals experienced through training, and the personal investment of time and effort, combine to connect the participant with the tenets of the culture.

Goal 6: Training should be available, of high-quality, and consistent.

In some areas there is a shortage of qualified instructors. There also were comments on the survey about lack of completeness, lack of access, and lack of interesting approaches in training.

More relevant training, more use of graphics, careful selection of personnel to be trainers, good train-the-trainers courses, and other means can help implement this goal.

Goal 7: Accelerate learning by emphasizing the positive lessons from successful incidents, not just the negatives from failures.

Incidents that have gone wrong, and serious injuries and fatalities are usually investigated, but some feel there is too little attempt to identify what went right in successful incidents, and what stopped them from going wrong. Identifying the success factors can be important in accelerating learning, and sharing experience. It requires identifying what problem factors did not occur, how problems were addressed, and reasons why things went well.

Goal 8: Training needs to be made more realistic.

As experience falls, it becomes more critical to make training realistic, as a substitute for the real thing. It also is possible to train for scenarios that one hopes are never encountered in the real world (such as entrapment of crews) – the equivalent of crash landings of aircraft in a simulator.

Realism in training is needed for all levels of supervisors (crew supervisor, IMT, IC, FMO). At higher levels, practice is needed in deciding whether or not to commit resources to a fire, and how to interpret fire behavior model outputs. Practice also is needed in making decisions on fire strategy and tactics.

More realism is also needed at the basic firefighter course level; one area noted in Phase I was the need to practice shelter deployments under windy, rough terrain conditions (vs. on a flat lawn on a sunny, calm day).

Implementation of this goal should consider the state-of-the-art in fire simulators and war-gaming type simulators and fire modeling. Virtual reality displays including terrain and fire models are quite feasible to visualize. Less expensive but still valuable are the use of table top demonstrations, slides, physical simulation, walk-throughs, etc., such as have been used already. Critiques from real fires should also be used.

This goal was given very high support by the firefighters responding to the survey (see Chapter 3).

Goal 9: Provide an adequate level of training to seasonals.

The seasonal firefighter tour of duty has been shortened, sacrificing their training time. That trend needs to be reversed. The majority of the active firefighters are seasonals. Those with the most risk are getting the least training. While it is most important that the senior strategists don't put them in harm's way, they do need training to be safe in their basic firefighting skills.

Goal 10: Develop training priorities to make the most efficient use of the limited training resources.

Give priority to training FMOs and crew supervisors. These two positions were felt to have the most impact on safety and to merit the highest priority in training. They were closed followed on ranking of training needs by division supervisors and agency administrators, as far as what will have the most leverage in safety.

When training slots are limited, give priority to training those who will take fire assignments, and who will be made available, if known. Some people take advanced training to build resumes and certifications with no intent to use them. That can be harmful to safety if they preclude someone who is active from getting trained.

Goal 11: Provide supervisors with training in leadership and supervisory skills.

The technical side of training was said to be quite good, but the human factors side needing improvement.

Goal 12: Provide training to crews on the reaction skills needed in emergencies that endanger them.

Knowing how to respond to emergency situations is needed at the individual level and at the crew level.

At the crew level, exercises in responding to supervisory directions in emergencies; groupthink vs. consensus building; ways to promote crew cohesion; and respectful interaction might be included. (This will be further considered in Phase III.)

At the individual level this includes practicing such things as getting into shelters under stressful conditions (wearing packs on a slope in high wind, throwing down tools and running, etc.) Some call this "stress resistant training." [See also the section on Decision-Making Under Stress later in this chapter.]

Goal 13: Teach wildland firefighters the basics on hazards faced in the urban/wildland interface.

The urban/wildland interface problem is growing. Because federal policy is to not fight structural fires (leaving that to state and local forces), the culture tends to ignore the hazards to firefighters.

Even if they are not going to undertake interior structural firefighting, wildland firefighters need to know the hazards of propane tanks buried in grass outside structures, hidden electrical wires, and other hazards if they are to protect structures externally. And if the cultural reality is truly faced, one will find that federal firefighters in some cases will join with locals to save homes.

Citizens expect firefighters to fight all types of fires. If firefighters may ever fight structure fires, they need to know the basic procedures and hazards. Similarly, wildland firefighters may need to know some basics on EMS: BLM firefighters have had people drive up to their fire house bleeding or about to have a baby, because they assume all fire houses provide EMS.

Goal 14: Maintain skills and safety awareness with on-the-job and refresher training.

On-the-job training is valuable because it is protected, it is cheap, it keeps people's attention (non-classroom setting), it is hands-on, and up-to-date.

Skills are needed to be a good on-the-job trainer. The military has done recent research in this area; Klein and Associates, a consultant to this project, is among the leaders).

All forms of training need to keep people focused on how to perform safety and how to think about safety.

Personnel Practices: Rewards, Penalties, Feedback

During the interviews and survey in Phase I, there were more suggestions for improving personnel practices than for any other area. A number of organizational culture changes are needed in personnel practices, especially to reward and recognize the most valuable, experienced personnel in the militia and in the seasonal workforce, and keep them coming back. Disincentives to return each year, and thereby build up experience, which is critical to safety, need to be removed.

Experience is one of the keys to safety, and good personnel practices are the key to retention of seasonals and the annual return to duty of permanent employees who volunteer for fire duty.

Goal 15: Encourage retention of permanent employees on fire duty.

One of the major approaches for retention of permanents is to reduce pay disincentives and eliminate any career penalties or even the impression that volunteering for fire duty is frowned upon by one's management. Overtime issues for permanents also need to be resolved. Release for fire duty should be as automatic as service in the National Guard. Recognition should be given to employees who volunteer, not brickbats!

Goal 16: Encourage retention of seasonals on fire duty.

There should be pay incentives for seasonals who return to fire duty each year. Some form of raises, even modest, is needed to show recognition and be an incentive.

Fatigue

There is much evidence from literature outside of fire, the experience of wildland firefighters, and common sense that being fatigued leads to increased risk of making bad decisions, losing attention and alertness, and not being able to handle the physical demands of the job. The organizational culture today does not do all it can to mitigate the problems of fatigue. The two major categories of changes needed are a) more explicit

monitoring of fatigue levels, especially of crews, and b) taking measures to reduce fatigue.

One of the more dramatic indications of the importance of fatigue in reducing injuries was that those respondents to the Phase I wildland firefighter safety awareness survey who had been injured multiple times on the job rated fatigue reduction measures as likely to have much positive impact on safety, much more than did those never injured.

Goal 17: Monitor and reduce fatigue levels to safe limits.

It is important to do a better job of monitoring fatigue levels of individuals in crews. There appear to be many cases of undetected fatigue, which clearly impacts safety. Crews or firefighters who have worked many consecutive hours on previous fires are sometimes treated as if they were fresh as they arrive on the scene of a new fire. As discussed earlier, its fatigue level needs to be one of the checkpoints reviewed on each crew.

There are many ways to reduce fatigue, such as not allowing firefighters to serve more than a consecutive number of days, hours, or fires. There are some goals relating to that at present, and some practices (e.g., a limit of three consecutive weeks in the field). Those limits may need to be revisited; the BIA has found that injuries sharply increase in the third week of an assignment, and was seriously considering limiting its firefighters to no more than two weeks in the field at one stretch, something that all agencies might consider.

More attention is needed to determine whether current R&R periods are satisfactory, and the types of R&R that will best refresh firefighters. Attention may be needed to conditions in incident bases and base camps, especially daytime sleeping conditions for night workers.

Crew Dynamics

Although it was not highly rated as a problem area on the survey nor an area highly ranked for improvement, some of the most knowledgeable experts on crew behavior in wildland fires and in decision-making under stress believe that it is extremely important to promote crew cohesion.

Crews that have cohesion communicate better, make better group decisions, care more about helping each other, and respond more quickly and accurately to instructions from the crew supervisors, especially in emergencies. A major goal in organizational culture and human factors is therefore:

Goal 18: Foster better crew cohesion, especially among Type 2 crews.

Cohesive crews are needed to maintain disciple in uncertain and dangerous situations, to communicate with each other and the crew supervisors, and to think and work cooperatively. The crew needs to help each other maintain awareness and evaluate environmental conditions. The cohesion needs to be strong, but tempered with the ability to express contradictory observations in respectful interactions.

Crew cohesion could be a sub-goal under preparing for decision-making under stress, or it might be considered a step rather than a goal, but enough people have flagged it as an important attribute to consider it as a goal by itself:

Type 1 crews already train together, have more screening of their members, and generally keep the supervisor and crew members together over a period of time. They generally have good cohesiveness already. Type 2 crews do not have the same luxury; they are often a collection of strangers. The job of creating cohesion with Type 2 crews is much more difficult, and may require different approaches than with Type 1 crews.

