FIRE COMMAND 2E

Approved by the Statewide Training and Education Advisory Committee

Adopted by the State Board of Fire Services

INSTRUCTOR GUIDE

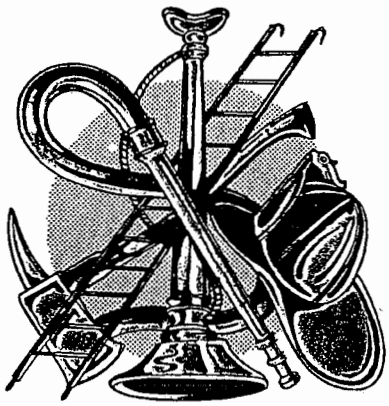
January 1994

California Department of Forestry and Fire Protection

State Fire Training

FIRE COMMAND 2E

Wildland Fire Fighting Tactics
Instructor Guide



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C F S T E S

The California Fire Service Training and Education System (CFSTES) was established to provide a single statewide focus for Fire Service Training in California. CFSTES is a composite of all the elements that contribute to the development, delivery and administration of training for the California Fire Service. The authority for the central coordination of this effort is vested in the Training Division of the California State Fire Marshal's Office with oversight provided by the State Board of Fire Services.

The role of CFSTES is one of facilitating, coordinating and assisting in the development and implementation of standards and certification for the California Fire Service. CFSTES manages the California Fire Academy System by providing standardized curriculum and tests, accredited courses leading to certification, approved standardized training programs for local and regional delivery; administering the certification system; and publishing Career Development Guides, Instructors Guides, Student Manuals and other related support materials.

This system is as successful and effective as the people involved in it. It is a fire service system developed by the fire service, for the fire service . . . and we believe it is the best one in the country.

ACKNOWLEDGEMENTS

The development of the material contained in this manual was coordinated by the Training Division of the California State Fire Marshal's Office and approved by the State Training and Education Advisory Committee (STEAC) and the State Board of Fire Services (SBFS). This curriculum is appropriate for fire service personnel and for personnel in related occupations who are pursuing one or more of the certification programs.

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FIRE COMMAND 2E

STUDENT MATERIALS

Quizzes printed on blue paper. Do not collate or staple quizzes.

Problems printed on green paper. Multi-page problems should be stapled.

The following student preassignment is sent to the students by the host agency 30 days prior to start of class, with instructions to read and complete as required.

- Introduction to Fire Behavior (S-190) - National Wildfire Coordinating Group Read and complete units tests.
- Wildland Firefighting. Read Chapters 1-7 and Chapter 11.
- Bring the following Incident Command System Publication - Operational System Description (ICS 120-1) and Field Operations Guide (ICS 420-1) to class.

The following information makes up the student manual provided by the CSFM. Items in bold are separate pamphlets and not included in the student manual reproduction "master."

HANDOUT #	TITLE	# OF PAGES
1	Introductory Sheet	1
2	Course Outline	1
3	Course Purpose and Objectives	2
4	Statutory Responsibilities of Various Agencies	2
5	Recommendations on Reducing the Risk of Wildland Fires and Flooding in California (04/81)	53
5b	Stealth AFB Layout	2
6	PROBLEM #1	2
7	Plans	2
8	Wildland Fire - Strategy and Tactics	5
9	**Planning For Initial Attack**	Pamphlet
10	Homework Assignment	1
11	Introduction to ICS Form 201	4
12	ICS 201 Incident Briefing Forms (double-side)	10
13	PROBLEM #2	2
14	Bulldozers in Fire Management (04/83)	4

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15	Wildland Hose Lays	2
16	Handcrew Capabilities	3
17	Conservation Camp Program (01/89)	25
18	Working With California Inmate Fire Crews (04/91)	66
19	PROBLEM #4	2
20	Safety Rules - Air Tankers (09/76)	2
21	Helicopter and Air Tanker Capabilities (1988)	5
22	Stand and Fight - Cut and Run	10
23	Buffalo Canyon Structure Protection Plan	15
24	PROBLEM #5	2
25	Fire Modeling	3
26	Fire Suppression Interpretations of Flame Length and Fireline Intensity	1
27	Radiation (1976)	10
28	*Deleted*	
29	Heat Conduction & Wildland Fire (1976)	13
30	*Deleted*	
31	Humidity (1971)	18
32	Rate of Spread Guidelines	2
33	Fire Environment Concept (1972)	14
34	Fire Whirls (1971)	12
35	Using the 1978 National Fire Danger Rating System	18
36	PROBLEM - Mapping	2
37	Acreage Grid	1
38	PROBLEM #6	4
39	Principles of Organization	3
40	Unified Command	12
41	Direction	1
42	Controls	2
43	Incident - Report on Conditions	1
44	Clear Text - Radio System - IFSTA	2

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45	Simulator Problem #1	1
46	Simulator Problem #2	1
47	Simulator Problem #3	1
48	*Deleted*	
49	**Heat Stress**	Pamphlet
50	**Survival Checklist**	Pamphlet
51	**Common Denominators**	Pamphlet
52	13 Situations That Shout "Watch Out"	14
53	*Deleted*	
54	You're In Your Car and Surrounded By Flames: Don't Panic	2
55	Wildland Fire Command Checklist	1
56	**Wildland Calculator**	
57	Foam Application for Wildland and Urban Fire Management (1990)	24

INSTRUCTOR GUIDE
INSTRUCTOR TO FURNISH

Video:

- Fire Weather
- Who's on First
- Ash Wednesday 1983
- Yosemite 1988
- Normal Heights 1985
- California, A State on Fire 1985
- Panorama 1980
- Fire fighter Safety & Survival (NFA)
- Dozer (SLO)
- Adelaide Mills
- Las Pilitas, 1987
- Wildfire Handtools
- Wildland Fire Foam
- Wildland Fire Safety Equipment
- Stanislaus Complex Fires, 1987
- Eagle Fire, 1989
- Fire in the Interface
- Rappin 10 Standard Orders
- Crank Fire, 1987
- Firesafe California

Slide:

- Firefighter Survival
- Stand & Fire or Cut & Run
- ICS General Familiarization
- Simulator Problems
- Aircraft/Helicopters
- Fuels

Printed Materials:

- California Fire Protection Map
- Oxbow Quads and Orthophotos
- Simulator Maps, Butte County
- Display items, accident reports, photos, books, magazines

Cassette Tapes:

- Romero Fire
- Problem #3
- Sound Effects

Others:

- Safety clothing
- Fire Shelter
- Belt Weather Kits
- Hose Appliances

PRESENTATION	APPLICATION
I. Introduction	
A. Introduction of staff	
B. Cover all requirements including smoking, coffee breaks, class and meal hours	
C. Introduction of course instructors	
1. Instructors available for special evening sessions if desired	
D. Have each student complete an Introduction Sheet indicating their name, department, rank, present assignment, years in fire service and listing of previous assignments and wildland assignments, e.g., Strike Team Leader, Division Supervisor	Handout #1 - Introductory Sheet
1. After completing this information collect and redistribute. Each student is to introduce another student	Determine how many students have had Basic ICS (I-220)
E. Have class determine ground rules for the week, no ties, one person talks at a time, etc.	
F. Class dinner, "ICS Kitty", appoint IC who will select Command and General staff. Establish daily raffle	
G. Announce S-190 Fire Behavior Workbook requirements. They will be discussed on Wednesday and tested on Thursday. Turn in unit tests by end of today	Determine how many students have OSD & Field Operations Guide, and Wildland Firefighting text book

PRESENTATION	APPLICATION
H. Explain Belt Weather Kit	Take weather twice a day and place on flip chart
I. Distribute Course Outline	Handout #2 - Course Outline
J. Thoroughly discuss Course Purpose and Objectives	Handout #3 - Course Purpose and Objective

PRESENTATION	APPLICATION
I. Using a blank sheet of paper, each student will write the statutory responsibilities and authorities of their agency regarding suppression of vegetation fires. Secondly, each student should discuss how, in fact, they operate	Display California Direct Protection maps
II. Call on students from various level of government (i.e., City County, Fire Protection District, State, Federal, Community Services District, Water Districts, County Service Area, Volunteer Fire Companies) and have them explain their responsibility as they see it	
III. Explain laws governing federal lands, SRA, and local responsibility area including cities. Discuss contract counties. Inter-mix this with explanations form selected students. Use concept of federal zone, state zone, and local zone	Handout #5 - Statutory Responsibilities
IV. Explain State Fire and Rescue Mutual Aid System including area, region and state responsibilities. Discuss availability of OES engines. Discuss reimbursement to local agencies for local equipment used on CDF and USFS fires after 12 hours	(Copy of Fire & Rescue Plan for each Instructor and Table)
V. Explain how this fits in with California's unique problems based on the introduction to the Governor's task Force on Chaparral Fire and Flood Risk Managements Report of April 1981	(Copy of Reimbursement Agreement for each Instructor and Table)
A. The continuing increase in California's population has created growing pressure for use and occupancy of the State's wildlands and other rural areas.	

PRESENTATION	APPLICATION
It has also created a rising demand for the use of natural resources and for an improved quality of the wildland environment	
B. These trends have given rise to a sharp increase in the number of human-caused wildland fires since the early 1960's. The destruction of natural resources, life and property by large fast-spreading fires in California's wildland and other rural areas should leave no doubt that the potential for fire-caused disasters is growing faster than our ability to cope with them.	
C. Here are some of the factors contributing to the State's wildland fire problem:	
1. People are moving into the rural and mountainous areas of the state at rapidly increasing rate	
2. Many new residents are moving into homes which are extremely vulnerable to destruction by wildfire, without fully appreciating the risk	
3. Because of inexperience with wildland fire hazards, new residents are causing more wildland fires to start	
4. Land-use planning practices still permit subdivisions and individual structures to be developed without adequate fire safety measures	

PRESENTATION	APPLICATION
D. Highly flammable vegetative fuel (slash, chaparral, brush, dense timber reproduction, etc.) is accumulating faster than it is being removed by natural decay, fire and other influences; consequently, wildland fires tend to burn with much greater intensity and are more difficult to control	
E. Unless actions are taken soon to mitigate those factors, the following conditions can be predicted with reasonable assurance:	
1. The trend of increasing fire incidence will continue	
2. An increasing number of fires will burn with greater intensity	
3. More people will be living in wildland areas or in adjacent urban developments	
4. More large fires will spread from the wildland vegetation and involve more people and their homes	
5. An increasing number of large fires will result in increased damage to renewable natural resources	
6. Damages to downstream areas from flooding, mudslides, and sedimentation following major fires will be magnified	
7. State and local resources to fight fires will not increase in proportion to the threat because of permanent fiscal constraints and competing demands for fiscal support	Hand out copies of this report (Handout #5). Highlight Executive Summary

PRESENTATION	APPLICATION
I. Introduction	
A. Our goal for all fire control activities is rapid containment of fires. The key to attaining this goal is effective management of fire fighting forces	Refer students to "Wildland Fire Fighting" Pages 70-75
B. As you've just heard, the effect of urban development on wildland fire control has shown that the need for fast, aggressive, well planned attack on all wildland fires is much more critical today than it was five or ten years ago	
C. Think about your area of responsibility. How many new homes have been constructed in the past two or three years? How many fires could reach a hundred acres without threatening a dwelling	
D. Our margin of error on fires has been drastically reduced, and will get narrower as long as people continue to populate vegetation covered areas	
E. As Incident Commanders you must know what your resources are capable of in order to plan their use and provide the public with the high degree of fire protection they expect and are entitled to	
II. Development	
A. There are many ways to suppress a wildland fire. It is not our intention to cover them all, but rather the basics	

PRESENTATION	APPLICATION
B. In order to understand wildland fire suppression, you must understand the language spoken. As in other professions, we also have a jargon	
Strategy is the "big picture" or overall objectives for the fire. Tactics are the actions you take to suppress the fire	NOTE: Explain here that a fire may have more than one head or the head may travel in several different directions during the course of a fire. Explain how wind speed and direction affect the head
1. Nomenclature of a fire	
a) Head - that part of the fire which is usually moving with the wind. It is usually the part of the fire that does the most damage. Usually, the head of the fire should be stopped first	Refer to Pg. 70, Wildland Fire Fighting
b) Origin - This is the spot where the fire originates or starts. This can usually be determined by a telltale sign such as a smoldering debris pile or by the fire sign on the trees and brush	
c) Rear - That area of the fire backing against the wind	
d) Flanks - Each fire has two:	
1) Right flank - this is generally the hottest flank and should be attacked as soon as the head is controlled	Explain that the reason this is the hottest flank is because of the quartering effect of the wind
2) Left flank - usually somewhat cooler than the right flank and should be contained after the right flank is suppressed	

PRESENTATION	APPLICATION
e) Fingers - generally found on the head and flanks. This is the long narrow strip of fire extending out from the main fire. It will usually occur when the fire hits and area which has both light and heavy fuels in patches. The light fuel burns faster than the heavy which gives the fingered effect	
f) Pockets - indentations in a fire edge formed by fingers or slow-burning areas. When a fire edge contains deep indentations of unburned fuel, these are termed pockets. A fireline should ordinarily be built across the mouth of the pocket and then it should be burned out. If the line is built directly on the fire edge, much more line is required, and the unburned area in the pocket is subject to fire pressure on both sides. Fire suppression activity inside a pocket area is not only ill-advised, it would be a dangerous place to put men and equipment	
g) Spot fire - the spotting effect of a running fire, spot fires may easily occur 1/2 mile advance of the main fire. Spot fires more commonly occur within 20 yards of the main fire. These spot fires must be suppressed or they become head fires. A spotting fire presents a hazard to fire suppression personnel and equipment since they could become trapped between two lines of active fire	

PRESENTATION	APPLICATION
h) Island - an area within the burn which did not burn	Example - ponds, marshes, areas of sparse fuels
i) Perimeter - the outside boundary of a fire area. The perimeter of a fire is the total length of the outside edge of the burning or burned area. It is constantly changing until control is established An easy way to orient yourself on a fire is to use your imagination. Imagine yourself to be standing on the burn with the wind to your back. Directly in front of you will be the head fire, to your right will be the right flank, to your left the left flank. Directly behind you will be the rear	
j) The Black - All burned area within the fire permimeter	
k) The Green - All unburned area outside the fire permieter	
C. Three basic types of wildland fires	Handout #8, Strategy & Tactics
1. Surface fire - one which burns away the low area fuels and ground litter	
2. Crown fire - one which burns through the tree tops. This type of fire is very dangerous and fast moving. Usually this fire is backed up by an oncoming surface fire	Walt Disney/Steven Spielberg fires