Crew cohesion can be developed in a variety of ways, including working together for a period of time, having common background or organization of origin, successful performance as a team, and good leadership. When time is short, team building exercises should be considered; they have proven effective in other fields and probably are applicable to wildland firefighting crews.

One change in culture that could contribute to crew cohesion is to more explicitly assign each person on a Type 2 crew to a named position on a crew, a practice that is often used on hot shot crews. They have the lead pulaski, second pulaski, third pulaski, lead sawyer, lead swamper, hot shovel, etc. These are colorful names that have high appeal. They practice hiking in "tool order" by position and "reverse tool order," which means an about face, often to evacuate a position. Naming positions like this is akin to having positions on a baseball team. Research shows that cohesion begins almost immediately on teams where people are assigned to a position. There is an immediate understanding of the role each person is assigned even if not everyone remembers the other team members names.

There was a suggestion to put name tags on fire shirts, which may also contribute to crew cohesiveness, especially for newly-formed Type 2 crews who do not know each other. The tags may be like the tags used in the military that are attached with velcro. The best argument in favor of name tags is that there is an increased likelihood of conversation and communication when names can be easily used. Another suggestion was to increase physical fitness training time together, which has a double purpose of conditioning and encouraging socializing.

Crew cohesion is likely to develop unless there are barriers to it such as divisive leadership, extreme fatigue, or unethical conduct. Often the question for the leader is not "what can I do to foster crew cohesion" but am I doing something to keep it from happening?"

In Phase III, research on "Advanced Team Decision Making" should be reviewed -- what makes some teams seem more advanced than others despite seemingly equal training and experience.

Physical Fitness

There were two big issues raised in Phase I on physical fitness: the validity and veracity of the step testing process, and the wide variation in physical fitness for Type 2 crews.

   Goal 19: Develop a widely accepted physical fitness test for wildland firefighters.

   Many respondents strongly believe that the step test is not a good indicator of real-world performance in the field. There were less strong feelings on exactly what the new tests should be than that the old test was not good. Our understanding is that as this project is in progress, a new wildland firefighter physical fitness test is being developed.

   There were expressions from men and women that the physical fitness test should be gender-blind. It was felt that women should be expected to pass the same physical test as men, especially if it was for stamina or skills related to the fireline. There also were concerns about the fairness of the test for Native Americans, and for obese people. A number of firefighters made the point that someone could be overweight but could have the stamina and ability to walk up a mountain and do strenuous physical work, though they didn't do well on the step test. Either there needs to be clear medical evidence that they are wrong, or the test must be more realistic, and more closely and obviously related to field skills.[11]

   Another view of this situation is that a cultural change is needed among firefighters to understand and accept the importance of physical fitness standards for their own good.

   Many respondents commented favorably about the pack test currently under consideration by the NWCG. The comments generally supported the idea of a timed hike with a weighted pack which would more accurately reflect the work of wildland firefighters.

   Goal 20: Physical testing must be conducted honestly and for all.

   There was indication that there was at least some cheating that allowed people to slip through without passing a physical fitness test, and that people were allowed to work

---

[11] Our understanding is that as this project is in progress, a new wildland firefighter physical fitness test is being developed by Dr. Brian Sharkey.

on the fireline without having their fitness credentials checked. The physical fitness test needs to have credibility.

There is an excellent record of not having many wildland firefighters die from heart attacks or stress at fires, and that should be maintained. The bottom line measure, which here is the overall goal, is as follows:

Goal 21: Minimize wildland firefighter fatalities from health or physical conditioning factors.

Differentiation of Crews ✍ Earlier, it was discussed that some form of rating of crews is desirable to let supervisors know where a crew ranks with respect to the wide variation in skills, experience, physical conditioning, and fatigue. Some way needs to be developed to easily pass on information about a crew's physical conditioning and fatigue level in addition to its experience. That might be portrayed as one factor, or perhaps two, one devoted to experience and training, and the other to physical fitness and fatigue. If one descriptor is not sufficient, then there should be a goal here to develop a measure reflecting physical fitness and fatigue levels of crews.

There is a question as to whether the fitness and fatigue levels of non-federal crews can be screened on federal fires. It certainly would be desirable to safeguard them as well as federal personnel, if there are no legal barriers.

Decision Making Under Stress

One of the most important changes needed in organizational culture and human factors is to improve decision making under stress. It is perhaps <u>the</u> most important skill needed to improve firefighter safety. Good decisions keep firefighters out of harm's way in the first place, and are critical in deciding what to do when faced with unexpected fire behavior or the risk of being overrun by a fire. There is a great deal of recent research and ongoing work on decision-making under stress. (See the Phase I Literature Review for a partial summary of this research.)

Goal 22: Develop a safety culture that encourages people to think in the context of safe practices, standards and procedures.

The first principle is getting people to use their heads. While not being locked in to rules, they should understand the context of safety practices, standards, and procedures. People at all levels literally need to understand what they are doing. Among all of the proposed "solutions" that were included on the firefighter safety survey, one of the very highest rankings (4th out of 116 choices) was given to "develop a culture that encourages people to think." A particularly critical time to think clearly is while under the stress of fighting a fire.

Goal 23: Prepare leaders for decision making under stress.

This might include: learning to draw on a crew's collective memory, wisdom, and logic (following the findings of Putnam and Weick); respectful interaction; meditation; training with realistic simulators and situations; reducing the number of watchouts and orders; managing information overload; and providing adequate, timely information. All of these are potentially contributing factors to improved decisions.

A more generalized but equally important goal is needed, given the challenges of wildland firefighting:

Goal 24: Prepare the entire workforce for working under conditions of stress.

This might include: preparing for being away from family for weeks; how to maintain attention to the use of the tool at hand (e.g., a Pulaski or saw) for hours on end, coping with boredom of repetitive tasks without accidentally slicing one's foot; and improved recognition of dangers (e.g., snags).

Also at question is how firefighters should deal with their supervisor under stressful conditions. Should the firefighter be told to always follow the supervisor's instructions closely, especially at times of critical danger, or should they be advised to follow the supervisor's instructions unless they think they don't make sense, in which

case try respectful interaction. If still not satisfied, they ultimately have the right to take full responsibility for themselves and go off on their own (humans may do the latter anyhow, but their instructions may influence how many do what). This relates to the more general discussion in Chapter 4 on the perceived hazard of assignments, which described situations before there was imminent danger, whereas this discussion is on employee-supervisor relations when danger is at hand[12].

> *Goal 25: Crew supervisors must get the information they need, but also be shielded from a flood of unnecessary information, and the risk of information overload.*

This is part of the larger problem of decision making under stress, but deserves being singled out. There were many who felt that crew supervisors had perhaps the most impact on safety, and there needed to be much more thought about how best to train and support them with not too much and not too little information.

There is need for supervisors and above to be good decision makers in emergencies, but there also is a need for individual firefighters to react appropriately in emergencies too, which leads to the following two goals:

> *Goal 26: Foster a sense of individual responsibility for safety actions.*

While the wildland firefighting system is highly concerned about the safety of firefighters, the individual firefighter should not depend entirely on the organization for his or her own safety, and feel that he or she will be taken care of. Individuals have a professional responsibility to stay alert and watch out for their own safety. Personal responsibility at the most basic level includes care with tools, keeping an eye out for snags or falling rocks and other debris, foot placement on rough terrain and recognizing signs of fatigue. There is also personal responsibility to know the location of safety zones and escape routes and to pay attention to weather and shifting fire behavior. The

---

[1]12   In Phase III of this project, planning implementation of the goals, OSHA's findings and experience from other professions should be considered for dealing with decision making under stress, for and other safety-related goals that are similar to other professions.

objective is not to question the knowledge of leadership but rather to broaden the effort to assure the safety of the crew.

> *Goal 27: Instill in each firefighter the necessity to switch modes and take extraordinary action in extraordinary emergency situations.*

Firefighters need to understand the necessity to switch modes of action when they are in life threatening situations. Repeatedly we were told of situations where the realization that "something had changed" was delayed. Statements like "I didn't realize we were truly in a bad situation until the squad boss shook out his fire shelter," indicates a real need for this goal. There has been a human factors or cultural problem in getting some firefighters to recognize when dropping their tools and fleeing makes sense.

Part of the change in behavior or culture here may require a new lexicon for bail out situations. Some clear instruction or trigger phrase is needed for "drop your tools and run," versus "move rapidly to a safety zone." It must be clear whether you are to take tools with you (so a place to set up a shelter can be scraped out) or not to take tools with you (so you can move faster). The goal is to elicit the proper response and to get firefighters to follow the instructions of the crew supervisor and act with their team. There needs to be a change in the mental paradigm in emergency situations, recognition that one is no longer fighting the fire but rather saving one's life.