PRESENTATION	APPLICATION
3. Sub-surface fire - this type burns below ground level and it burns partially decomposed organic materials such as muck and peat. this type of fire is difficult to suppress and is hazardous to fire fighters. It will burn in depth of less than 1" to many feet in depth. When it is necessary to cross the burned area, caution must be used. (Cross only if absolutely necessary and use a long pole to probe ahead for deep burning pockets.) Usually, this type of fire has a surface fire as its ignition source and it must be suppressed before the ground fire can be suppressed.	
D. Suppression Methods	
There are three basic methods of attacking fire involving wildland fuels. They are called, "direct", "Indirect", and "Parallel" methods. Present suppression methods are aimed primarily at establishing a perimeter control line to stop fire spread. The most obvious and practical approach in most situations is to rob the fire of its fuel by physical means	Refer to Page 71 Draw on board
1. The direct attack	
The direct attack method consists of a series of related direct actions to cool, frown, smother, beat out, starve, or otherwise extinguish the flames of a going fire. As the term implies, the control line is along and directly on the edge of the fire	
a) Conditions when used:	
1) Small fires	

PRESENTATION	APPLICATION
2) Light fuels	
3) Sub-surface fire (duff, peat)	
4) Flanks and rear of larger fires (areas where moving more slowly)	
5) Where burning intensity, heat, smoke and terrain will allow	
b) Standards of line construction	
1) To the depth of mineral soil	
2) Width of fire line will vary with:	
o Slope and aspect	
o Fuels	
o Topography	
o Weather conditions	
o Parts of fire (head, flank, rear, etc.)	
o Size and intensity of fire	
o Equipment and personnel available	
3) Throw all unburned material to the outside of the fire perimeter	
4) Lines are constructed directly on the edge of the fire	

PRESENTATION	APPLICATION
c) Pros and Cons 1) Pros: o Limits chance for fire to gain momentum or size o Eliminates the uncertain elements of backfiring o Reduces danger of fire crowning o If necessary, you can escape into unburned area o Takes advantage of burned out areas along the control line 2) Cons: o You work in heat and smoke o More mop up and closer patrol required o More danger of slopovers and spot fires o Control line generally follows fire edge; is longer and irregular o Does not take advantage of existing fire barriers (natural or man-made)	

PRESENTATION	APPLICATION
d) Do's and Don'ts 1) Do's o Take advantage of wind lulls o Time attack to coincide with fire entering lighter fuels, if possible o Conserve water by using to cool flames so hand tool persons (if available) can get in close. Use water only as necessary on flanks and rear o Scatter heavy fuels inside the burn o Fell snags adjacent to the control line o Work as a team 2) Don'ts o Attack head on fast moving hot fires o Waste water o Risk safety of you and equipment	

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PRESENTATION	APPLICATION
2. The indirect attack	Draw on board
Control action conducted a variable distance from and usually parallel to the edge of a fire in such a manner as to deprive the advancing fire of fuel and thereby halt its further progress	Refer to Page 72
a) Conditions when used:	
1) Where the burning intensity, rate of spread, and working conditions (heat, smoke, terrain) are too extreme	
2) Insufficient personnel	
3) Good natural fire barriers available	
4) Fast spreading and/or hot fires	
5) To straighten fire lines (across pockets)	
b) Standards of line construction	
1) To a depth of mineral soil	
2) Width of fireline will vary with:	
o Slope and aspect	
o Fuels	
o Topography	

PRESENTATION	APPLICATION
o Weather conditions	
o Parts of fire (head, flanks, rear, etc.)	
o Size and intensity of fire	
o Equipment and personnel available	
o Width - rules of thumb	
- Fast-moving fires in light fuels	
- Head - at least twice as wide as brush height	
- Flank - as wide as brush height	
- Creeping - light fuels	
- Head - 3 to 4 feet	
- Flank - 6 to 8 inches to mineral soil	
c) Pros and Cons	
1) Pros	
o You are not working in heat and smoke	
o Takes advantage of changes in fuel types	

PRESENTATION	APPLICATION
o Eliminates irregularity of lines	
o Less danger of slop overs	
o Permits taking advantage of:	
- Tops of ridges	
- Benches	
- Bottom on slopes	
- Natural barriers such as roads, trails, streams, swamps, old burns, etc.	
o Permits precision teamwork	
2) Cons	
o Sacrifices acreage	
o You may be flanked by fire	
o Back fire may go out of control	
o Fire may change direction suddenly	
o You must be held in readiness where fire is due to burn out by itself	

PRESENTATION	APPLICATION
d) Do's and Don'ts	
1) Do's	
o Establish lines in lighter fuels if possible	
o Make lines as straight as possible	
o Try to keep downed logs and dead snags on the outside of your lines	
o Make use of natural barriers	
o Clean line down to mineral soil	
o Maintain patrol of established lines	
o Set back fires when needed	
o Establish periodic rest periods	
2) Don'ts	
o Overextend yourself	
o Set back fires	
o Construct line adjacent to tall fuels	

PRESENTATION	APPLICATION
o Take unnecessary chances with personnel and equipment	
III. Fire Control Actions and Terminology	Refer to Pages 74 & 75
A. Control Actions that fall either in direct or indirect categories	Diagram on board
1. Envelopment	
2. Flanking	
a) Pincer	
b) Tandem	
3. Hot spotting	
B. Other important terminology	
1. Cold trailing (direct)	
a) Cutting a final fire line around a controlled or contained fire	
b) Feel out - bare hand	
c) 1-1/2 X height of vegetation or minimum of 18"	
d) Burned in burn - unburned in green - no windrows	
e) Check for overhangs or roots	
f) Trench under cut line, with good berm	

PRESENTATION	APPLICATION
2. Scratch line	
a) An unfinished preliminary control line hastily constructed as an emergency measure to check the spread of the fire	
b) Need only be wide enough to hold fire temporarily	
3. Snag removal (direct and indirect)	Asking for snag definition
a) Snags will burn easily	
b) Safety	
c) 200-300 feet from fire edge in burn	
d) 50 feet from fire edge in green	
e) If removal impossible - ring snags	
4. Backfire (indirect)	
a) Fighting fire with fire	Diagram
b) Lighting a fire along inner edge of control line with expectation that it will be influenced by the advance of the main fire and thus burn out intervening vegetation	Will illustrate dangers later with Timberlodge survival program
c) An offensive action	
d) Must be done by experienced personnel	
e) Uncertainties - tricky	

PRESENTATION	APPLICATION
f) PRC 4426 - No one can set backfires except State or Federal Forest Officer or to save life or property	
g) Extreme way to fight fire	
h) Start at highest point in line, work downhill	
i) Tie-in ends of line before starting	
j) Watch for spots	
k) Work slowly	Lecture
l) Stay clear of saddles	
m) For long jobs use drip torch	
n) Just over the ridge or just up opposite slope	
o) Always alert all personnel	
5. Burn out (indirect or direct)	
a) Removal of hazardous fuels from <u>within</u> the control line with fire	
b) A defensive action	
c) Do not confuse with backfire	
d) For added safety	
e) Blackline concept	

PRESENTATION	APPLICATION
6. Mop-up	
a) Making fire safe by extinguishing or removing burning and hazardous material	
b) Extinguish all burning material	
c) Protect against rolling material	
d) Spread fuels out - do not bury	
e) Cover fuels to keep from igniting or to cool only	
f) Let fuels burn out	
g) Eliminate snag log, etc., near control line	
h) Remove roots or overhang fuels	
i) Search for spots	
j) Roll over, fell out, scrape	
k) Use hand tools and water together	
7. Patrol	
a) Assuring that the fire will not escape	
b) Can last months	
c) Fast fuels - patrol short time	
d) Heavy fuels - patrol longer	

PRESENTATION	APPLICATION
8. Reburn a) Subsequent burning of an area in which fire has previously burned but has left flammable fuel that ignites when burning conditions are more favorable	Handout #9 - Planning for Initial Attack Handout #10 - Homework Assignment

FIRE COMMAND 2E
INTRODUCTION TO ICS 201 FORM

PURPOSE:

To record resource and situation information in a standard format to assist in a complete, concise briefing and transition to a formal planning operation.

To make a permanent record of the initial response to the incident.

GOOD REASONS:

During the extended attack stage, the initial IC can become overloaded with information. Recording must be simple and standard so the information will be easily understood by new IC and/or Planning Section Chief.

Giving complete and accurate resource information to Planning Section personnel will expedite formal resource information management. This takes a burden from the early Operations Section Chief.

The resource format can be useful to an Operations Section Chief for managing resource information in a way that will provide rapid retrieval for decision making. This helps maintain control of resources during the scarce resource phase of mobilization.

DISTRIBUTION:

After the initial briefing of the extended attack Incident Commander and General Staff members, the Incident Briefing is duplicated and distributed to the Command Staff, Section Chiefs, Branch Directors, Division Group Supervisors, and appropriate Planning and Logistics Unit Leaders. The sketch map and Summary of current Actions are given to the Situation Unit, and the current Organization and Resources Summary are given to the Resources Unit.

METHOD:

Initial IC starts preparing form immediately after deploying resources on initial plan. The form is then used to assist in briefing the extended attack IC.

Be sure to use proper symbology.

INSTRUCTIONS FOR COMPLETING THE INCIDENT BRIEFING (ICS FORM 201)

ITEM NUMBER	ITEM TITLE	INSTRUCTIONS
1.	Incident Name	Print the name assigned the incident.
2.	Date Prepared	Enter date prepared (month, day, year).
3.	Time Prepared	Enter time prepared (24-hour clock).
4.	Map Sketch	Show perimeter and control lines, resources, assignments, incident facilities, and other special information on a sketch map or attached to the topographic or orthophoto map.
5.	Resource Summary	Enter the following information about the resources allocated to the incident.
	Resources Ordered	Enter the number and type of resource ordered.
	Resource Identification	Enter the agency three letter designator, S/T, Kind/Type, and resource designator.
	ETA/On Scene	Enter the estimated arrival time and place the arrival time or a check mark in the "on scene" column upon arrival.
	Location Assignment	Enter the assigned location of the resource and/or the actual assignment.
6.	Current Organization	Enter on the organization chart the names of the individuals assigned to each position. Modify the chart as necessary.
7.	Summary of Current Action	Enter the strategy and tactics used on the incident and note any specific problem areas.
8.	Prepared By	Enter the name and position of the person completing the form.

* NOTE: ADDITIONAL PAGES MAY BE ADDED TO FORM 201 IF NEEDED.

PRESENTATION	APPLICATION
I. Introduction - As Incident Commander, how can we determine the amount of line a particular dozer can construct? What are we basing our decisions on when ordering dozers? Are we considering important aspects of dozer safety? Are we providing for dozer servicing and support?	
II. In an attempt to answer the question of how much line a dozer can construct, dozer tests have been conducted in various areas of the state. Determining amounts of single pass line that different types of dozers might be expected to cut. Single pass line is where the machine clears an area slightly wider than the bulldozer blade down to mineral soil. Backing and turning is done as necessary to remove all of the vegetation from the intended fire line. Remember that theses are guides only. Actual performance may be affected by time of day, intensity of fire, rocky terrain, age and accessories on the dozer, or operator experience on fires	Wildland Firefighting, Pages 53-55
III. With the advent of the Incident Command System, which we will discuss in more depth later, dozers are classified into three types by relative power and capability (See p.4-1 ICS Field Ops Guide):	
A. Type 1 (Heavy Dozers) D-7, D-8, D-9, TD25	
B. Type 2 (Medium Dozers) D-6, HD-11	
C. Type 3 (Light Dozers) D-4, HD-6	
D. Under most conditions, a Type 1 dozer is capable of putting in more fire line, faster through heavier fuel. The disadvantage might	

PRESENTATION	APPLICATION
delayed or slower responses or less maneuverability in tight terrain or bridge limitations	
E. Type 2 and 4 dozers are more typically used for rapid initial attack by fire service agencies. Fire service dozers are specifically equipped for fire duty with radios, roll cages, fire blankets, air systems, lights, fire tools, and suitable blade types and angles	
F. Since dozers usually are more effective working in tandem, ICS provides for the use of a dozer strike team which includes two dozers of the same type with transports, a dozer tender, and a dozer strike team leader	
G. Remember: Fire service bulldozers construct line at an average of 900 yards per hour or approximately 1/2 mile per hour	
IV. The Incident Commander should keep several safety considerations in mind when using dozers	
A. Any dozer used at night must have swamper and be equipped with lights	
B. Slope limitations should always be considered. Normal maximums are:	
1. Medium (Type 2) - Forward 75% Reverse 70%	
2. Light (Type 3) - Forward 67% Reverse 56%	

PRESENTATION	APPLICATION
C. Over extended periods, operator fatigue becomes an important factor	
D. Hand crews and engine companies should not be assigned to work in areas where rocks and debris loosened by a dozer might roll their way	
E. Non-fire service operators should be thoroughly briefed on their assignment and should be supervised by qualified fire personnel	
F. Beware of adverse damage claims resulting from dozer access and operations	
G. Safety conditions on dozers for hire should be inspected carefully. If you hire the dozer you become liable	
H. Beware of environmental concerns such as stream damage or winter siltation caused by unmitigated dozer operations	
I. Safety islands should be installed along constructed fire lines to provide safe space for crews, engines, and dozers in case of fire blow up	Dozer video Handout #14 - Bulldozers in Fire Management

PRESENTATION	APPLICATION
I. Two Basic Types of Wildland Hoselays	"Wildland Firefighting", Page 51-52
A. Simple	Handout #15, Wildland Hoselays
1. Laid point to point dry then charged when completed	
2. Typically used as a supply line only	
3. No protection for crew when being laid	
B. Progressive	
1. Each length is charged as it is added	
2. Normally put in on fire perimeter; fire is suppressed as the hoselay progresses	
3. When needed, 1" lateral lines with tees are added every 200 to 300' to be used for subsequent mop up and safety along the fire line	
II. Equipment Used	
A. Hoses	
1. Normally 1" and 1-1/2" single jacket hose or light weight hose with light alloy couplings in 100' lengths	
2. Rolled single or double doughnut with brass and hose clamps, or on special hose packs	

PRESENTATION	APPLICATION
B. Nozzles, clamps, tee's	
1. Nozzles 1" or 1-1/2" combination	
2. Forester hose clamp used for 1" and 1-1/2" hose	
3. Tee's used to lateral 1" lines from 1-1/2" lines	
III. Rules of Thumb	
A. Under average conditions assign at least 3 engines with at least 9 personnel per hose lay	
B. Select the pumping engine based on tank capacity and pump pressure capability (head pressure can be critical in wildland hose lays; relay pumping might be required)	
C. Allow sufficient engines or water tenders and sufficient travel time to provide a constant supply of water	
D. Allow 4 minutes per 100' of hose for a progressive hoselay. This includes suppression and holding time. Remember that steep terrain, thick fuel, and personnel fatigue can reduce this production rate	
E. Another study of production rates indicated that well trained fire fighters may lay as much as 50' per minute in the initial attack stages of a fire	

PRESENTATION	APPLICATION
F. Based on their minimum required hose complements, ICS Type 3 engines are normally most suitable for this type hoselay	
G. Handcrews are a valuable resource in making extended hoselays	
IV. Hoselay Safety	
A. Avoid using booster lines or other 1" lines on extended hoselays. Friction loss is too great and there will be an inadequate volume of water to protect the nozzle operator in case of a dangerous intensifying of the fire. Combination nozzles providing a particular fog pattern must always be used because they will add an extra measure of safety	
B. Always provide communications between the nozzle operator and the pumping engine	
C. Always have an anchor point for your hoselay. Avoid the danger and embarrassment of an outflanked line and burned hose	

ENGINE MODEL 14 - "BUTTE SPECIAL"

This pilot model was developed by the Butte Ranger Unit and Davis Mobile Equipment using extensive field input. Although the original intent was to combine a Model 5 apparatus body with a five person crew cab, the engine has since evolved to an enhanced capability urban-wildland intermix apparatus that complies with current NFPA crew carrying standards. The Model 14 prototype was placed in service at Cohasset Fire Station during fire season 1988.

CHASSIS STATISTICS

Engine:	IG DT466 Turbocharged Diesel. 210 HP @ 2800 RPM
Transmission:	Allison MT 653 automatic.
Wheelbase:	152"
Front Axle:	9,000 lbs.
Rear Axle:	17,000 lbs.
GVW:	25,370

FIRE PUMP FEATURES

Model:	Waterous CPK-3-400, 2 stage.
Volume Mode:	430 GPM @150 psi.
Pressure Mode:	280 GPM @150 psi, 230 GPM @250 psi.
Maximum Pressure:	600 psi.

HIGHLIGHTS

Chassis

1. International S-1800 5-person fully enclosed cab with dual roll bar protection. All crew seated and belted.
2. Siren and air horns mounted on front bumper to protect crew hearing.
3. Low profile emergency lighting to reduce overall apparatus height and improve response safety. (Installed 4/89).
4. All wheel drive. Design also suitable for conventional drive application.
5. Retains a 152" wheelbase for maneuverability in tight quarters.
6. Extensive in-cab storage space including all crew personal gear.
7. Excellent approach and departure angles for off-road operation.
8. 106 gallon fuel capacity.

Fire Pump

1. Hydrostatically driven by constant running hydraulic system. Saves significant fire body space.
2. Full stationary and mobile pumping capability via all discharges.
3. Significantly more wildland hoselay pressure capability than most current models.

Water Tank

1. 500 gallon steel baffled tank integrated into fire body.
2. Electronic tank level indicator on pump panel.

Water Handling Connections

Two - 4"suction inlets, left and right
One - 2 1/2" gated suction inlet, left
Two - 2 1/2" gated discharges, left and right
Two - 1 1/2" gated pre-connect discharges, left and right
One - 1 1/2" gated discharge, left pump panel
One - 1 1/2" gated pre-connect discharge, rear of fire body
One - 1 1/2" gated swivel pre-connect discharge, front bumper
two - 1" gated hardline discharges, left and right

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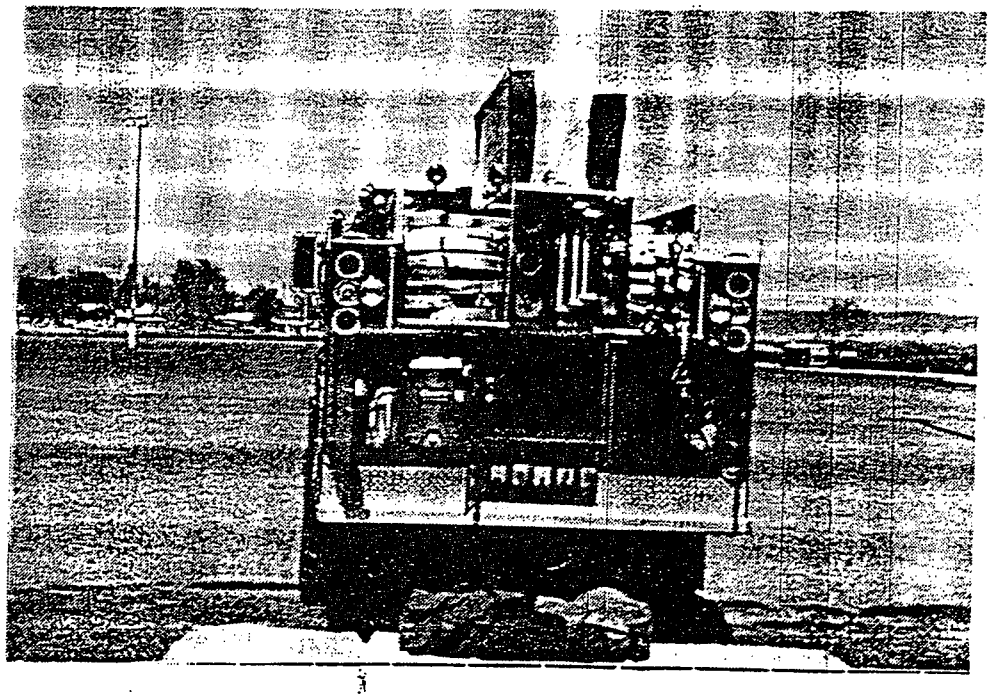


Hose

500' - 2 1/2" cotton double jacket; bedded in right side main hose bed. (An additional 1000' can be bedded in the left rear main hose bed during non-fire season).

200' - 1 3/4" rubber matrix; bedded in right side rear pre-connect tray; primary structural attack line.

2050' - 1 1/2" cotton single jacket; 1600' carried in 200' Gnass hose packs in left main hose bed; 200' in pre-connect cross-lay; 50' in front bumper covered bed, 200' in donut rolls.

1000' - 1" cotton single jacket; carried in Gnass hose packs in left main hose bed.

300' - 3/4" hardline; left and right power reels.

25' - 3" cotton double jacket soft suction; carried in compartment.

21' - 4" hard suction in three sections; carried in rear center compartment.

Nozzles

1. Wildland KK nozzles commensurate with hose complement plus one 1 1/2" variable flow 120 GPM Task Force nozzle for mobile attack.
2. Structural complement includes one 1 1/2" 200 GM Task Force automatic flow nozzle for the 1 3/4" structural pre-connect line, one 1 1/2" Akron Turbojet variable flow nozzle, and one 2 1/2" Task Force automatic flow nozzle for heavy stream application.
3. Two KK 1 1/2" Bubble Cup nozzles for Class A foam application.

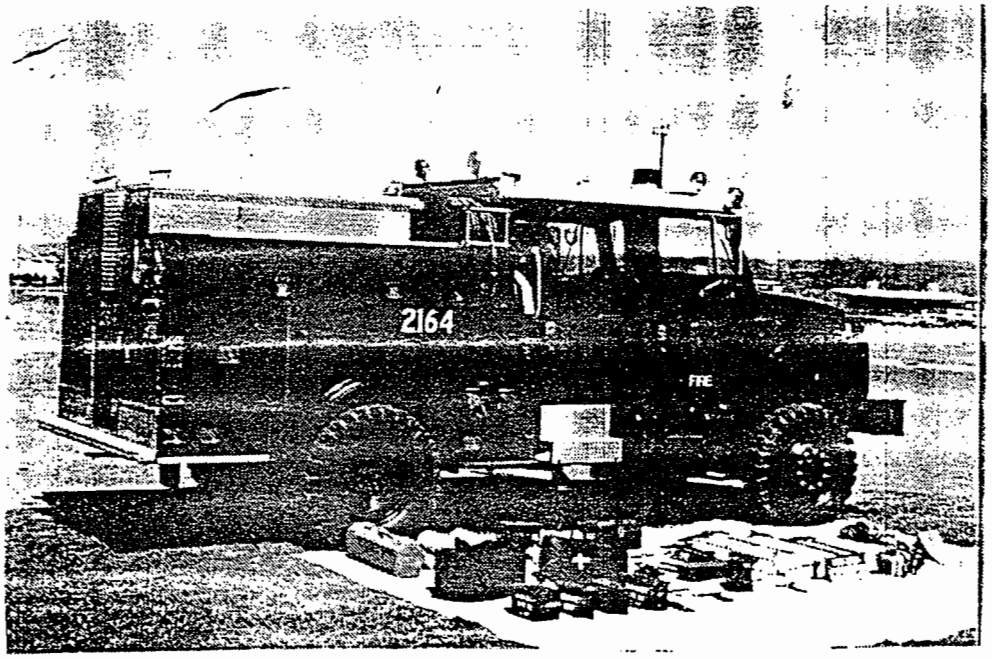
40

Fire Body

1. Twelve fully enclosed compartments of various shapes more than double equipment storage space of previous models. Two chock block compartments. Equipment, such as floating pumps, extinguishers, drip torches, etc., are not stored on exterior of engine.
2. High use and scuff surfaces are aluminum diamond plate for low maintenance.
3. Main hose bed constructed of aluminum diamond plate to reduce high weight and lower center of gravity.
4. All hose storage protected from embers and weather by covers.
5. Lift up compartment doors controlled by gas pressure shocks for safety.
6. Safety grab handles and tread steps everywhere climbing on the apparatus may occur.
7. Narrow style power hardline reels to save fire body space.
8. 6" rear step for easy access to main hose bed.

Firefighting Foam System

1. Computerized overboard Class A foam injection system.
2. Panel controls proportion of foam from .1% to 9.7%.
3. Meter indicates GPM flowing and total GPM flowed.
4. Pumps to all 1" and 1 1/2" discharges.
5. 8 gallon foam reservoir.

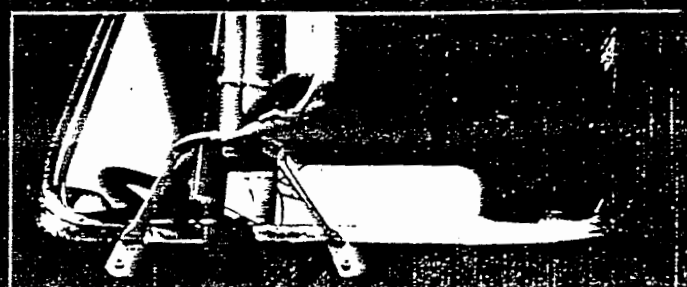


Key Equipment

1. Hale Fyr-Float portable pump.
2. Chain saw - 24" bar.
3. SCBA - 2 plus 2 spare bottles.
4. Turnouts - full sets for all personnel.
5. EMS - full EMT I trauma kit; resuscitator with spare bottles; burn kit; back boards; kedboard.
6. 16' 3 section fire department ladder, pike pole, hooligan tool, pickhead axe.
7. Extensive lighting for fire scene and compartment interior.
8. Midland 80 channel programmable high band radio; King 14 channel portable programmable radio.
9. Full complement of wildland fire equipment standard on all CDF models ranging from hose roller and tire chains to a coffee pot and rations.

THE FUTURE

1. The engine is scheduled for state-wide review following the 1989 fire season.
2. Some identified chassis modifications, such as a hydraulic retarder, air shift four wheel drive, should be seriously considered. Others, such as the tool compartment doors being integral rather than lap-type and a hydraulic retarder, will wait until production.
3. Consideration will be given to pumps of 500 GPM capacity and possibly a somewhat longer wheelbase for some applications.
4. The Computer Aided Navigation (CANT) program and Loran C capability of our aircraft, coupled with the Automatic Lightning Detection System (ALDS) indicate we should consider testing a ground Loran C unit in the engine.
5. The combination of full wildland capabilities and safety features exceeding that of existing Models 1 and 5 coupled with substantial structural firefighting capability will make this an attractive alternative for CDF, volunteers and other fire departments.