As discussed earlier in Goal 12 in this chapter (section on training), it will be necessary to explicitly train crews on how to react to emergencies, not only so people know what to do, but also so they easily switch modes in an emergency and remember that what might be inappropriate in normal circumstances (such as dropping tools) may be necessary in extraordinary circumstances.

CHAPTER 7. EXTERNAL INFLUENCES ON SAFETY

This chapter discusses the largest outside pressures that affect wildland firefighter safety. They include political pressures regarding which fires to fight and how to fight

them; the diminishing budget and resources for firefighting; and forest health. We also included the growing interdependence of various levels of government involved in firefighting.

Public Education

The public attitude toward fire is often based on lack of adequate understanding and information on the wildland fire problem, and the urban/wildland interface.

Goal 1: Educate the public on the limitations and dangers of wildland firefighting.

Homeowners who live in or are planning to build homes in places that are frequently susceptible to fires should be advised of that danger, and should be advised that there may be many situations where firefighters may be unable to stop a wildfire from destroying their home. The public needs to understand that the danger of moving into a forest that periodically has fires is the same as building a house on a seashore that regularly is buffeted by hurricanes. People do not expect emergency management forces to stay and buckle down their house, nor to face hurricane winds or tornadoes. They have to understand the same is true for wildland fires. They need to understand that, just as a river in full flood may overwhelm a line of sandbags, a fire driven by winds may overwhelm a fireline. Residents of flood-prone areas recognize that there is a point at which the sandbags cannot hold and the defense switches to an evacuation of the community. This same mode switch occurs in urban interface fires; however, in general, even the potential to do so often comes as a surprise to the resident.

This educational effort will hopefully motivate the public to support mitigation of fire risks by homeowners and agencies, and also to decrease the political pressure for firefighter heroics to save homes. It also may help in dealing with the media and politicians when a fire could not be stopped if the homeowners involved had been advised of the danger ahead of time.

The American public has become quite sensitive to risking "America's youth" in brush fire wars, but not brush fires. The press coverage of the South Canyon disaster and recent western fires have increased the public's awareness of the dangers of fighting wildfire. The public should be reminded of the dangers faced by wildland firefighters and given some background on the tactics of firefighting. Increased public knowledge should result in decreased public pressure to accomplish the impossible.

The education of "the public" here should include the media and political leadership at all levels. In addition to being made aware, they need specific information on mitigation. The education efforts can be done by local and state agencies in partnership with federal agencies.

Goal 2: Educate the public on the specific mitigating factors that may influence wildland fires and reduce damage from them.

The public at large still does not have sound understanding of how to mitigate wildfires. They understand the need to use strong fasteners for tying down a roof, and the need to board up windows, sandbag low areas, etc. for hurricanes. They must also understand the importance of tile roofs, safe landscaping (defensible space) etc., for wildfires.

Local ordinances and building codes that address wildfire issues should be supported. Education efforts about how wildfires in interface areas occur should be expanded.

Fire Program Budgets

Goal 3: Fire budgets and their allocation need to be set with an eye toward their implication for firefighter safety.

The clear connection between the budget and the level of firefighting it will pay for must be acknowledged. Safety priority has to remain a constant regardless of the budget level. If suppression effort is reduced, a minimum level is still needed for safety. For example, if funding for seasonals is reduced, that should not come out of the minimum amount of training they need at the beginning of the season. As staffing of a fire is cut, there still is need for a safety officer or officers.

The reduction in the spendable part of the budget attributable to indirect costs (the pre-planned limit for non-production items) needs to be considered as well as the total budget when considering impacts on firefighting resources and safety. The indirect costs have been escalating but are often not taken into account in assessing capability.

Decision makers need to receive the same type of education as the general public. Budget decisions need to be made in the light of how many large fires could be fought at one time. These should be compared to the expected number of large fires, and the shortfall acknowledged. The shortfalls should not be made up by cutting corners in firefighter safety.

An effort should be made to define the "bang for the buck" that a given budget level entails. What the public gets for its money should be identified as well as what the public won't get.

Fuel Build-up

Goal 4: Improving forest health and removing accumulated fuels should be pursued to reduce the intensity of fires.

The highest priority solution on the wildland firefighter survey was to implement a long range program of hazard fuel reduction.

Land management objectives should be determined in the context of firefighter safety as well as other considerations. Those interested in firefighter safety should support moves to improve forest health and reduce fuel accumulation. Reduced fuels may reduce the number of fires, and will reduce the severity of fires that do occur. The accumulation of fuels over years is one of the largest contributors to wildland firefighter risk.

Of special concern is the reduction of accumulated fuels in high-risk areas (warmer, drier habitat types), especially in proximity to interface development. Fuel reduction is expensive. To reduce the costs and ultimately help firefighter safety, it is necessary to develop markets for the understory biomass, or have tax incentives, price supports or other means to make the concept more economically feasible.

Another potentially key approach toward realizing the above goal is to consider amending the National Environmental Policy Act (NEPA) to require that firefighter safety be evaluated and provided for in the selection of land/resource management direction.

Goal 5: Take extra safety measures in drought years.

Many respondents identified occasions where by were caught off guard by rapidly changing fire behavior in dry years. Dry years dramatically increase the risk to firefighters, primarily because of the speed with which fires can move and rapidly grown in intensity. Extra levels of caution, more frequent distribution of information on fuel conditions, larger firefighting forces and other measures might be needed in drought years.[13]

---

[1]13   In 1996, The National Interagency Fire Council did daily briefings on fuel conditions using fire behavior analysts and fuel specialists. According to the NIFC Public Affairs office, it helped.

Intergovernmental Cooperation

Goal 6: Further improve federal-state-local interagency coordination.

As local, state and federal governments all reduce firefighting resources, or do not increase resources to keep up with demand, there needs to be maximum mutual support at all levels of government. Lack of adequate resources can lead to endangering firefighters. In many areas, the interagency cooperation is working well, but in some it is not. The interagency relationships need to be based on mutual respect, and "respectful interaction." These concepts need to be part of training for managers and supervisors at all levels. Interagency relationships are like marriages in that they take work to succeed, and may fall apart without nurturing. The culture needs to develop these relationships, and help instill safety consciousness in all interagency activities.

CHAPTER 8. SUMMING UP

This chapter presents a summary of the changes needed in the culture to promote safety, and a series of "wiring diagrams" showing the linkages between the major goals for changing the organizational culture, leadership concepts, and human factors that most affect firefighter safety. At the end of the chapter is a list of all the goals discussed in the report.

Vision for the Future

The goals described in this report and based on the findings of the first phase of this project are pieces of an effort to change an entire culture. A unifying vision of the culture of the future is in many ways as important as these piece parts in defining where the culture is headed. The "goal linkages" diagrams, discussed later in this chapter, help show the interrelationships of the goals. The unifying vision or "in a perfect world" scenario outlined below ties the goals together and describes the target culture. It also defines the frame of the puzzle in which all of the objectives and goals must fit. Conflicting agendas and pressures can create incompatible goals. It is important to have a unifying vision to draw attention to those conflicts.

It would be naive to think that even meeting the vision described below is enough to create an ideal fire world culture. In the year since the first interviews of this project were conducted there may well have been changes in the fire culture that might elicit additional goals. The next phase of this project may need to further improve or expand the goals. However, a description of the culture that will take shape as the pieces of the puzzle come together ensures that everyone working on the pieces agrees on at least a tentative overview of the end result or target culture.

The Wildland Firefighting Culture - The fire culture of the future will continue to be a dynamic changing culture as new people enter and others leave the fire world. External factors such as drought, wildland urban interface issues, funding, and public perception will all continue to impact fire safety.

The envisioned culture has an adequate cadre of experienced and well-trained personnel at each position level. Members of the culture recognize the value of experience. Experienced individuals share the knowledge they have collected with other members of the community as they move up through the ranks within the culture.

The importance of experience on real fires is reinforced and constructive efforts are made to utilize training more effectively to augment real experience. Everyone recognizes that training is not a substitute for experience but is an important adjunct. However, through realistic training exercises and simulations firefighters are able to experience situations that are rare or too dangerous to re-create on fires. Realistic training plays an important role in keeping individuals with limited experience opportunities current on tactics, strategies, and methods. Through effective training individuals learn to work together and operate more effectively under stress. Training encompasses much more than firefighting techniques. Instructors teach tools for decision making under stress, situational awareness, critical thinking, and planning for future fire behavior. Training courses draw upon resources and experiences from other high risk occupations and incorporate their techniques. The culture develops into a safety culture that encourages people to think rather than just obey rules.

All members of the community, across agencies, consider themselves professionals and sees that professionalism reflected in an attention to safety and accountability for poor decisions. Across all agencies and all levels there is a strong sense of responsibility for one's own safety and those of others. Respectful interaction is used by all ranks to point out and discuss safety issues. It also is the basis for a spirit of teamwork on the hottest firelines and during the midnight hours of camp duty. Although disagreements occur and personal friction is sometimes present, everyone involved in fire agrees on the importance of safety and professionalism.

A stronger certification system develops as the culture comes to recognize that not everyone has the appropriate leadership abilities to attain every position. The requirements for "passing" certification training are more rigorous, and there is a decrease in the pressure to gain certification prematurely. Expanded requirements for certification include skills in decision making, crew leadership, and situation awareness. There are realistic and valid qualifications for each supervisory position. Trainers recognize that

signing off on a task book assignment is a statement that the trainee is truly qualified to operate in that position and has demonstrated the skills outlined in the task book.

The importance of a physical fitness standard will be inculcated in all crews, not just Type I units. Fatigue will still be a part of wildland firefighting even with improved physical fitness. However, recognition of the dangers associated with fatigue will grow. A crew's fatigue level will be assessed at check-in and recorded with other characteristics of the crew. These crew ratings of fatigue, experience, and expertise become the basis for assignments on the fireline. There are great efforts made to provide night crews with quiet daytime sleeping areas, and maximizing quiet in large camps to mitigate fatigue whenever feasible. Trained crew leaders recognize signs of fatigue in themselves and their crews and act to minimize the risks of poor decisions related to exhaustion.

Firefighters of all levels report safety problems, near misses, and injuries promptly, honestly and in the spirit of learning from incidents and accidents. Review of incidents becomes a training tool for those involved as well as the rest of the community. The dissemination of "lessons learned" is the objective, not retribution. Peer review of performance, additional training, and fair and appropriate revocation of certification when necessary are the norm after accidents. Firefighters see safe and effective firefighting as the best indication of their professionalism.

All members of the culture recognize that information is a tool as important as a Pulaski or drip torch in fighting wildfire, and preventing safety incidents. Status reports and size ups take on added importance as communication shifts from reporting to two-way dialogue and risk assessment. Checklists provide incident commanders, crew supervisors, and individual firefighters guidance and help ensure that needed information is on hand. On small fires the dispatcher becomes a member of the firefighting force by tracking weather, time, resources, and other factors. The dispatcher becomes the sounding board for the lone crew on initial attack who need to review the checklists of where they stand and what to expect. In this context, respectful interaction and the responsibility for one's own safety translate into requests for more information and clarification of assignments when anyone is in doubt. There is positive feedback that intended recipients receive important information, which decreases the risks of crews operating without pertinent information. Every crew has radios and uses radio protocols,

which are included in even the most basic firefighting courses to improve the quality of radio communication. Problems with the forest radio system are resolved.

Incident commanders and Agency Administrators define fire fighting strategies with an acute awareness of the resources available and with high regard to firefighter safety. An educated public and cognizant elected officials recognize the connection between funding, resource availability, and the strategies available to firefighters. Education campaigns explain the challenges of wildfire to the public and emphasis the role the public plays in reducing the risks and intensity of interface fires. In the same way that the public recognizes the risks of floods in flood plains they come to recognize the danger of fires in fire-prone zones, and do not put undue pressures on firefighters to do the impossible.

Goal Linkages

The previous chapters set forth a variety of specific goals. Some are very high level goals such as improving decision making under stress, having adequate protective equipment for the job, mitigating the hazards faced by firefighters through forest management, and educating the public on their potential contribution.

Other goals have been at an intermediate level, and are not ends in themselves. For example, increasing experience levels is not an end in itself, but rather a goal because experience affects decision making under stress and good judgment about safety practices. Increasing situational awareness is important for identifying dangers and for input to making good decisions. Those goals feed the higher goal of good tactical decision making under stress.

There are also goals that are one or two tiers below those intermediate goals. For example, equipping all crews with at least two radios improves the opportunity for the flow of information critical to safety, which in turn improves situational awareness.

On the following pages are a series of "goal linkage diagrams" showing the interconnectivity of the various goals. Any formulation of new goals should consider where they are located in the hierarchy, and what other goals they impact.

These systems diagrams may be useful in trying to set out what is most important, and the critical elements needed to meet higher level goals.

Note that while some connections are clear, the impact of one level goal on another is not always clear. For example, it is known that the professional image of firefighters was thought by many to be important for retention, which in turn aids the build-up of experience. It also was said to be important for motivating people to pay attention to their training, which in turn affects readiness and the awareness of hazards. But others feel that changes in the job title from forestry technician to firefighter would just be cosmetic, and that the goals of retention, improving awareness, training, and caring about safety all can be achieved by appealing to people's professional instincts without a need to change position titles. A goal regarding professional image at the base of the hierarchy does not necessarily mean that is the most important area for an incremental change.

There are many ways that the goals identified in this phase are interrelated. The location of topics in the attached diagrams is only one way of visualizing their relationship. Building a hierarchy of over 80 goals would create an unreadable and complex collection of arrows, lines and boxes. Some concessions were made to simplify the diagrams.

Each box on the diagrams represents a collection of goals associated with that issue. For example, the box entitled "Fire Leadership Training," implicitly contains goals for "more realistic training," and for "training in decision making under stress." It some cases a box may have only one goal associated with it while in other cases one goal may "appear" within more than one box. The goals of "utilizing prescribed fire for training" would implicitly appear in both the training box and the experience box.

Second, not every connecting arrow was included on the diagrams, only the most direct and significant directions of influence. There are clearly multiple connections between boxes. There are connections down the hierarchy as well as the "up the hierarchy" arrows that are shown.

Third, the diagrams are not meant as an exhaustive list of the topic areas discussed in this phase. Each goal within this phase must be seen in light of its importance to the overall objective of improved firefighter safety. Many of the goals might be "good" in and of themselves but it is their support of the primary objective that has earned them a position here. They are not stand-alone objectives, but rather steps toward a culture of improved firefighter safety.

Visualizing the Interconnection of Goals - Figures 8-1 through 8-6 provide a top-down view of the interconnectivity of the goals or general categories of goals for wildland firefighter safety that were discussed in this report. *Figure 8-1* starts with the highest level considerations. One might think of the three broad principles to achieve wildland firefighter safety as reducing the firefighters' exposure to fires in the first place; increasing safety behavior at fires they are sent to; and, when the situation deteriorates, escape or take refuge. The latter could be considered part of increasing safety behavior, but we break it out because it represents the failure of efforts to make things more safe.

As shown in Figure 8-1, two main strategies for reducing exposure of firefighters to fire are to send them to fewer fires, or to get them to fires when the fires are still small. A third, less useful strategy is to send fewer firefighters to the fires.

Increasing safety behavior at fires can be divided into those aspects of behavior that are affected by strategic decisions, local or tactical decisions, and personal or individual safety decisions. How to fight the fire, whether to use direct or indirect attack, the amount of resources, and redeployment, are strategic decisions. Local or tactical decisions are those made by crew supervisors or division supervisors for the most part, and include the detailed placement of crews , exactly what they are told to do, and keeping them out of harm's way. At the individual level, the use of tools safely and keeping an eye out for falling snags or dislodged rocks are examples of ways to increase personal safety.

This page is for wiring diagram 8-1

all wiring diagrams can be found in g:\8-1.ppt; etc

When escape is necessary, it requires escape routes to get to safety zones, with the possibility of deploying shelters in safety zones, or less desirably, wherever one has to. Planning for escape routes, safety zones, and shelter deployment are all affected by local tactical decisions, and to some extent, by strategic decisions. Shelter deployment is not intended to be left as a personal decision, but individuals may ultimately make their own decision, despite what they have been told to do.

Figure 8-2 shows the goals relating to reducing the exposure of firefighters to fires at a few more levels of detail. The goal of sending firefighters to fewer fires is affected by the decisions on which fires to fight, and whether fires have been prevented in the first place. The decision on which fires to fight in turn is affected by goals relating to pre-fire planning, real-time fire modeling and management training that together affect the decision-making process. Prevention of fires is affected by citizen behavior, which can be addressed through education programs. Prevention of fires and impact on the severity of fires that do occur are both affected by fuel reduction programs, which in turn get influenced by the public's willingness to support fuel reduction policies. The goal of getting to fires when they are smaller and less intense is affected not only by fuel reduction, but also by the ability to field a stronger initial attack and to respond more quickly. That, in turn, is affected by early detection, and by providing adequate suppression resources. And as noted in discussing Figure 8-1, the exposure of firefighters to fire is also affected by the strategy at individual fires, which is discussed in Figure 8-3.