CALIFORNIA
DEPARTMENT of FORESTRY
and FIRE PROTECTION

FORESTRY

FIRE

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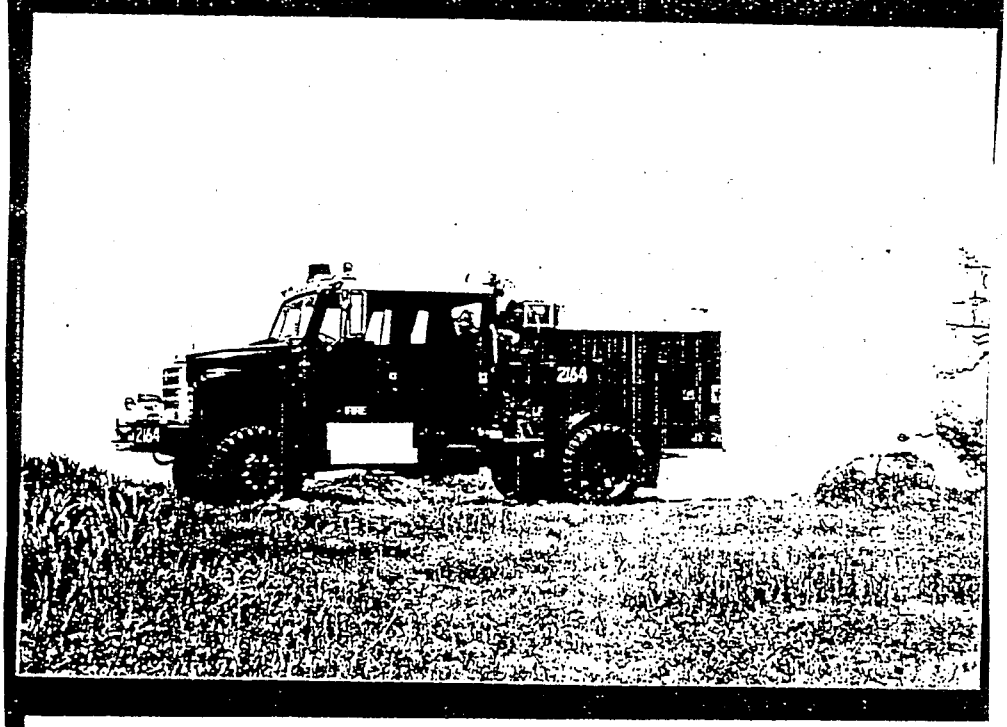
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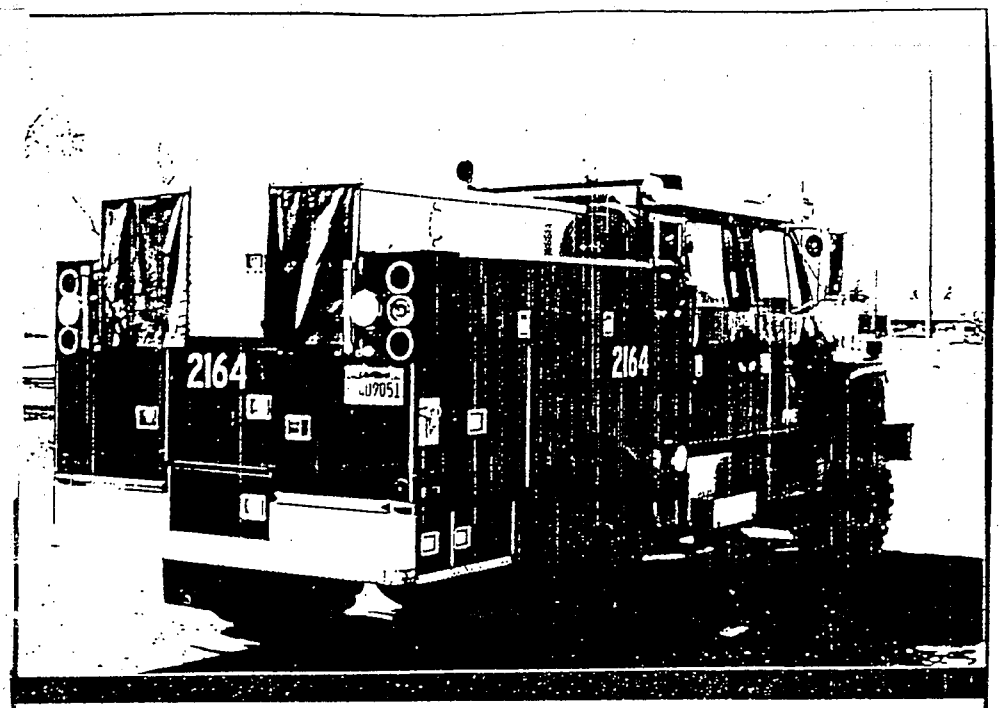
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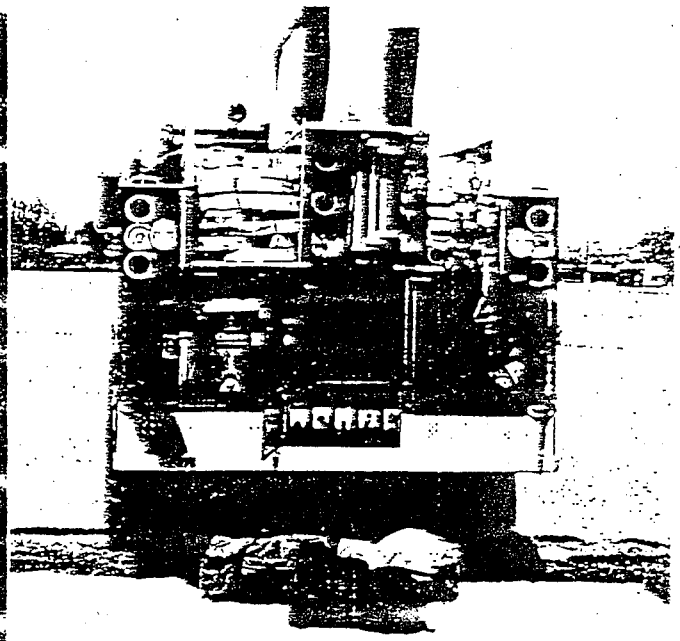
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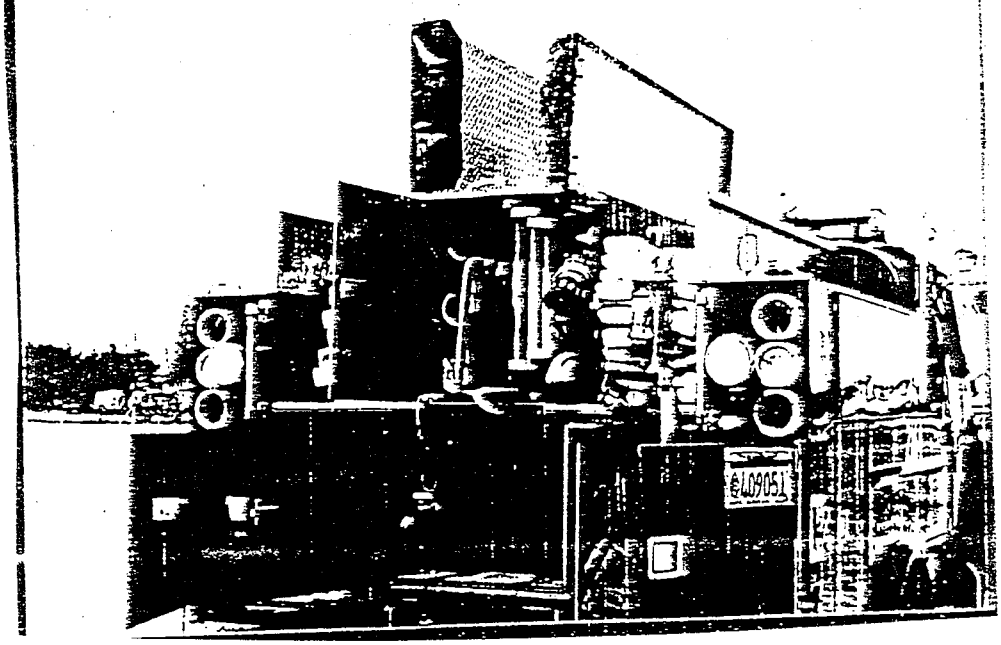

PRESENTATION	APPLICATION
a) Blowing sparks trapped under shingle or shake roofs	24 - ROOF FIRE
b) Heat or flames trapped beneath the eave of a roof	
c) Burning debris blown through ground vents or attic vents	25 - TOTALLY INVOLVED
d) Windows broken from heat and drafts	
e) Doors or windows left open	
f) Exposures from burning (remove if possible and desirable)	
1) Shrubbery, trees	26 - HOME IN BRUSH
2) Combustible garden furniture	
3) Fences	
4) Wood piles	
5) Automobiles	
6) Adjacent structures	
7) Combustible rubbish	
2. Survey ahead of fire and give priority of protection considering construction and topographical factors, equipment and personnel to be utilized and fire spread	27 - WESTON 28 - HOME
3. Common <u>Errors</u>	

PRESENTATION	APPLICATION
a) Laying hose lines too far away from the structure using too much hose and tiring out the fire fighters	29 - HOSELAY IN GRASS
b) (Meet the fire where an easier standard can be made)	30 - DIRECT IN GRASS
c) Not maintaining sight or radio contact with engines in the strike team	31 - FF/FIRE
d) Wasting time and energy on structures that will be lost no matter what your effort	32 - MOBILE HOME FIRE
e) Employing unnecessary apparatus where less will do - clogging roadways	
f) Parking equipment where it is unnecessarily exposed to direct fire	33 - ENGINES ON HIGHWAY
g) <u>Laying Unnecessary Line</u>	
h) Wetting down single roofs and adjoining areas when insufficient water is available	
i) Don't use hardlines	34 - HARDLINE
G. Safety	
1. If fire is too hot, retreat into structure, close engine cab, or even swimming pool temporarily, when fire passes, extinguish burning exterior or exit engine	35 - FIRE

PRESENTATION	APPLICATION
2. Without a specific purpose, don't face an intense fire, retreat to protection (behind fence, ledge, house) and go	36 - BEHIND HOME
3. Keep apparatus mobile - at a fast moving fire, this is called hit and run or stand and fight or cut and run. Run not in fear but because it is the best decision	37 - ENGINE/FIRE
a) Move from structure to structure with the fire	38 - FF WITH 1-1/2"
b) You may leave a fire fighter at difficult situations	
c) If the civilian owner is present, point out possible places of dangerous flare-ups before you leave	
d) Park behind a structure, heading out of the driveway	39 - HOSELAY
4. Engine safety	
a) Headlights on at all times (spotlight can be turned upward at night for visibility	
b) Windows closed	
c) Coiled preconnected charged 100' 1-1/2" or 1-3/4" hose	40 - COILED 1-1/2"
d) Pump running if auxiliary or skid mount	

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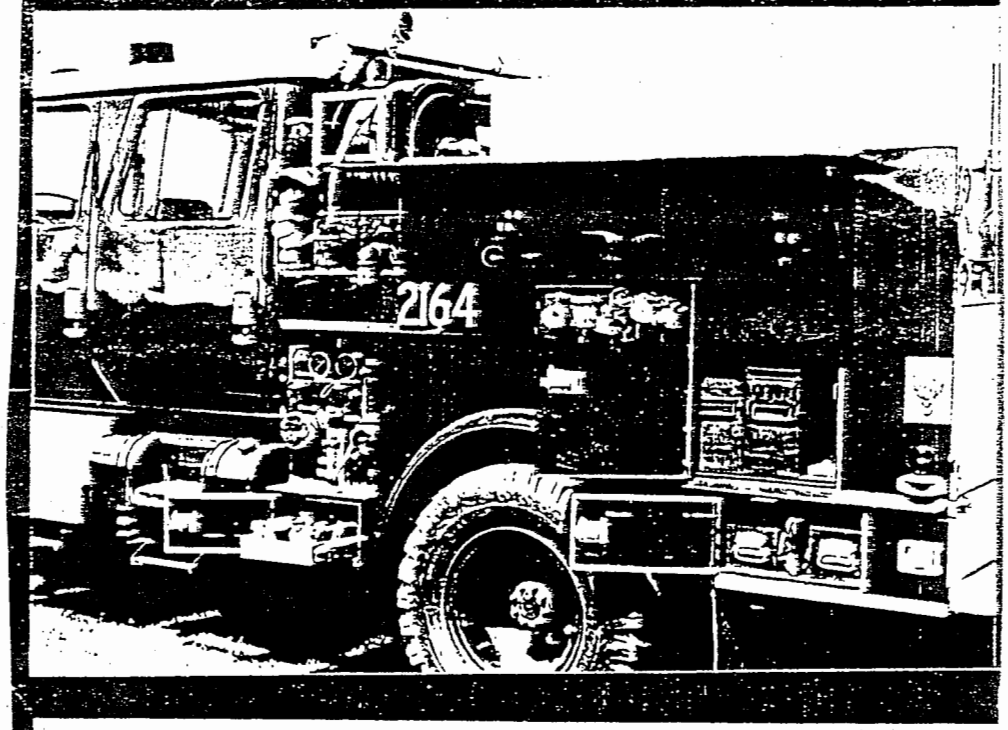
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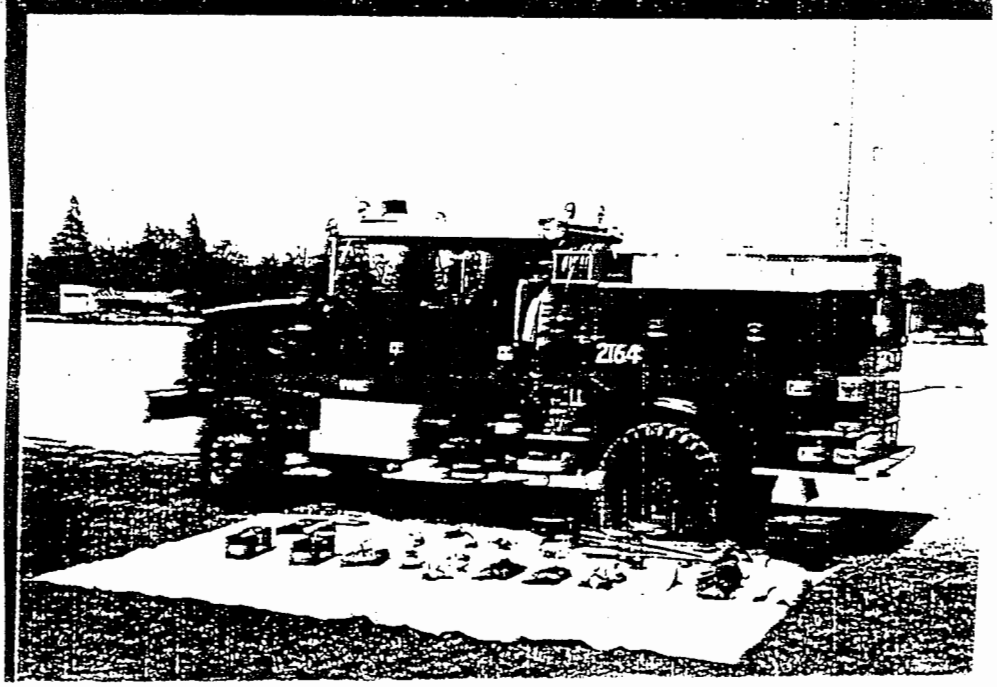
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850. Neither a public entity nor a public employee is liable for failure t establish a fire department or otherwise to provide fire protection service.
(Added by Stats. 1963, Ch. 1681.)

850.2. Neither a public entity that has undertaken to provide fire protectio service, nor an employee of such a public entity, is liable for any injury resultin from the failure to provide or maintain sufficient personnel, equipment or othe fire protection facilities.
(Added by Stats. 1963, Ch. 1681.)

850.4. Neither a public entity, nor a public employee acting in the scope of hi employment, is liable for any injury resulting from the condition of fire protectio or firefighting equipment or facilities or, except as provided in Article (commencing with Section 17000) of Chapter 1 of Division 9 of the Vehicle Code for any injury caused in fighting fires.
(Added by Stats. 1963, Ch. 1681.)