Figure 8-3 revolves around the central strategic decision of choosing a strategy for a fire that is commensurate with the available resources and the values to be protected. This might be called strategic decision-making, often under stress. Strategic decision making is directly affected by the training and experience of the strategic decision makers, the resources available to them, the degree of interagency coordination, and outside pressures from the general public or political leadership, and pressures from agency administrators and other non-fire officials within the agency having jurisdiction for the fire.

This page is for wiring diagram 8-2

This page is for wiring diagram 8-3

The strategic decision making also is affected by what we might call overall or global situational awareness – what is going on at other fires, what the future may hold, and the overview of the specific fire for which strategy is being made and how it is progressing. Fire leadership training, in turn, is affected by position requirements for incident commanders, fire management officers, and IMT positions which brings different backgrounds and knowledge bases to the training. Training also is affected by inputs from fire safety statistics and investigations of both successful and unsuccessful previous fires. (Training also is affected by the supply of competent trainers, training materials, simulators, and other factors that affect the quantity and quality of the training, but are not broken out in the figure.)

Fire leadership experience is affected by the retention of the key people with most relevant experience for making strategic decisions. The retention in turn is affected by personnel practices such as incentives to volunteer for fire duty, removal of disincentives such as impacts on one's career for "missing time," salary penalties, and ability to be released for fire duty.

The outside pressures are affected by the education of the citizens, media and political leadership as to what is and what is not feasible in wildland firefighting, akin to their growing understanding of what is and isn't feasible in holding back the effects of hurricanes or floods. For agency administrators, they either need fire experience themselves or training to fill the gap left by not having direct fire experience so that they know the appropriate bounds and of what they can reasonably affect, and also know how to set proper safety tone and how to delegate strategy making.

Figure 8-4 shows the relationship of goals related to local and tactical decisions that affect safety. At the top of the chart we show that the results of safety decisions should be fed into the reporting of safety results, which wind up getting fed into training and also into accountability.

The actual local or tactical decision making, especially decisions under stress, are affected by many factors: an improved risk assessment approach, information on crew status, ideas provided directly from the crews, local situational awareness, the training received in decision making, information from the IMT that is needed to make the

This page is for wiring diagram 8-4

decisions, and the experience level of the decision makers. The experience and tenure of crew and division supervisors is affected by retention factors such as recognition, pay, professional status and career ladder opportunities. Tenure (and experience) are affected by the screening of supervisors for leadership, and their passing and maintaining red card certifications.

The screening for leadership receives input from the accountability system, and also is affected by how well crew and division supervisors are trained. The training is affected by self-image, in that those with high self-image are more likely to have the desire to train and to try to improve themselves. Training also receives input from the analysis of firefighter safety and past successes.

Situational awareness is affected by input from crews, the fatigue level of the supervisors, and information they receive from the IMT.

The information flow from the IMT is affected in part by distribution of radios to all crews, clarity of the communication, and the availability of checklists to be sure the communications are complete, with timely information sent down the chain and appropriate feedback as to its receipt.

Fatigue is an important factor which affects crew status and local situational awareness. Fatigue in turn is affected by various fatigue-reducing policies and programs such as transport of crews, rest and relaxation for crews, and limitations on days out on the fireline.

Figure 8-5 shows the relationship of goals relating to personal and individual safety decisions. Personal safety decision-making is affected by personal situational awareness, training, experience, and one's self-confidence and risk awareness.

Improved personal or individual safety is affected by the complex process of personal decision making as to whether to stay with the group, whether to speak up about safety issues, etc., but it also is directly affected by the use of personal safety equipment, safe use of tools and physical fitness training, which do not pass through any decision making process on the part of the individual.

Figure 8-6 shows the relationship of goals associated with escape. Individual decision making with respect to escape is affected by what the rest of the crew does (crew cohesion), and crew cohesion is affected by what each individual does. Individual decision making is also affected by training on undertaking extreme safety actions such as fleeing with or without tools, and training on escape and emergency decision making (i.e., whether the need to think about escape routes).

Another wrinkle here is considering rescue and emergency medical service ability to assist people who are injured or to literally rescue people (e.g., by flying them out).

This page is for wiring diagram 8-5

This page is for wiring diagram 8-6

***

The above goal interrelationship diagrams could be done at even more detailed levels. The main point is to show that there are many interrelationships and some complex relationships between various goals, and of goals with respect to the highest principles.

One important caveat in interpreting the diagrams: The lowest level boxes do not "drive" the higher ones, but rather are just contributors to them, of various levels of importance. For example, in Figure 8-4 the goals for improving information flow would be assisted by having a more complete set of checklists as to what information is needed by whom and with what timing. However, much of that is fairly well established already. Having feedback between the person sending the message and the person receiving the message is more important than having checklists. So while a checklists box is shown as input to the information flow process, it is not necessarily critical to it.

Summary of Goals

Table 8-1 is a comprehensive list of all of the goals discussed in this report, chapter by chapter. In addition to being of interest in itself, it can be used as a worksheet for the next phase of this study, which will address the implementation and further refinement of the goals.

Some prioritization will be needed, because it is unlikely that resources would be available to start all changes simultaneously. The priorities should first be set in terms of which goals seem the most important, and then reconsidered in light of costs, the state-of-the art, and the length of time it will take to make changes.

Table 8-1 Summary of Goals

CHAPTER 4. ORGANIZATIONAL CULTURE

Preserving Strengths

1. The existing strengths of the federal wildland firefighting system should be preserved and built upon.

Safety Attitudes

2. A "Code of Conduct" should be established in which employees should have both the right and obligation to report safety problems, and to contribute ideas on safety to their supervisors. The supervisors are expected to give the concerns and ideas serious consideration.

3. Every employee is expected to report a) injuries, b) entrapments/shelter deployments/burnovers , and c) near misses.

4. The five agencies should strive to obtain a clear quantitative picture of the pattern of safety incidents, their causes, trends, and the lessons learned, and to identify potential problems at the earliest.

5. All wildland firefighter fatalities should be investigated in a consistent manner to glean lessons for averting future fatalities

6. An individual or crew supervisor should have the right of refusal to pull themselves or their crew out of what they perceive as undue danger.

7. The safety goals and rules should apply to all firefighters working at a wildland fire which is a federal worksite.

Accountability

8. Individuals at all levels should be held accountable for safety violations.

Experience Levels

9. Adequate experience levels are needed for crew supervisors and higher positions. A minimum cadre of experienced personnel is needed at each supervisory level of the fire program.

10. Develop ways to use training of various types to compensate for lack of experience.

11. Ensure that individuals and crews coming from low fire incidence areas have the opportunities for experience in others, and/or have adequate oversight.

Certification

12. Certifications (e.g. red cards) should be meaningful indications that a person is ready to take on the requirements of the job they are certified for.

13. Signing off on red card credentials without reasonable evidence that the person has met the requirements (training, experience, and performance competency) should be a punishable offense.

14. Credentials should be reviewed for all resources before the resources are utilized.

Information Flow

15. One-way communication should be replaced by a two-way dialog. People at each level of the organization should be more assertive: there should be no stigma attached to requesting clarification, it should be considered professional to do so.

16. Information needed for safe operation, and warnings, needs should to be transmitted up, down and laterally within the organization at an incident, with positive feedback that the

information is received and understood.

17. Dispatchers are key nodes in the communication system and must be well-trained, well-informed during an incident, and not exceed their authority

Equipment and Personal Protective Gear

18. All firefighters must be equipped with the personal protective equipment needed for their job.

19. Every crew should have a continual communications link to incident management and to nearby crews; this means having at least two radios in good working condition per crew.

20. The communications system used at fires needs to provide adequate channels, adequate clarity, and adequate reliability for communicating with all ground troops, aircraft and IMTs.

21. There should be accountability for keeping equipment well-maintained.
22. Situational awareness should be improved by improving the ability of crew supervisors, IMTs, incident commanders and above to obtain overhead views of the fire, including data from IR and possibly other sensors

Transportation
23. Crews, teams, and individuals should be transported where needed with attention to net risk reduction and with consideration of reducing fatigue.

24. All transportation drivers should have adequate experience and training.

Rescue
25. Injured firefighters should be speedily rescued.

Equity Considerations
26. The rights and responsibilities of wildland firefighters should apply to all, regardless of race, gender, or ethnic affiliation.