850.6. Whenever a public entity provides fire protection or firefighting servic outside of the area regularly served and protected by the public entity providin such service, the public entity providing such service is liable for any injury fo which liability is imposed by statute caused by its act or omission or the act o omission of its employee occurring in the performance of such fire protection o firefighting service. Notwithstanding any other law, the public entity receivin such fire protection or such firefighting service is not liable for any act or omissio of the public entity providing the service or for any act or omission of an employe of the public entity providing the service; but the public entity providing suc service and the public entity receiving such service may by agreement determin the extent, if any, to which the public entity receiving such service will be require to indemnify the public entity providing the service.

Notwithstanding any other provision of this section, any claims against the stat shall be presented to the State Board of Control in accordance with Part (commencing with Section 900) and Part 4 (commencing with Section 940) o Division 3.6 of Title 1 of the Government Code.
(Amended by Stats. 1965, Ch. 1203.)

850.8. Any member of an organized fire department, fire protection district or other firefighting unit of either the state or any political subdivision, an employee of the Department of Forestry, or any other public employee wher acting in the scope of his or her employment, may transport or arrange for the transportation of any person injured by a fire, or by a fire protection operation to a physician and surgeon or hospital if the injured person does not object to the transportation.

Neither a public entity nor a public employee is liable for any injury sustaine by the injured person as a result of or in connection with that transportation o for any medical, ambulance or hospital bills incurred by or in behalf of the injured person or for any other damages, but a public employee is liable for injury proximately caused by his willful misconduct in transporting the injured person or arranging for the transportation.
(Amended by Stats. 1981, Ch. 714, Sec. 158.)

P-3 CREST 8-20-78

5. RESOURCES SUMMARY

RESOURCES ORDERED	RESOURCE IDENTIFICATION	ETA	ON SCENE ✓	LOCATION/ASSIGNMENT
T ATT, CONT.	6314C	1730		
	E 6301			
	6302			
	6303			
	6304			
	6305			
	6315C	1800		
	6306			
	6307			
	6308			
	6309			
	6310			
2 G S.T.	6344 G	1800		
	PR 1			
	PR 4			
	PR 5			
	1170 G	1800		
	19-1			
	19-2			
	19-3			
LSC	BDF 304	1730		
PSC	BDF 305	1730		
4 W.T.	BDF 327	1700		
	BDU 6312	1700		
	—			
	—			

5. RESOURCES SUMMARY

RESOURCES ORDERED	RESOURCE IDENTIFICATION	ETA	ON SCENE	LOCATION/ASSIGNMENT
INITIAL ATTACK	BDF 307		✓	IC
	" E-395		✓	DIV A SUP
	" E-397		✓	DIV B SUP
	" E-333		✓	A
	" E-323		✓	B
	BDU D-6562		✓	B
	BDU D-6585		✓	A
	AA 210		✓	
	AT 72		✓	
	AT 73		✓	
	BDU C PR-2		✓	A
	BDU C PR-3		✓	B
EXTEND ATTACK				
2 C ST	BDU 6314C		1730	
SEE P-3	—			

7. SUMMARY OF CURRENT ACTIONS

1300 INITIAL ATTACK: 2 ACRES RUNNING NORTH – PINCER ATTACK

1415 REQUEST EXTENDED ATTACK RESOURCES

OBJECTIVE: CONTAIN FIRE SOUTH OF CLEGHORN TRUCK TRAIL.

1630 TERRAIN ABOVE PIPELINE TOO STEEP FOR DOZERS.

DIV. A.: DIRECT ATTACK HOLDING ON LEFT FLANK FROM ORIGIN TO PIPELINE.

BDU 6314C ENROUTE TO CLEGHORN T.T. FOR INDIRECT ATTACK; FIRE AND HOLD.

DIV B: DIRECT ATTACK HOLDING FROM ORIGIN TO JUST ABOVE PIPELINE.

4 @ 1330: T 90, RH 28, W-SW 20, FM 4.0

PRESENTATION	APPLICATION
I. Line Construction Capabilities	"Wildland Firefighting", Page 53
A. As with any other suppression resources, handcrew effectiveness is controlled by many factors:	Handout #16, Handcrew Capabilities
1. Leadership	
2. Amount of experience	
3. Degree of training	
4. Crew members turnovers	
5. Crew morale	
6. Crew fatigue	
7. Fuel, weather, topography and time of day	
8. Fire behavior	
B. Numerous studies on handcrew production rates have been conducted	
1. Fore the purpose of the line construction studies, fuels were divided into four types based on the average width line required:	
a) Grass - a 3' wide line	
b) Medium brush - a 6' wide line	
c) Heavy brush - a 9' wide line	
d) Very heavy brush or timber slash - at least 12' wide line	

PRESENTATION	APPLICATION
2. The studies indicated that one crew member can cut an average of 20 square yards of line per hour. A 15 member crew could then cut 300 square yards (15 x 20 sq. yds. = 300 sq. yds.)	
3. This provides the Incident Commander with the following guidelines for a 15 member crew a) Grass - 900' per hour of 3' wide line b) Medium brush - 450' per hour of 6' wide line c) Heavy brush - 300' per hour of 9' wide line d) Very heavy brush or timber slash - 225' per hour of 12' wide line	
4. Another way of visualizing this is that a 15 member crew should be able to put a 3' line around a one acre grass fire in one hour (one acre of land 4 (sides) x 208' - 832 lineal feet)	
5. When in doubt - ask the crew leader how much line the crew can put in for you	
6. The above standards are for a top line production crew for the first or second hour of line construction. Production rates will then decrease considerably thereafter	

PRESENTATION	APPLICATION
II. ICS Crew Typing and Crew Strike Teams	
A. Review ICS Field Ops Guide, Page 4-1	
III. Crew Available by Agency	
A. Federal Agencies	
1. U.S. Forest Service	
a) Hot shot - normally 20 members (Type 1)	
b) USFS regular crews, trail or timber crews (Type 2)	
c) Blue card USFS certified pick up crews (Type 2)	
d) Helishot crews	
2. Department of Interior	
a) Bureau of Indian Affairs	
b) Bureau of Land Management - Hot Shot and Alaska crews	
c) National Park Service	
3. Boise Interagency Fire Center	
a) May provide crews from other states throughout the nation	

PRESENTATION	APPLICATION
b) Coordinates acquisition of out-of-state resources	
4. Department of Defense	1987 siege - largest peacetime CNG mobilization, 7,000 guardsmen
a) Organized crews such as Vandenburg AFB	
b) Military personnel assembled for fire fighting	Yellowstone 1988 - 4,000 military personnel used
B. State of California - Department of Forestry and Fire Protection maintains Conservation Camps and Fire Centers throughout the state, housing nearly 250 fire crews	Handout #17, Conservation Camp Program
1. Crew members are provided by the Department of Corrections, California youth Authority, California Conservation Corp and various county prison systems	
2. These crews are generally 15 person supervised by a Fire Captain	
C. Local government - various county and city fire departments operate organized fire crews, the greatest concentration is in the Southern California area	
D. At various times, other volunteer and paid crews are available through colleges, volunteer departments, though quality varies greatly	

PRESENTATION	APPLICATION
IV. Custodial and Logistical Aspects	
A. Since nearly 4,000 handcrew members in California are in the custody of various correctional agencies, certain precautions must be taken	
1. CDC, CYA, county inmates, must not be mixed, particularly in camps or incident bases. The Crew Technical Specialist, a Chief Fire Officer, will handle these problems for you	
2. CCC crews which are composed of free people, including many women, should not be mixed with inmates and wards	
3. Items such as medicine, weapons, and other valuables should be kept away from these crews and secured	
4. Report any problems with individual crew members to the crew leader or appropriate custodial agency representative immediately	
B. The inmate crews are very well trained, physically fit and motivated	
1. They take the same and quite often higher risks than others on the fire	
2. Treat them with respect and dignity and remember their leaders are also brother or sister fire officers	

PRESENTATION	APPLICATION
3. Food and water to a handcrew are no different than fuel and oil to an engine	
4. Support equals production	
5. If a crew does an outstanding job for you, tell them so	
a) Next time they'll work even harder	Handout #18, Working with California Inmate Fire Crews

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
	SLIDE NUMBER
BLACK OUT	1
CDF INTRODUCTION	2
DO WE "STAND AND FIGHT?"	3 - FIRE ENGINE
OR DO WE "CUT AND RUN?"	4 - FIRE
DO WE "STAND AND FIGHT" HERE?	5 - SHED FIRE
OR DO WE "CUT AND RUN" HERE?	6 - FFS
HOW, IN CLOSE COMBAT WITH WILDLAND FIRE, DO WE STOP THIS?	7 - FFS
FROM BECOMING THIS?	8 - STR FIRE
OR THIS?	9 - STR FIRE
FROM BECOMING THIS?	10 - PANORAMA
WE LIVE WITH WILDLAND FIRE EVERY YEAR IN CALIFORNIA	11 - FIRE
THE 1985 AND 1987 FIRE SEASONS SAW THE LARGEST MOVEMENT OF MUTUAL AID RESOURCES IN THE HISTORY OF THE UNITED STATES	12 - ENGINES
AT ONE TIME, OVER A THOUSAND LOCAL GOVERNMENT ENGINES, FORMED INTO NEARLY 200 STRIKE TEAMS, WERE FIGHTING OUTSIDE OF THEIR HOME JURISDICTIONS	13 - ENGINES
HOW WERE WE ABLE TO MIX ALL OF THERE DEPARTMENT AND THEIR VARYING EQUIPMENT INTO AN EFFECTIVE TEAM, CAPABLE OF BOTH PROTECTING AND STOPPING THE SPREAD OF FIRES?	14 - ENGINES FIRE

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
	SLIDE NUMBER
WHAT TACTICS DO WE USE?	15 - CDF COVER
LET'S BEGIN ANSWERING THESE QUESTIONS BY LOOKING AT THE ENGINES WE USE	16 - ENGINE LINE-UP
THE INCIDENT COMMAND SYSTEM GROUPS ENGINES INTO FOUR TYPES. THESE TYPES CAN BE READILY REFERENCED IN THE ICS FIELD OPERATIONS GUIDE	17 - F.O.G.
ENGINES ARE TYPED ACCORDING TO GENERAL OVERALL CAPABILITY WITH TYPE 1 HAVING THE GREATEST OVERALL CAPABILITY	18 - WORD SLIDE
COMMAND OFFICERS MUST TAILOR THEIR REQUESTS FOR ENGINES TO THE SPECIFIC NEED AT HAND	19 - ENGINES
DO YOU NEED TO JUST MOVE PEOPLE, OR DO YOU NEED THE VERSATILE FIRE FIGHTING TOOL THAT AN ENGINE IS?	20 - FFS/ENGINES

PRESENTATION	APPLICATION
	SLIDE NUMBER
I. Choosing The Engine For The Job	21 - EQUIP. LAYOUT
A. Equipment complement	
1. Hose complement	
a) Single or double jacket hose	22 - HOSELAY
b) Amount of 1" and 1-1/2"	
1) Type 3 1000' 1-1/2"/800' 1" VS	
2) Type 1 1200' 2-1/2"/400' 1" 1/2"/200' 1"	
c) Reel or hard lines, booster line	
2. Tools - Wildland vs Structural	
B. Water tank capacity	
1. Ability to sustain an attack absent a static source	23 - BUTTE CO. ENGINE
2. Type 1 400 min.	24 - NOZZLE FFS
3. Type 2 400 min. 500 Normal	
4. Type 3 300 min.	
5. Type 4 200 min.	
6. Tenders 1000 +	
STAND AND FIGHT OR CUT AND RUN FIRE ENGINE CAPABILITIES AND TACTICS	

PRESENTATION	APPLICATION
C. Open or closed cab	25 - CLOSED CAB
1. Open cab is very dangerous on wildland fires. There has never been a recorded instance where a fire fighter was burned to death in a closed vehicle, but numerous fire fighters are burned out in the open, on the back of an engine, or attempting to outrun the fire	26 - OPEN CAB
2. Hose bed - is it covered and with what? Diamond plate is best	27 - HOSE BED
D. Conventional or 4-wheel drive - off road capability	28 - CDF ENGINE
1. Depending on terrain a 4-wheel drive may be required if traction, climbing ability, or ground clearance are important	
2. Remember - 4-wheel drive engines may require longer travel time on the highway and may not be as readily available	
3. Most 4-wheel drive engines are Type 3 or Type 4	29 - FWD ENGINES
E. Wheel base	
1. Ability to negotiate narrow roads with short radius or steep climbing turns	30 - LA CO. ENGINE
2. Turning radius short enough to change directions rapidly when needed	

PRESENTATION	APPLICATION
F. Weight	
1. Roadbed	
2. Bridge capacity	
3. Septic tanks	
G. Mechanical condition	
1. Strike teams often may end up with relief engines that are not first line equipment	31 - OLD ENGINE
2. Structural type engines may not be equipped with adequate air cleaner protection	32 - OPEN CAB DUSTY
a) Flying embers in paper elements - motor quits	
3. Tires not adequate for off road use	
H. Pump type	
1. Main pump - midship	
a) Disadvantage - not mobil	33 - PUMP
2. PTO	
a) May be capable of pumping and rolling slowly	34 - MOBILE PUMP

PRESENTATION	APPLICATION
3. Auxiliary pump with separate power source	
a) Best if pump and roll is what you need - hit and run	35 - MIDSHIP
b) Water curtain can be provided for safety even when engine is moving	
I. Personnel on Engine - Type 1-4, all others Type 3	
1. You can't expect a 3 person crew to put a progressive hoselay in as fast as a 4 or 5 person crew - order what you need	36 - CREW ACTION
2. Experience of the company officer crew members determine what the capability of an individual engine is	
3. Fatigue becomes a critical factor	37 - FF - DIRTY
J. Remember that when things are tough and homes are burning, what you may need is just the closest engine of any type right away	38 - 4 WAY
II. Type of assignment for an engine or strike team will help you determine the best suited engine for the job	
A. Mobile attack on grass fires	39 - MOBILE ATTACK
1. Ability to pump and roll	
2. Shorter wheel base generally better	

PRESENTATION	APPLICATION
a) Ability to pump and roll	
b) Better ground clearance	
B. Stationary pumping on a hoselay	40 - PUMP
1. Length of hoselay may indicate the need for a larger water tank if supply is being transported to scene	41 - HOSELAY
2. Hoselay elevation may require a pump that will pump 450# pressure	42 - NUMBER 1 PUMP
C. Primarily off-road pumping	43 - BLM ENGINE
1. Generally best to use brush engines	
2. Avoid damage to larger more expensive engines	
D. Structure Protection	
1. Water tank capacity is important - larger the better	
a) A strike team of OES engines for example can sustain themselves longer without replenishing their water because most carry 850-900 gallons	44 - OES ENGINE
2. Depending on terrain and area you're working, smaller and shorter wheel base engines may be better due to narrow winding roads and short steep driveways	45 - BLM ENGINE

PRESENTATION	APPLICATION
III. Fire Engine And Strike Team Tactics on Wildland Fires	46 - USFS STRIKE TEAM
A. Strike teams	
1. Up to 5 strike teams per division, 5 divisions per branch	47 - ICS
2. Strike team components	
a) Common capability	
b) Common communications	48 - ICS
c) Common leader	
3. Although 3 kind, we'll focus on engines	49 - ICS
a) Typical type first	50 - LINE UP
b) Remember, you can also use mixed task forces	51 - ST/MIX
B. Strike teams may be dispatched to staging areas or directly to the fire	52 - LA ENGINES 53 - ENGINE/FIRE
1. If you report to staging area, the strike team leader must check in with the staging area manager, remember	54 - ENGINE FF
a) Responding directly to incident, check in with division supervisor	55 - S.T. CHECK-IN
b) Responding to staging area, check in with division supervisor	

PRESENTATION	APPLICATION
c) A staged strike team is under the direct supervision of the Operations Chief	56 - S.T. CHECK-IN
d) A staged strike team is considered an available resource and must be able to respond within 3 minutes. This means no wandering around in the staging area, keep teams parked together	
	57 - WHITE HAT
2. The STL must report his arrival either by radio or in person to obtain his assignment	TRAY #2
C. Deployment of equipment	1 - ENGINE IN SMOKE
1. When assigned to a fire engine deployment is critical. Get a clear assignment from your supervisor	
a) Always have an escape route	2 - HAVE ESCAPE ROUTE
1) Back engines in	
2) Use buildings or natural barriers for protection	
3) Don't park at top of draws or natural funnels	3 - FIRE IN CHIMNEY
b) Don't park under power lines. Keep engines working as a team. Exercise tight control	
1) Don't spread out too far. Visual Contact is best	

PRESENTATION	APPLICATION
c) Strike team leader should survey area to check for special conditions or hazards	
d) Unless absolutely necessary, don't have engines lay long hoselays. They will cut mobility and may burn up a lot of hose	4 - HOSE PACKS
2. Before deploying, assure that all personnel are in full protective equipment, all water tanks are full, all engines have adequate fuel, and all radios work	5 - FF WITH HOSE
D. Use of water - plan and discuss its use ahead of time	6 - PUMP PANEL ADVANCING FIRE
1. Water conservation - with hydrant supply	
a) Consider effect of heavy water consumption on other lines tapped off main line laid	7 - 2-1/2" LINE
b) What about adjacent water main? Other companies working out of your vision? Residents or fire fighters working off garden hose?	
c) When water conservation is important, don't wet down ahead of fire, extinguish only what is absolutely necessary	8 - FIRE SIDE OF GARAGE
1) Don't waste water on wood shingle roofs - they dry too fast	9 - ROOF FIRE

PRESENTATION	APPLICATION
2) Cut the cypress hedge down	10 - ROOF FIRE PLANTS
3) Cut and remove brush along hillside road where stand is to be made - while waiting for fire	
e) Let everything burn that is not vital to fire control or not an exposure hazard to objects of value	11 - STR. FIRE
f) Don't lay a line, just because there is a lot of fire and a hydrant. Have a compelling reason	12 - LAY IN
g) If lines are left at a fast moving fire, take the fittings with your apparatus if possible	
2. Water conservation, with tank supply	
a) Conserve limited supplies, use hand tools in conjunction with a hose line when working on brush	13 - MOP-UP
b) Always know what your water level is	
c) Never go below 100 gallons or 60 seconds worth of water	
3. Water Tender Use - Where water supply is a problem Strike Team Leaders, Division Supervisors or operations Chiefs should order sufficient water tenders to keep strike teams adequately supplied	14 - WATER TENDER

PRESENTATION	APPLICATION
a) Depending on travel time and distance, 1 or 2 water tenders can keep a strike team supplied	15 - NO. 8
b) Water conservation must be enforced even when working with water tenders	16 - FF IN SMOKE
	17 - BACK UP PUMP
E. Protecting structures and motor vehicles (ahead of fire)	18 - FULLY INVOLVED
1. Close windows - garage doors, etc.	19 - LISTING
2. Leave lights on so house can be seen at night	
3. Put combustible garden furniture in garage or house, in any event place furniture so that it will not expose a structure	
4. Move wood piles away from structures	
5. Move combustible fences away from structures	
6. Ask residents to move lace-type curtains from windows on exposed side. Heavy drapes may be advantageous	
7. Chop down highly combustible shrubbery and place where it will not expose a structure	
8. Remove any combustibles from vicinity of LPG tanks	
9. Shut off gas	20 - LISTING CONT.

PRESENTATION	APPLICATION
10. Have civilians place stepladders, etc, on front porch, or where readily visible	
11. Place fire department extension ladders at houses you will later try to save by working on the roof	
12. Hook up available garden hose - test for water pressure	
13. Remove leaves from roofs and gutters	
14. Call for truck companies where or if practical	21 - TRUCK COMPANY
15. Civilian motor vehicles	22 - CAR IN GARAGE
a) Put in garage - preferably heading out not in	
b) Close all windows - no matter where vehicles are	
c) Park where lease exposed - but, not in driveway where fire apparatus might operate or hose lines might be laid	
1) Not in a narrow street, front lawn would be better if practical	
F. Protecting structures (when fire hits)	23 - FIRE/FF
1. A structure seldom will burst into flames; it usually will start as a small fire in one or more spots	

PRESENTATION	APPLICATION
5. Park on roadway adjacent to structures, always choose between heading with direction of fire travel or heading towards a possible escape route	41 - ENGINES/STR
6. When protecting structures and also making a stand along a road, detail fire fighters to prevent fire from spotting across	42 - STAND
7. Fire out around structures where possible but only after advising your supervisor of your intention	43 - FIREING OUT
8. Stay out of topographic saddles and chutes	
IV. What To Tell Civilians About The Dangers	44 - CIVILIANS
A. Remind them that even fire department activities can be dangerous to them	
B. Ideally, evacuation is primarily a police problem - Leaving the fire department free to operate	
C. Encourage civilians, especially elderly or ambulatory individuals to leave fire area on foot or in vehicles if practical	
D. Inform them of danger of running up hills, canyons or draws ahead of a moving fire	45 - UPHILL RUN
E. Explain that in almost all instances, a person is safe in a well built structure when a fire sweeps past, even though it may eventually be destroyed	

PRESENTATION	APPLICATION
F. If civilians are determined to stay with their homes, explain the value of removing any exposures (furniture, shrubs, wood piles, etc), and how to protect themselves and handle a garden hose	46 - CLEAN HOMES
G. Try to impress the mother or father with the importance of keeping the family together, this reasoning sometimes assists the evacuation effort	
V. Structure Protection Triage	47 - TOTAL
A. Company Officers, Strike Team Leaders, Division Supervisors, and Operations Chiefs must be capable of making one of the most difficult decisions on a wildland fire, which home to try and save and which ones to write off. Some guidelines are:	48 - 4 WAY
1. If its well involved and others are not, go for the ones that are not	
2. Look at types of roof coverings, wood overhangs, and proximity to brush. In an intense fire shake shingle roofs and wood sided houses are very difficult to save	49 - ROOF FIRE 50 - DECK FIRE
3. Consider personnel safety	51 - AIR TANKER
4. Consider available personnel	52 - FF
5. Consider water supply	53 - PUMP
6. Consider values at stake including human life	

PRESENTATION	APPLICATION
7. Sometimes everything you try won't be enough, and	54 - BURNING STRUCTURE 55 - GOVERNOR
8. At other times the rewards and thanks will be great	56 - SIGN
VI. Remember It Is Each Of Us Who Must Decide Whether -	
TO "STAND AND FIGHT" OR "CUT AND RUN"	57 - FFS W/HOSE 58 - SCULL FFS 59 - CUT AND RUN
End (Thank you Fire Fighters)	60 - SIGN
CDF Title	61 - END

77

STRUCTURAL SAVE ANALYSIS SYSTEM FORMULA

FLAME LENGTH DIVIDED BY 50% OF TOP WIND GUST SPEED X RELATIVE HUMIDITY DIVIDED BY 10, USE THIS NUMBER AS FACTOR 1. TAKE FACTOR 1 X THE TOTAL NUMBER OF STRUCTURES 1,000 METERS FROM THE FIRE LINE. DIVIDED THIS BY THE NUMBER OF SHAKE ROOFS X THE TOTAL SQUARE FEET OF THE SHAKES. THIS WILL GIVE YOU FACTOR 2. TAKE FACTOR 2 DIVIDED BY FUEL CLEARANCE FACTOR (.5 GRASS, 1.0 BRUSH, 2.25 TIMBER), THEN MULTIPLY BY THE NUMBER OF TYPE 2 ENINGES OR TYPE 3 ENGINES AVAILABLE. THIS GIVES YOU FACTOR 3. NOW TAKE THIS NUMBER X THE NUMBER OF YEARS OF EXPERIENCE OF OPERATIONS SECTION CHIEF WITH STRUCTURE PROTECTION. THIS FINAL FIGURE DIVIDED BY 100 GIVE YOU IN A PERCENT THE STRUCTURAL SAVE RATIO.

THIS SIMPLE FORMULA WILL GIVE YOU EQUAL NUMERICAL CO-EFFICIENT EQUAL TO YOUR STRUCTURAL SAVE RATIO (SSR).

FEATHER RIVER BULLETIN
NOTES FROM A FIRESTORM
SEPTEMBER 9, 1987
BY: MARK MICHAELS

SLIDE #

A strong sense of foreboding - not to mention a dense curtain of brownish-yellow smoke -- lay ahead of us as Don Rogers and I, along with Captain Paul Schaden of the California Department of Forestry and Fire Protection, drove south on Highway 395 below Milford. The Clark fire had come down out of 1
the mountains. Propelled by violently gusting winds, the flames were headed directly for the rustic homes and ranches along the 2
highway.

Three-ninety-five had been closed to traffic minutes earlier; fires were erupting in the brush along both sides of the highway, with ribbons of the acrid smoke reducing visibility to only a few feet. Out of the gloom appeared the flash of red lights, and lots of the; a column of fire engines roared past us, rushing to set up their hoses at the next group of structures in the path of flames. As soon as they were past us, they disappeared again, swallowed by the smoke.

At Herlong Junction, the winds were incredibly strong. Over the busy fire radio, we heard one report of "gusts exceeding 46 miles per hours." Here behind a gas station, fire fighters were 3
attempting to save several homes in imminent danger of being consumed.

Jumping out of our truck, Rogers, Schaden, and I were immediately in the midst of a hellishly hot storm of smoke, dust and 4
flying firebrands. The front of the fire had come through only moments before. Several outbuildings and woodpiles were burning 5
fiercely, along with the trees and shrubs.

One house in particular was in was in dire danger. The wind was whipping flames from a fully involved shed to within 6
inches of the wood-frame house and garage. Fire fighters were 7
attempting to cool the structure with streams of water.

As a team of engines from Reno and Truckee Meadows arrived, Rogers and I stationed ourselves on either side of the house, taking pictures in rapid-fire fashion of the unfolding drama. 8
The heat, in places, was nearly unbearable, and we were forced to 9
pull back.

Then the wind came up even more. 10 -11

All at once, the house itself was on fire. Tongues of flame 12
licked at the corners and the eves. The fire was being blown 13
horizontally along the ground. Visibility was absolutely zero; you had to keep your eyes tightly closed to keep them from being attacked by smoke and dust. 14

Suddenly, there was an explosion; a tank of flammable liquid 15
went off like a bomb, sending up an evil orange fireball rimmed in 16
black smoke. The garage was now burning freely, and the fire fighters started cutting their hoses to pull their engines away from the doomed house.

In only a few minutes, the house itself was fully afire. At fire, just the corners and one side were ignited; then heavy black smoke began pouring out of the windows and the attic vents, signifying that full combustion was about to occur. Then the black smoke disappeared and, all at once, bright jets of flame shot out of the windows and vents. The siding went curling in rolls of orange as it changed its form from matter to energy.

I stood there, still shooting pictures, watching the house die. I had to remind myself that this was more than just a building; it had been somebody's home, where people had laughed and loved and eaten holiday dinners and lived their lives. And now it was swiftly being reduced to rubble.

I ran back down to the truck and we returned to the highway. The Clark fire was still running at full speed. Up ahead, through the smoke, I could see another group of homes about to be overcome. (End of Article)

F. C. Weaver of the California Department of Forestry and Fire Protection was in charge of this operation and stated due to smoke and flame they did not know the gas tank was illegally stored next to the garage and was aware of it only after the explosion at which time they rapidly retreated, cut their hose lines and moved south to save more burning structures.

Pictures taken the next morning. Drive way to garage and ruptured 300 gallon gas tank. 17

Ruptured gas tank that BLEVED remainder of vent tank stand at far left of slide. 18

Home with cut hose lines. 19

Melted chain link fence. 20

Drive way with cut and burned through hose lines; burning pieces of wood actually pierced the charged 1-1/2" lines before the fire fighters could retreat.

All personnel survived with no injuries. 21

* UNDERLINED words note time to show respective slide.