CHAPTER 5. LEADERSHIP

Fire Management Policy

1. Set firefighting goals commensurate with available resources

2. Do not fight fires in a way that will endanger firefighters, regardless of the values to be protected.

3. The strategy and tactics of fighting a fire must be flexible and periodically reconsider the available resources and the changing situation.

Appropriate Use of Various Crew Types

4. A method is needed to rate the capability (competency and condition) of a crew.

5. The condition and competency of crews needs to be considered when making assignments.

6. Crew supervisors need to accurately report the status and competency of their crews.

7. The equipment of crews should be reviewed, and taken into consideration when giving them assignments

Strategy and Tactics

8. Define adequacy of safety zones by terrain type, fuel type, and fuel condition.

9. Assure that safety is adequately considered as transitions are made from initial attack to extended attack and from extended attack to Type 2 IMT, and Type 2 to Type 1 IMT.

10. More fires should be attacked when they are small, if resources are available (and when the potential for spread is a concern.)

11. To prevent information overload and allow flexibility, the fire orders should periodically be screened to identify the minimum essential set, and that should be rigorously enforced.

12. Fire safety practices should be driven by a systematic risk assessment that gets updated periodically.

13. The list of watchouts needs to be integrated into training and decision making, and their roles as warnings emphasized.

14. Workable spans of control should not be exceeded at any level of management, especially not by division supervisors.

15. Develop and use criteria for when night operations would be safe and effective. Acknowledge that, depending on the circumstances, night operations are a tool that may enhance safety or may increase risk.

Leadership Experience and Competence

16. Fire experience and competency should be considered a critical selection factor for fire leadership and fire management positions.

17. All personnel in a given position must meet the performance requirements of that position.

18. Those in sensitive command functions should have relatively fresh or updated experience

19. Crew supervisors should be selected not only for technical knowledge and experience, but also for their leadership skills, interpersonal communications, and ability to conduct on the job training.

20. No one should be allowed to set fire strategy or tactics for a fire or give any operational orders without having adequate fire experience, or training considered reasonably equivalent.

21. Fire management officers (FMOs) should be selected from among those with fire backgrounds.

22. Agency administrators should have: fire background, or strategic fire training, or delegate fire responsibilities to a subordinate with those qualifications.

23. The tone and substance of briefings by agency administrators should be conducive to and emphasize safety.

Safety Officers

24. The Safety Officer position responsibilities, priorities, and independence should be clearly defined.

25. For extended attack fires (and larger), someone needs to monitor operations to ensure compliance with established safety requirements, procedures, policies and standards.

Ecological Considerations

26. Long-term fire growth assessment models should be used in making decisions on fire management strategy on fires.

CHAPTER 6. HUMAN AND PSYCHOLOGICAL FACTORS (INCLUDING TRAINING)

Self-Image and Self-Assurance

1. Firefighters need to maintain an appropriate psychological balance, avoiding the extremes of paralyzing fear of the danger, unawareness of the danger, or over-confidence/ complacency/denial.

2. Recognize and promote the image of the professionalism of wildland firefighters

Situational Awareness

3. Do what it takes to achieve and maintain good situational awareness at each level.

4. Good communication is needed between crews working in proximity, especially one above the other

Substance Abuse

5.   Maintain zero tolerance policy for substance abuse at fires (including camps)

Training

6.   Training should be available, high-quality, and consistent.

7.   Accelerate learning by emphasizing the positive, lessons from successful incidents, not just the negatives from failures.

8.   Training needs to be made more realistic

9.   Provide an adequate level of training to seasonals.

10. Develop training priorities to make the most efficient use of the limited training resources.

11. Provide supervisors with training in leadership and supervisory skills.

12. Provide training to crews on the reaction skills needed in emergencies that endanger them.

13. Teach wildland firefighters the basics on hazards faced in the urban/wildland interface.

14. Maintain skills and safety awareness with on-the-job and refresher training.

Personnel Practices

15. Encourage retention of permanent employees on fire duty.

16. Encourage retention of seasonals on fire duty.

Fatigue

17. Monitor and reduce fatigue levels to safe limits.

Crew Dynamics

18. Foster better crew cohesion, especially among Type 2 crews.

Physical Fitness

19. Develop a widely accepted physical fitness test for wildland firefighters.

21. Physical fitness testing must be conducted honestly and for all.

22. Minimize wildland firefighter fatalities from health or physical conditioning factors.

Decision Making Under Stress

22. Develop a safety culture that encourages people to think in the context of safe practices/standards and procedures

23. Prepare leaders for decision making under stress.

24. Prepare the entire workforce for working under conditions of stress.

25. Crew supervisors must get the information they need, but also be shielded from a flood of unnecessary information, and the risk of information overload.

26. Foster a sense of individual responsibility for safety actions.

27. Instill in each firefighter the necessity to switch modes and take extraordinary action in extraordinary emergency situations.

CHAPTER 7. EXTERNAL INFLUENCES ON SAFETY

Public Education

1. Educate the public on the limitations and dangers of wildland firefighting.

2. Educate the public on the specific mitigating factors that influence wildland fires, and reduce damage from them.

Fire Program Budgets

3. Fire budgets and their allocations need to be set with an eye toward their implication for firefighter safety.

Fuel Build-up

4. Improving forest health and removing accumulated fuels should be pursued to reduce the intensity of fires.

5. Take extra safety measures in drought years.

Intergovernmental Cooperation

6. Further improve federal-state-local interagency cooperation.

CHAPTER 9. EVALUATION MEASURES

This four-phase study of firefighter safety awareness will hopefully generate some changes in the goals of the agencies with regards to safety, and changes in attitudes, procedures, training, and other activities. The study also may lead to both formal and informal discussions that cause changes apart from the study's direct recommendations.

This chapter addresses how to measure whether any changes in safety are occurring, whether they are for the better or the worse, and to what are they are attributable.

The evaluation measures here are divided into two categories: <u>global outcome measures</u> reflecting changes in the bottom line of safety (deaths, injuries); and a wide variety of <u>intermediate measures</u> that reflect whether the recommended changes in organizational culture, leadership and human factors are taking place. Having the bottom line measures alone would not reveal whether changes in deaths and injuries occur as a result of new actions and goals, or were just statistical variations, or due to other factors. On the other hand, the intermediate measures alone, while more directly associated with particular recommended actions, are not useful without the bottom line measures, because the actions taken may or may not affect the bottom line, which they are presumed but not proven to do. One might find that various recommended programs and ideas were implemented but did not have the desired bottom line effect, even though there was a consensus that they were the best thing to do. If casualties decrease and the intermediate measures show that various recommended programs indeed have been implemented, some cause and effect may be inferred.

The measures developed here are candidates for measuring the progress of changes in the organizational culture in Phase IV of this project. But they also can be used immediately, independent of this project, by any of the five participating agencies.

Global Measures of Effectiveness

The whole point of this firefighter safety project is to reduce deaths and injuries to firefighters. While they can be directly measured, the measurements are more subtle and complex than might be thought at first. For each measure proposed below, the trend should be considered, or at least the value of the measure before and after implementation of a program.

1. *The number of federal wildland firefighter (on-duty) deaths.*
2. *The number of federal wildland firefighter (on-duty) injuries.*

These measures should be broken out in several ways: first, by firefighting activity -- whether the fatality or injury occurred enroute to a fire, on the fireline, in training, undertaking ancillary duties, in an aircraft crash, or other. The measures should also be broken out by geographic area, federal agency, gender, age, position (firefighter, supervisor, FMO, etc.), seasonal vs. permanent, years experience, and ethnic group (Hispanic, Native American, etc.). It also would be useful to sort casualties by the terrain (grasslands, forests, etc.)

The injury data should also be broken out by the nature of the injury (e.g., broken bones, cut, etc.,), the severity of the injury (e.g., whether hospitalized or not, number of days lost from work, etc.), and the activity at the time of injury, the cause of the injury. The US Fire Administration's National Fire Incident Reporting System (NFIRS) casualty report form or an equivalent can provide most of the necessary data elements. It should be filled out for each wildland firefighting injury. Some data elements peculiar to wildland firefighters may be added, but the NFIRS form reflects NFPA fire reporting standards. Unless there is a good reason not to, it makes sense to use the standard data elements and their definitions and value lists, so that the measures can be compared to other firefighter casualties, and so the data can be used in the National Fire Data System.

In categorizing injuries, an important dimension for evaluating wildland firefighter safety is whether the injury occurred during initial attack, extended attack, on a project fire, or during the transitions from one level to another. During Phase I, there were great concerns about the increased dangers during transitions, and it is important to capture whether injuries are indeed occurring during or right after transitions.

It also would be useful to know how many consecutive days, weeks, and fires the victim had been working, and/or their fatigue level prior to the injury or fatality.

Information on the personal protective equipment worn and any failure of it is also of interest.

The U.S. Fire Administration publishes an annual report on U.S. firefighter fatalities, which includes wildland firefighter fatalities. The format and analysis of the 1995 report could be used as a model for the fatality portion of the reports.

Each wildland firefighter fatality should be accompanied by an investigation report and description of the circumstances of the fatality, with particular attention to the lessons learned. This tends to be done and widely publicized today more for multiple firefighter casualty fires, but less so for individual causalities. In 1994 more than half of the wildland firefighting fatalities were not at the South Canyon fire that killed 14 firefighters, but rather occurred one at a time. Their lessons are not nearly as well known as those of South Canyon.

For both the injury and fatality measures, the definition of an injury and fatality to be counted needs to be agreed upon. The standard definition of an injury required to be reported by NFPA fire reporting standards is an injury requiring medical attention, whether the attention is received or not. That still is somewhat vague, and will never totally resolve whether a slightly sprained ankle should be counted, or a mildly burned finger. Requiring reports only for those hospitalized or for injuries involving lost time from work is imperfect, because hospitalization and leave policy vary by local policy and practices, and even individual feelings. Burn injuries can be identified more accurately, because there are standard burn severity measures that are based on percent of the area of

119

the body burned, and whether it is a first, second, or third degree burn. The medical community is fairly accurate in recording these measures, and a minimum reporting standard can be set.

Whether an injury or fatality is "on-duty" has been given much attention in the development of USFA's national annual count of firefighter fatalities. The same approach can be used.

3.   Deaths per thousand firefighters (or better, per 100,000 hours of exposure).

4.   Injuries per thousand firefighters (or better, per 100,000 hours of exposure).

These are much more complicated measures than appear on the surface. It is difficult to get a total count of federal firefighters, and not all are active. Using FTE years would require more information than is usually tracked, though it must exist for payroll purposes scattered across personnel records. A better version of the measure, if feasible, would be the number of injuries (or fatality) per hundred thousand exposure hours. Also, it would be useful to break out the rates per thousand firefighters by each of the various categories listed above for Measures 1 and 2 (agency, activity when injured, etc.).

Another useful pair of global measures is the following*:*

5. Number of firefighter deaths per hundred fires fought.

6. Number of firefighter injuries per hundred fires fought.

This helps sort out whether changes in injury rates are due to exposure to more fires, or greater risk per fire. This might be broken out by type of fire (e.g., range, forest, interface, other) and by crew type (Type 1, Type 2, EFF, military, inmate, etc.)

A related measure, injuries and deaths per thousand acres burned, might also be considered; It would reflect the severity of the fires. It would be even more useful broken out by fuel type.

One of the most important bottom line measures would be the analysis of reasons for injuries, deployment of shelters, fatalities, burnovers and near misses. Those reasons are the ultimate indicator of whether various safety problems exist, and the relative proportion among various problems, weighted by the seriousness of the incident. The measures would be of the following form:

> *The percent of injuries where [specified problem] was the prime or one of the most important factors.*
> *The percent of deaths where [specified problem] was the prime or one of the most important factors.*

Firefighters Perceptions, Observations, and Experiences

One of the main evaluation approaches would be an annual random survey of federal wildland firefighters, which would collect data for measures dealing with the safety actions of the firefighters, their experience, their perceptions, and the actions of their supervisors and colleagues. The data can be used for both overall outcome measures and intermediate measures. This survey would be based to a large part on an edited, shortened version of the original national wildland firefighter survey developed in Phase I of this study, since that will give an excellent "before" baseline . The survey would include questions dealing with the following areas. The performance measures would be of the form "the percent of wildland firefighters who believe that...", or "the percent of wildland firefighters who report that...". The measures can be sorted by the same cross-tabs suggested for measures 1-2 above. The survey could be conducted anywhere from annually to once every five years, depending on how fast the culture is likely to be changing. The very next version of the survey compared to the baseline survey of 1996, will be revealing as to how fast attitudes and experience change.

Questions in the survey would address the following:

Injury and Incident Experience

- Were you injured in the last 12 months in connection with wildland firefighting actions or training?
- How severely? Lost time from work? Hospitalized?
- Did you experience any near misses? What kind? (falling snags, exposure to flames, exposure to smoke, etc.?)
- Did you deploy a shelter?
- Which of the above were reported?

The above questions are like a victimization survey, and will show what percentage of injuries get reported. Some of the measures from this data would be:

9.   *Percent of injuries and percent of safety incidents that are reported.*
      Rate of injuries (whether reported or not). (from the survey)
      Rate of shelter deployment per 1000 firefighters.
      Rate of near misses per 1000 firefighters.[14]

If a reporting system and protocol were set up to reliably report near misses, burnovers and shelter deployments, the rates from the official reports would be compared to the rates from the survey.

Several people might report the same incident on the survey, but it still would give a good picture of whether most injuries and safety incidents were reported or not. The respondent might not know whether some incidents were reported by their

---

[1]14 What constitutes a "near miss" needs to be clearly defined. One senior fire manager suggested that one indicator of a near miss is loss of equipment, such as engines abandoned because of changing fire conditions or other factors.

supervisors, so the percentage would be based on those for which it was known. The crew supervisors would be crucial to survey on this dimension, both with respect to their crews and themselves. It is important to have at least a rough estimate of underreporting of injuries and incidents to interpret the change in trends of the number of reported incidents. Reported incidents or injuries may increase or decrease because of increases or decreases in the percentage of reporting rather than a true rise or fall in incidents.

The firefighter survey can also be used for a rich array of intermediate measures of perceived changes in the organizational culture, leadership, training, accountability and human factors.   The survey might be conducted as part of the seasonal termination process.

Code of Conduct – For each of the following, firefighters would be asked about the frequency with which they took certain actions (once, twice, or more often) during the last five seasons. Firefighters would be asked whether they felt they could do these actions without fear of reprisal. The measures would be of the form "the percent of firefighters (survey respondents) who..."

> *Pointed out a safety problem to their supervisor during a fire.*
>
> *Refused to undertake an assignment as an individual or for a unit they led because of perceived lack of safety.*
>
> *Felt they did not receive information needed for safety.*
>
> *Felt that the overall wildland firefighter system was about the same, moving backward, or moving forward in safety, relative to last year..*
>
> *Felt that their supervisor truly cares about safety or doesn't reflect concern for safety. A question might be included or the perception of upper management's attitude, too.)*
>
> *Felt comfortable raising safety questions or suggestions to a) supervisors in the field, b) day-to-day in your job.*

Accountability - Accountability can be measured in part by perceptions of the level of accountability, and in part by data on numbers of reprimands or other actions taken for accountability. That is a little tricky, because if people generally act safely and make good decisions, there is less for them to be held accountable for, but no less effectiveness of the accountability system. (Could personnel records be tapped to get numbers of reprimand actions, with the names masked of course? Would accountability decisions flow through a particular level?) Specific measures might include the following:

> *Percent of firefighters who believe that people are being held accountable for their safety decisions and actions.*

> *Percent of firefighters who received a reprimand or other action for a safety violation.*

Information Flow

The degree to which appropriate information needed for safety is sent, and the degree to which information feedback loops are established and used would be reflected by several measures:

> *Percent of safety incidents where one of the factors was found to be a lack of adequate information or lack of timely information, or information being misunderstood.*
> *Percent of firefighters who say they often ask questions to clarify information received in the field (especially crew supervisors).*
> *Percent of monitored or observed conversations in which checklists were used and appropriate communications procedures were observed*

Data for Q21 would come from incident investigations. Data for Q22 would come from the survey. Data for Q23 could be obtained from a sample of conversations at wildland fires, which could be monitored by listening on radio channels or by observing

124

IMTs in action. The Bell System telephone companies and other organizations have sampled telephone operator's conversations to see if they regulated the appropriate information and provided appropriate information.

> *Percent of respondents who feel safety-related information is not adequate in the field, by type of problem and type of information.*

On the firefighter survey, there were significant numbers of respondents who pointed out problems with many types of information transfer: information exchange during crew changes between operational periods; poor information given at briefings; unclear radio communications; etc. Questions could be asked about each factor individually, or in one overall question as above.

> *Percent of crews not having two radios.*

This could be determined through field checks, and by surveying firefighters, especially Type II crew supervisors, since the problem was most acute for them. Bulldozer operators were another key subgroup to query regarding lack of radios, based on the one-on-one interviews.

Proper Use of Crews

Since it is unlikely, though desirable, to be allowed to run the survey for various non-federal firefighters associated with federal fires, because of OMB constraints on surveys, questions on the perceived misuse or safety of various types of nonfederal crews might be added, especially regarding local volunteer fire departments, career fire departments, inmate crews, military crews, contract crews, and EFF crews.