PRESENTATION	APPLICATION
I. Introduction	
A. As we've said before, California has a wildland fire potential that is found nowhere else on earth. The combination of highly flammable vegetation, long and dry summer, rugged topography and people who work or recreate in the wildlands adds up to a situation which results in over ten thousand wildland fires each year. Dependent upon local burning conditions, these fires can and do occur in any month of the year throughout the state	
II. Presentation	
A. Fire behavior knowledge	
1. Essential to fire fighters	
a) Where and when fires start	
b) Basis for decision for fast efficient and SAFE fire fighting	
2. Primary purpose	
a) To prevent unexpected blow-up or runs	
3. Safety	
a) Most dangerous person on a fire is the person afraid of fire and who does not understand it	

PRESENTATION	APPLICATION
B. Quote from Psychological Aspects, FS 1984 "Whether or not the safety program has encouraged fear of fire rather than respect for it is hard for an outsider to determine. The emphasis on pulling out can have serious consequences. Several instances were cited in which fire fighters left the fire's edge and retreated to the 'safety zone' much more hazardous than where they had been". "Instead of implicit emphasis on conflict between safety and effective fire suppression action, there is need for emphasis on the positive relation between the two. If there ever was a time when safety was sacrificed in the interest of aggressive fire fighting, it seems to no longer be the case. It appears that safety is jeopardized far more by a lack of sufficient aggressive action. Good fire fighting includes effective leadership, proper burning out, consideration for the welfare of personnel, and the Eighteen Fire Safety Standards as an integral part of effective fire suppression action. There is need to emphasize that fire fighters are in the long run generally safer working aggressively at the fire's edge than in backing away cautiously. Also, some type of aggressive action should be expected in almost all cases, and safety should not generally be an excuse for lack of aggressive action. Emphasis should be on proper fire fighting for its own sake, with safety included as an important integral part."	

PRESENTATION	APPLICATION
C. Remember however, that as with structural fire fighting, that rescue is the only part of fighting a wildland fire where the calculated risk of human life is considered. <u>There is no wildland fuel in California worth a fire fighter's life</u>.	
III. Heat Transfer	Ask students questions
A. Radiation - most important to wildland fire fighters	Handout #27 - Radiation and Wildland Fire
B. Convection	Handout #28 - Convection
C. Conduction	Handout #29 - Heat Conduction and Wildland Fire
D. Mass transport	
IV. Fire Behavior Key Components	
A. Three most important primary factors which influence fire spread	
1. Weather	List on flip chart
2. Fuel	
3. Topography	Discuss S-190 Workbook
a) Slope	
b) Aspect	
c) Longitude - Latitude	

PRESENTATION	APPLICATION
V. Weather	Show "Fire Weather" video Handout # 31 - Humidity Pamphlet
VI. Fuels	
A. Flammability varies greatly	
1. Fire fighter must be able to evaluate	
B. Two broad classes	Don't confuse with types of fires: sub-surface, surface, crown
1. Ground fuels (light and heavy)	
a) Duff	
b) Roots	
c) Dead leaves	
d) Grass	
e) Fine deadwood	
f) Down logs	
g) Low brush and reproduction	
2. Aerial fuels (light and heavy)	
a) Tree branches and crowns	
b) Snags	
c) Tree moss	
d) High brush	

PRESENTATION	APPLICATION
C. Fuel continuity	
1. Horizontal continuity - the distribution of fuels in a given area	
a) Uniform fuels	
b) Patchy fuels	
2. Determines spread characteristics	
D. Fuel volume/loading	
1. Fuels availability - the total amount of fuel in a given area (tons/acre)	
2. Determines total heat units developed	
a) Have you ever wondered why a grass or brush fire burns so hot? Grass weighs anywhere from 1 to 4 tons per acre and brush weights 10 to 50 tons per acre. 40 lbs of forest fuel burns with the same intensity of 1 gallon of gasoline. An acre of grass with 2 tons of available fuel equals 100 gallons of gasoline	
E. Fuel Compactness	Ask students if duff is compact? Grass? Aerial fuels? Fuel bed depth?
1. The number of individual fuel particles per unit of volume	
2. Varies greatly	
3. Less compactness means more exposure to oxygen and faster spread	

PRESENTATION	APPLICATION
F. Live fuel moisture	
1. Moisture in living fuels	
2. Highest at emergence of new foliage	
3. Influenced by soil moisture	
4. Can be determined by fuel sampling and California Chaparral Report	
5. Grass curing degrees	
a) Green - green color, moist when crushed	
b) Curing - turning brown, tips first, tan colored	
c) Cured - dry, tan, crackle when crushed	
d) Last grasses to cure are in deep moist soils or near water in shade	
G. Dead fuel moisture	
1. Moisture present in a dead fuel either on the ground or in the canopy	
2. Fuel moisture influenced by relative humidity	
a) Call hygroscopic change	
3. Explain diurnal changes	

PRESENTATION	APPLICATION
4. Time lag fuels:	
1 hour T.L. = 1/4" or less - pine needles/dry grass	
10 hour T.L. = 1/4" - 1" small branches	
100 hour T.L. = 1" - 3" small dead trees	
1000 hour T.L. = 3" or more - logs, large dead branches	
Time required to reach (the constant) 63% of saturation point	
H. Fuel arrangement	
1. Vertical arrangement in relation to length of crown	
a) i.e., thick stands of brush with little growth underneath	
b) Vertical continuity (ladder fuels) i.e. poison oak	
2. Determines potential of crown fire or torching out	
3. Understory	
4. Overstory	
I. Fuel temperature	
1. Air temperature and sunlight influence fuel temperature	Ask students how hot fuel can get lying in the sun? (450 degrees)

PRESENTATION	APPLICATION
2. Fine fuels heat quickly	
3. South west slopes hottest (flashy)	
4. Ground fuels usually hotter than aerial fuels	
J. Special fuel conditions	
1. Slash area	
2. Bug kill	
3. Snags	
4. Reproduction	
5. Snow damage	
6. Winter kill	
7. Wind throw	
8. Drought	
K. Barriers	
1. Natural	
2. Person-made	
L. Age	
1. 33-40 years most flammable	
2. After 25 years, dead materials increase substantially	

PRESENTATION	APPLICATION
M. Chemical content	
1. Volatiles can greatly influence rate of spread and intensity	
VII. Topography - Shape Of The Country	
A. Elevation	
1. High elevation - green longer, fewer fires, fewer large fires, shorter fire season	
B. Latitude - distance from equator	
1. Effects weather and fuel	
C. Longitude - coastal or inland	
1. Effects weather and fuel	
D. Exposure or aspect	
1. Direction a slope faces	
2. South and southwest slopes, generally more fires	
a) Hotter	
b) Light, flashy fuels	
c) Greater chance of ignition	
d) Faster spread	
e) Lower umbrella	

PRESENTATION	APPLICATION
f) Soil dry, hot and shallow	
g) Exposed to prevailing south wind	
h) Greater fire problem	
i) More erosion on south slopes	
j) More fires in past years	
3. North and east slopes	
a) Do NOT under-estimate the potential	
b) Can be a problem later in the year - strong north and east wind	
c) Heavy fuels	
E. Slope	Slope calculation
1. Usually expressed in percent	Refer to page 23, Wildland Fire Fighting
a) 1% = down or up 1' in 100' or 45 degrees = 100% slope	
b) Divide rise by run	
c) Hints	
1) Use correct map scale	
2) Same rise and run measurements (e.g. both in feed)	
3) Measure distances carefully - 10% makes a dig difference in fire behavior	

PRESENTATION	APPLICATION
2. Fires usually burn uphill faster	
a) Radiation - uphill fuel closer to fire	
b) Convection - hot air rises - spotting more likely	Handout #32 - Rate of Spread
3. Rolling material can cause escapes	
4. A few general rules of air movements on slopes	
a) The wider the canyon the less the danger of fire spotting across to a different slope	Handout #33 - Fire Environment Concept
b) Narrow canyons have more turbulent drafts	
c) The steeper the slope more likely a narrow head and spotting	
d) The crest of the hill is logical place to hold fire	
5. Fire Whirls	Handout #34 - Fire Whirls Pamphlet
a) Great danger to fire fighters caused by unstable air and/or contradictory winds	Eagle Fire Video
VIII. Fire Danger Rating System (FDR)	
A. FDR areas are established where conditions of fuel, topography, and weather are similar	

PRESENTATION	APPLICATION
1. Fuels classified by model type	
2. One location in each area monitors and reports weather at 1400 PDT daily	
3. A county may have several areas	
4. Component and index values change with fuel model	
5. Outputs are based on "worst case"	
6. Based on 100,000 acres	
B. Ignition Component (IC)	Handout #35 - Using NFDRS
1. A number related to the probability that a spreading fire will result if a firebrand encounters fine fuel	
a) Experience has shown that spotting can be expected above 50. It becomes a major problem above 90. It requires nothing more than a sling psychrometer and a table to calculate. The same procedure is used for all of the fuel models	
b) Example: If the IC was 80 and you threw 100 lighted matched into receptive fuel; 80 of them would start actionable fires	80 and above spot fires certain
2. Based on temperature and fine fuel moisture (FFM)	
3. On a scale of 0 to 100	

PRESENTATION	APPLICATION
C. Spread Component (SC) 1. A number related to the forward spread of the head of a fire 2. Based on wind speed, slope, and fine fuel moisture 3. Value changes with fuel model 4. Expressed in ft/min, or ch/hr D. Burning index (BI) - Scale = 0 - Infinite (0-100 old NFDRS) 1. A number related to effort needed to contain fire 2. Based on FFM, SC, and intensity with which fuel will burn 3. Value varies with fuel model 4. The higher the BI, the higher the difficulty of control 5. Burning index divided by 10 = flame length E. Uses of NFDRS 1. Special staffing patterns 2. Red flag watch	

PRESENTATION	APPLICATION
a) Issued 72 hours in advance of humidity drops of 10%, dry lightning storms, increase of wind 25+ (not made public)	
3. Red flag warning	
a) Same conditions	
b) Made public	
4. Red flag alert	
a) Same conditions	
b) Statewide program, flags, patrols, etc.	
5. Dispatch levels	

PRESENTATION	APPLICATION
I. Handout Oxbow Ridge Map - DO NOT WRITE ON MAP	
A. Explain the following	
1. General map familiarization 2. Scale: mile, feet 3. Contour intervals/bench mark 4. Sec., Twn, Rng 5. Road classification 6. Adjacent topo's for continued information	Use + or - to denote in calculations
B. Computing slope percentages by drilling with students	
1. Sec. 6, 26N, 6W from Bell Road/Lanyon Trail to hill 1409 = $\frac{369'}{1579'}$ = +23%	
2. Sec. 24 & 25, 27N, 7W so. end of Suplhur Spring Lake to hill 1386 = $\frac{226'}{2700'}$ = +8%	
3. NE 1/4 Sec. 12 T27N R7W jeep trail in creek NE corner of Sec. 12 North to top of ridge in Sec. 1 $\frac{170'}{1150'}$ = +14%	
4. 1/2 mile SE on Bell Road from S. fork Cottonwood Creek in Sec. 36 T27N R7W travel from fork to E on ridge top $\frac{220'}{600'}$ = +36%	

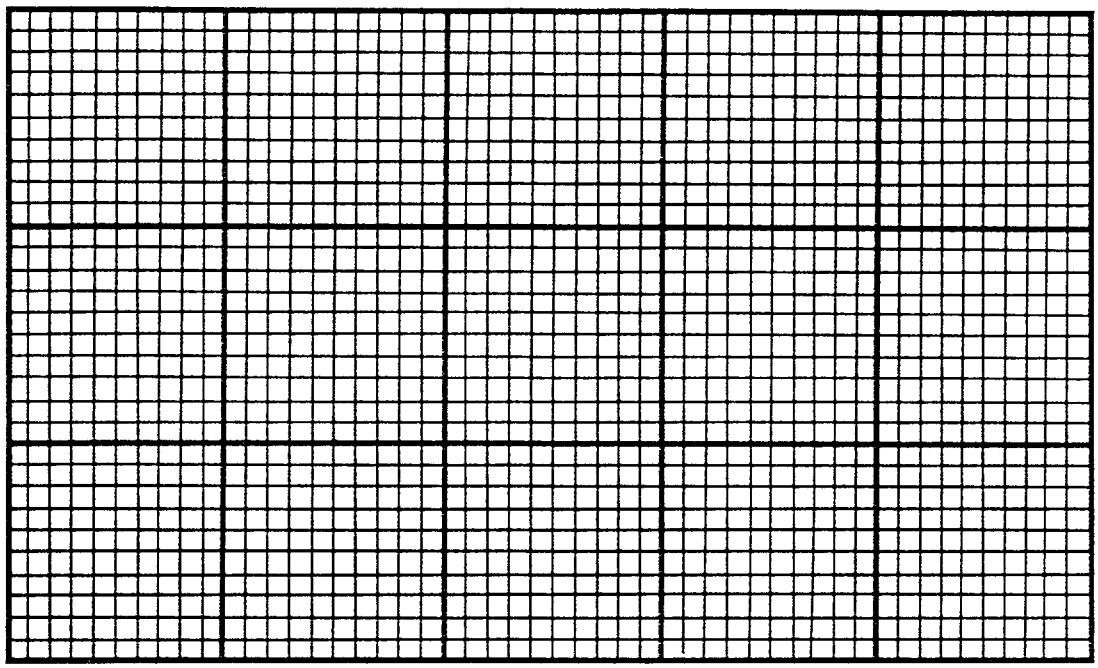
PRESENTATION	APPLICATION
5. North across the river from the structure in Sec. 36 T27N R7W. True N to the 1400 ft. elevation line $\frac{400'}{600} = +66\%$	
II. Orthophotos	
A. Orthophotos	
B. Orthophoto quads	
C. Availability	

PRESENTATION	APPLICATION
This Problem will be solved by first locating Sec. 15, T27N, R6W of the Oxbow Ridge 7.5 min. quad.	Exercise should be printed as "green/problem"
Divide Sec. 15 into equal quarters	
(1) 1. How many peaks are there in the N.W. quarter?	1. 3 (1 surveyed, 2 non-surveyed)
(1) 2. What does the symbol B.M. mean?	2. Bench Mark or Vertical Control Station
(2) 3. Does the trail from Cannon Road to point 1068 generally follow the ridge or a canyon?	3. Ridge
(1) 4. What is the elevation of the lake in Sec. 15?	4. 860' (20' leeway)
(1) 5. What are the contour intervals of this map?	5. 20'
(1) 6. What side of Vestal Road is the steepest?	6. West side
(2) 7. In a straight line how far is it from point 969 to point 1068 in feet?	7. 2500' (100' leeway)
(2) 8. What is the percent of slope of the trail beginning at Cannon Road and running North to point 1068?	8. 1% - 8%
(1) 9. Are the streams in Sec. 15 intermittent?	9. Yes

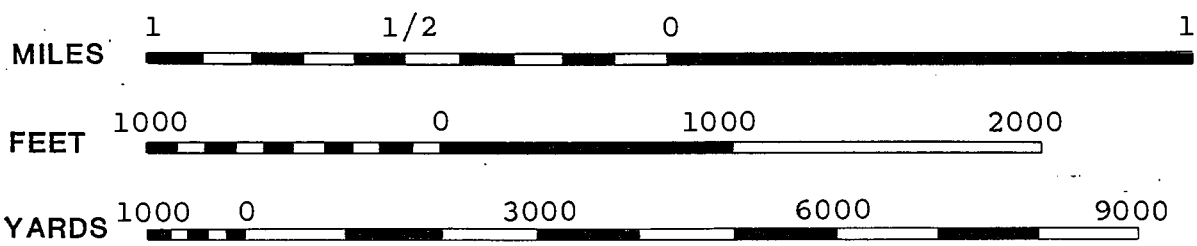
ACREAGE GRID

EACH SMALL SQUARE = 1 ACRE
EACH LARGE SQUARE = 100 ACRES

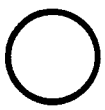
7.5 MIN. QUAD



DISTANCE SCALES



SLOPE



(1000 Ft. I.D.)