> *Percent of firefighters who report having observed misuse of crews, by type.*

A good baseline exists for this measure from the original survey. A second, related measure could be as follows, if the OMB approval can be obtained:

27. Percent of particular types of crews (Type II, EFF, local volunteers, local
    career, inmate) who feel they were not appropriately used, sorted by reason
    or type of misuse.

This measure would require an extra effort to locate a sample of crews of different types and get their perceptions. To keep that manageable, one might consider using a fixed cohort of crew supervisors for different type crews, and getting their opinion of whether the situation was changing over time. (The National Criminal Victimization survey keeps respondents on a panel for several years, to get year-to-year changes from the same group of observers.)

The rating would reflect either individually or in combination the crew's fatigue level, physical fitness, equipment, experience and training.

Physical Fitness and Fatigue

Percent of wildland firefighters who are injured or die on the job from
cardiovascular or stress problems (e.g., heart attack, stroke).

Physical fitness also makes it easier to avoid dangerous situations and to escape, but that linkage is harder to establish than cardiovascular illness.

Percent of firefighters who fail standard physical fitness tests.

 One might argue that they would not be allowed to be firefighters if they failed the test, but that would still indicate whether they were keeping themselves in shape when they presented themselves.)

If a good way to measure the status of a crew is developed, as has been recommended in the previous chapter, then the following measure should be used:

Percent of crews reporting for duty at a fire with a condition rating above X. (a specified threshold)

Experience

Change in years of experience, by firefighting position.

At present, perceptions have been relied on to say there is a decrease in experience. It would be more valid to monitor changes in experience levels by position type based on personnel records. Another approach is to use data on experience levels from the random sample of firefighters used on the firefighter safety survey. The initial survey would provide a baseline. Years of firefighting experience is one of the personal data elements collected.

Equipment

The major equipment problem identified in Phase I was distribution and maintenance of radios. It merits a separate measure. The second measure reflects equipment more generally. The measure could be used for non-federal crews at federal fires as well as for federal crews.

The percent of crews with two working radios.

This can be determined by field observations and by a survey question.

33. Percent of firefighters not adequately equipped with a) Personal Protective Equipment; b) appropriate firefighting tools in good condition.

Part A addresses boots, gloves, helmets, etc. Both parts can be determined by direct observation or by firefighter survey. It also would be reflected in the analysis of factors contributing to injuries.

Training

> *Percent of firefighters who report they have adequate access to training.*
> *Percent of firefighters who are satisfied with the quality of training and the percent dissatisfied, by reason for dissatisfaction.*
> Separate questions could be asked about the realism and relevance of training, and overall quality of the training.

34. *Percent of wildland firefighting courses judged to have good instructors, materials, realism by a) student; b) observers.* The first two measures can be covered by the annual firefighter survey. The third measure here would require judging the quality of instruction, which is difficult to do objectively, but is done all the time nevertheless in school systems. Trained observers sit in on classes and rate instructors for their teaching ability, the quality of materials, the curriculum used, etc. The in-class observers' ratings combined with student ratings of the same factors should give a fairly accurate picture, and indicate whether there is a change in quality and satisfaction over time.

37. *Grades on standardized safety tests, by position.*

An annual safety test for firefighters can be developed and used to assess knowledge of the minimum essentials of safe firefighting, such as the size of safety zones on different terrain, basic fire orders and their application, use of protective clothing, etc.

Leadership

Changes in the experience level and the quality of training of leadership would be reflected by the measures above, broken out by rank. Meaning changes in other aspects

of leadership that relate to safety would be reflected by the questions on the survey that related to leadership.

Decision Making Under Stress - Ratings of how decisions are made under stress can be based on observation by trained observers and by interviewers of the decision makers themselves. Specific survey questions about decision making were included on the survey. Exactly what to measure and how remains to be developed; the experience of military research and practices in this area will be tapped.[15]

Measures of External Factors

A set of measures of the changes in the external environment that affects firefighter safety may be even more important than some of the other intermediate measures above. For example:

> *The percent of urban/wildland residents who know about mitigation measures.*

A test can be administered to a sample of citizens either independently, or as part of some other citizen survey activity. The insurance industry might be interested in co-sponsoring this survey. It would test knowledge of defensible space, use of something other than wood shingle roofs, and the basics of not starting woodlands fires. It also would test citizens' awareness of the ability of firefighters to stop wildland fires.

> *39. Percent of homes in urban/wildland interfaces using concepts of defensible space.*

This could be based on a random sample of wildland homes and/or homes in areas which have wildland fires in a given year. (An analogy is the present national survey of

---

[15] Two of the project team members, Gary Klein and Marvin Thordsen, are involved in the related research, and will further develop these ideas in Phase III.

homes with smoke detectors, and the reporting of smoke detector operation in homes that
had fires). It would be of interest to know whether the percentage of urban/wildland
interface homes built with wood shingles, landscaping, etc. is changing over time. The
results of this survey could be fed back into the citizen education programs.

> *40. Percent of fires where the incident commander or IMT felt political pressures
>   on how the fire was fought.*

This can be assessed by a survey question. It reflects in part citizen awareness of
what is feasible with wildland firefighting.

Forest Health and Fuel Accumulation

While they contribute to firefighter safety by reducing fuel accumulation, the main
thrust of forest health and fuel reduction programs are for reducing fire losses and better
land management. It is not clear that a measure of progress in this area should be
considered a measure of firefighter safety. Rather, it might be considered an explanatory
variable for changes in firefighter casualties over time. The measure could be expressed
in terms of the activity level (amount of resources spent on prescribed burns and debris
removal) or in terms of number of acres treated in some manner, as follows:

> *The percent of forest lands to which fuel reduction measures have been
> applied.*

> *Percent of acres with forest health problems affecting fire occurrence.*

Use of Safety Anecdotes

Another way to evaluate safety and change in organizational culture relating to
safety is to collect examples of successes brought about by changes in training or safety

policy. For example, The National Fire Protection Association collects documented anecdotes of children saved through their *Learn Not to Burn* program, where the safety actions of a child are traced to a *Learn Not to Burn* class in school. Although in a sense most success in the field can be attributed to things learned in wildland firefighter safety courses, which would make this approach meaningless, it may be possible to collect anecdotes where changes in the information feedback policy, or in realistic training using simulations, or the encouragement of individuals to speak up, has averted or mitigated incidents that might otherwise have occurred.

Likewise, anecdotes of safety problems which still exist despite changes in policy would be revealing of a failure to improve, or indicate where there was further room for improvement. Anecdotes by themselves are not useful in providing a situational evaluation, but, used in combination with the more statistical measures discussed above, can be very powerful and help interpret the data.

Summary of Data Collection Approaches for the Measures

The above measures addressed what we considered to be the most important aspects of organizational culture, leadership modes and human factors that contribute to safety with a direct linkage. They would give a great deal of insight into whether the culture and the bottom line of safety is changing. While a performance measure could be developed for each and every goal statement in this report, that probably would be an unwieldy system.

As noted throughout the above discussion, there are a few data collection approaches that will yield the vast majority of the desired information. These are summarized below.

Firefighter Survey – Measures of the perceptions of firefighters and changes in behavior of firefighters can be collected using a firefighter survey questionnaire scaled down from the original questionnaire.

Citizen Survey – Either independently or as part of broader survey for other services, a citizen survey would provide information on citizen knowledge and actions taken to mitigate wildland firefighter losses.

Trained Observers – Trained observers can be used to collect information for measures that reflect firefighter behavior at fires. Trained observers also can be used to review the "defensible space" around structures. Trained observers have to be careful not to disturb the process they are observing.

Analysis of Incident and Casualty Data – In addition to tracking trends in these bottom line measures of deaths and injuries, an analysis of factors that cause the incidents can be extremely important in reflecting changes in the culture.

Anecdotes – Collections of anecdotes relating to successes or failures add flesh to the statistics, and can be revealing themselves as to whether the culture is changing. Sometimes anecdotes may reveal positive behaviors that never existed before.

Interviews with Firefighters and Fire Managers – In Phase I, structured interviews and a series of focus groups were conducted involving over 300 firefighters to identify problem areas, strengths, and solutions. Revisiting firefighters one-on-one or in focus groups to discuss changes in the culture that they have perceived over, say, the last five years could be very revealing. Year-to-year changes may be too subtle to be reflected through these perceptions, therefore the concept of doing this once every five years. An alternative is to use a structured questionnaire to collect information on behaviors one-on-one.

More goal-specific measures may be added after the goals in this report are reviewed and approved. Additional measures also may be added after the development of implementation approaches in Phase III.