1. Place circle over area.
2. Count contour lines within circle (do not count across ridges or creeks).
3. In table below, find number of contour lines counted (next to proper contour interval for your quad) and read "% Slope" at bottom.

		NUMBER OF CONTOUR LINES COUNTED						
CONTOUR INTERVAL	20	12	20	28	30	32	36	40
	40	6	10	14	15	16	18	19
	50	5	8	11	12	13	14	15
	80	3	5	7	8	8	9	10
% SLOPE	▶	25	40	55	60	65	70	75

PRESENTATION	APPLICATION
I. Organization Lecture	Handout #39 - Organization
A. Compare the principles found in Handout #39 with the key elements of the Incident Command System (ICS)	
II. Review Current Utilization Of ICS And Implementation Imperatives	
A. Dollars committed to development and testing	
B. Adoption by State Board of Fire Services	
C. Recommendations of Governor's Task Force	
D. California Fire Service Training and Education System	
E. California Fire Academy at Asilomar	
F. National Interagency Incident Management Systems (NIIMS)	
G. National Fire Academy	
H. National Wildfire Coordinating Group	
I. Other non-fire agencies	
III. Show "ICS General Familiarization" Slide/Tape Program (Optional)	
IV. Answer questions about the slide program. Cover expansion of the system from initial attack to major incident	

PRESENTATION	APPLICATION
I. After giving the Direction lecture and distributing Handout #41 show the movie "Who's on First" to further demonstrate the need for clear concise communication	Refer to Handout #41 - Direction
II. The need for clarity in your communication is magnified on wildland fire where, because your forces are scattered over a large geographical area, you cannot conduct as much face to face communication	
III. Always on the Radio --	
A. Speak clearly	
B. Follow agency radio procedures	
C. Exhibit "command presence" with your voice and actions	
D. Ask for feedback to assure that you are understood	

FIRE COMMAND 2E
CONTROLS

What is control? Why have controls? Webster's states controls are:

1. Power, authority.

2. Holding back, keeping down, restraint.

3. Means of restraint, a check.

4. To regulate.

Okay, what's this mean to us? What control do we, as Incident Commanders need to employ?

For our purposes here, a control can be defined as a method, or system designed to inform the IC of a breakdown in his operation in tie to correct the situation and still meet the objective.

Sounds simple, doesn't it; but it isn't. We've already seen planning, organizing, and directing 's not an easy task; in fact, it's pretty hard intellectual work in any situation. In a fire situation, it's even worse. Why? Because it's got to be done right now. In fact, as extended attack fire managers, we have to do the whole show. We have to plan, organize, direct and control. We've got to do it, and do it right now. So then, among these functions of planning, organizing, directing, controlling, the most important for us as managers, and those which are most poorly done, are the managerial functions of planning and control. It's almost impossible to separate the two. Why? Because you cannot possibly control without a plan. You cannot know if you're going where you want to go unless you know where you want to go. Since control is the job of making sure things happen according to your plan, obviously, first you must have a plan.

Planning is hard to do, as we've seen. Well, control is no easier. In fact, probably harder because we're dealing with people. In many cases, people we know well, either as subordinates or of equal rant, or even of superior rank. Yet in our role of IC, we've got to control all these people. It's not easy. We know how we resent stringent controls. We know our jobs and don't like people constantly checking on us. Now, how can we, as Incident commanders reconcile our need for controls, and basic subordinate resistance to controls?

In our day-to-day operations, a good rule to work by is not to impose too rigid a system on your subordinates. Use only that amount of control that is absolutely necessary to get the job done. Well, how about our control of emergency incidents? Remember we've got to meet our objective of controlling the fire. Not tomorrow sometime; or next week; but right now. My advise to you is your control of an extended attack fire situation, or any fire situation, should be quite rigid, even at the risk of annoying your subordinates, peers, and even your supervisors.

Remember our definition of controls now. To inform you in time ..... to permit you to correct the situation and still meet your objective. Any deviations of your plan or breakdowns in operations that may change your plan must be known by you in time enough to correct the situation. That's why our control system must be rigid. We have to know what's going on almost constantly; and that's what our control system must show us.

Now, what are some control elements available to us during a fire situation?

1. Constant visual control. There are many fire situations where you can actually watch what's going on almost constantly.

2. Periodic reporting from your subordinates. Especially important when you can't see everything that's going on; also periodic checking with your subordinates.

3. Periodic inspection by you. A good control method. However, remember that the role of the IC dictates that you remain at the ICP the majority of the time.

4. Airline. A very effective control tool when available. You (they) can see the big picture and can immediately report any breakdowns.

5. Can any of you think of any other control factors?

FOR DISCUSSION:

1. Any questions?

2. Are rigid controls on fire operations really necessary? Why can't you trust your subordinates to take care of things?

PRESENTATION	APPLICATION
I. Discuss need for standardized Report-on-Conditions. Example could also use what has happened, what is happening, and what will happen format	
II. A "Report-on-Conditions" is: "A clear and concise verbal report of existing conditions, expected needs, and the potential of the incident" A. At a minimum, your "Report-on-Conditions" should include: 1. Type of incident - on wildland fire, describe the fuel in simple terms (e.g., grass, light brush, heavy brush, timber, etc.) 2. Confirmed location of incident - this is critical to routing of additional resources. On wildland fires failure to do this could mean many hours of delay for certain resources. Always give access information 3. Size of incident - Normally stated in acres. This also helps you determine fire history by bringing together accurate acreage estimates with times of estimation 4. Rate of spread - standard terminology is - slow, moderate (less than 1 MPH) dangerous (1-3 MPH) critical (over 3 MPH) 5. Topography - indicate features such as canyons, ridges, flat concerning the incident's probable spread in terms of speed, size, difficulty of control and values threatened	Handout #43 - Report on Conditions

PRESENTATION	APPLICATION
6. Potential of incident - include pertinent information concerning the incident's probable spread in terms of speed and size, difficulty of control and values threatened	
7. Equipment needs - can you handle with the equipment dispatches; if you need less, release what you don't need. If you need more, order it. Remember, response times are typically much longer for wildland fires than for structural fires	
B. Discuss need for Standard clear text	Handout #44 - Clear Text
C. Refer to Standard Resource Designator in Field Ops Guide, Pages 4-2 and 4-3 under radio call column	

PRESENTATION		APPLICATION
TIME LAPSE:		ACTION/SOUNDS
10 Sec	Dispatch - Prevention 7 - Fire Traffic. I'm on Highway 20 looking north. We have three fires, apparently all sets. Two are along Lake Access Road. The one closest to the lake is moving out. The other fire is on the west side of the highway. I'm in Code 3 pursuit of a suspect headed toward Lake County	Siren
20 Sec	Dipatch to all units responding to the Lake Mendocino Fire (IC's radio #) is Mendocino IC	2 beeps Copter noise
25 Sec	Mendocino IC, dispatch. Engines 10, 11, 12 and 13 plus transport 40 at scene	Copter noise Sirens
4 Min	Mendocino IC, dispatch - Helitender 101 at scene	Copter noise
3-5 Min	Possible Chief of Department (Chief 1) interference - first with IC and then with units on ground Air tankers not available for one hour	Dozer

PRESENTATION			APPLICATION
ADDITIONAL EQUIPMENT AVAIALBLE			
ENGINES	ICS TYPE	ETA	COMMITTED
Calpella Eng. 1	1	:10	_____
Potter Vly Eng. 5	4	:20	_____
Ukiah Eng. 1	2	:20	_____
Ukiah Eng. 3	3	:20	_____
CDF Engine 1183	3	:40	_____
CDF Engine 1184	3	:45	_____
CDF Engine 1191	3	:45	_____
CDF Engine 1187	3	:50	_____
CDF Engine 1189	3	1:00	_____
Little Lake Eng. 1	2	1:00	_____
OVERHEAD			
CDF Battalion 1112		:15	_____
Ukiah Battalion 2		:15	_____
Calpella Chief 1		:15	_____
CDF Battalion 1114		:25	_____
ENGINE STRIKE TEAMS			
CDF S/T 9110 C	3	:45	_____
CDF S/T 9130 C	3	1:00	_____
OES S/T 2001 A	1	:25	_____
OES S/T 2002 A	1	1:00	_____
DOZER			
CDF Transport 1140	2	:30	_____
Ross Construction	1	:45	_____
CDF Transport 1141	2	1:15	_____
DOZER STRIKE TEAMS			
CDF S/T 2 9118 L	2	1:00	_____
CREWS			
Chamberlain Crew 1	1	1:00	_____
Chamberlain Crew 2	1	1:00	_____
Parlin Crew 3	1	1:00	_____
Parlin Crew 4	1	1:00	_____

PRESENTATION		APPLICATION
TIME LAPSE:		ACTION/SOUNDS
15 Sec	Dispatch, Engine 10 at scene. The fire is about 1 acre of medium brush, moderate rate of spread. It's about 1/4 mile west of Golf Road on Silverado Trail. Continue the first alarm	Pump running
30 Sec	Beep, Beep. Dispatch to all units on the silverado fire (it's radio #) is Silverado IC	
When Asked	Engine 10 is making a progressive hoselay on the right flank. I'll need two more engine companies and water tender	Pump running
10 Min	Silverado IC, Silverado Air Attack. You're getting spot fires in the treeline south of the golf course	

PRESENTATION			APPLICATION
ADDITIONAL EQUIPMENT AVAILABLE			
ENGINES	ICS TYPE	ETA	COMMITTED
Engine 14	1	:15	_____
Engine 15	1	:15	_____
Engine 16	3	:15	_____
Engine 17	4	:15	_____
Engine 18	1	:20	_____
Engine 19	1	:20	_____
Engine 20	3	:25	_____
Engine 21	3	:25	_____
Engine 22	1	:30	_____
Engine 23	1	:30	_____
OVERHEAD			
Battalion 3		:10	_____
Battalion 4		:15	_____
Chief 2		:20	_____
ENGINE STRIKE TEAMS			
Strike Team 1	1	:15	_____
Strike Team 2	1	:20	_____
Strike Team 3	3	:25	_____
DOZERS			
Transport/Dozer 42	2	:40	_____
Transport/Dozer 43	2	:50	_____
Transport Dozer 44	2	1:00	_____
DOZER STRIKE TEAMS			
Strike Team 4	2	1:00	_____

PRESENTATION				APPLICATION
ADDITIONAL EQUIPMENT AVAILABLE				
CREWS	ICS TYPE		ETA	COMMITTED
Crew 54	1		:30	_____
Crew 55	1		:30	_____
Crew 66	1		:45	_____
COPTER				
Copter 110	2	w/bucket	:20	_____
TANKERS				
Tanker 61	1		:10	_____
Tanker 62	3		:15	_____

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PRESENTATION		APPLICATION
TIME LAPSE:		ACTION/SOUNDS
(Given)	Dispatch - Miguel Engine 17, additional report on conditions Miguel Engine 2 - go ahead 4-5 acres of heavy brush involved. The fire is moving rapidly toward structure	Sirens, pumps
10 Sec	All units at the Helix Fire (IC's radio) is Helix I.C.	2 beeps
Anytime IC must ask	Miguel Engine 17's disposition or attack plan. Making hoselay on right flank of fire off Lemon Avenue with Engine 18	Sirens, pumps
1 Min (Given)	Helix I.C., Dispatch - we're getting numerous calls on this. They're saying its rapidly approaching homes	Airtanker
2 Min	Helix I.C., Dispatch - Engines 19 and 20 and Transport 42 at scene	
2 Min (if not asked or anytime ask for)	Helix Air Attack's report on conditions - Fire is making a strong run towards 20-30 homes	Airtankers, sirens
3 Min	Engine 22 at scene	Show spot fires
4 Min	Helix I.C., Helix Air Attack - you have 6 homes with roof fires and two more with well involved attics. What's your assignment for the airtankers	Dozers, airtanker, sirens

PRESENTATION			APPLICATION
EQUIPMENT AVAILABLE FOR DISPATCH			
ENGINES	ICS TYPE	ETA	COMMITTED
CDF Engine 3381	3	:07	_____
CDF Engine 3377	3	:10	_____
CDF Engine 3387	3	:12	_____
CDF Engine 3385	3	:12	_____
La Mesa Engine 3	2	:08	_____
San Diego City Eng 10	1	:10	_____
El Cajon Engine 6	1	:12	_____
Santee Engine 5	2	:15	_____
Lakeside Engine 1	2	:18	_____
Cleveland Engine 3-10	3	:25	_____
AIRTANKERS			
AT 72	3	:15	_____
AT 73	3	:15	_____
AT 14	1	:30	_____
AT 87	1	:30	_____
HELICOPTERS			
CNF 540	3	:15	_____
CNF 538	3	:18	_____
STRIKE TEAMS			
San Diego S/T 6442A	1	:15	_____
Heartland S/T 6440B	1	:05	_____
OES S/T 6441A	1	:10	_____
OES S/T 6443A	1	:20	_____
OES S/T 6444A	1	1:00	_____
TRANSPORT/DOZERS			
CDF 3347	2	:30	_____
CDF 3348	2	:35	_____

PRESENTATION			APPLICATION
ADDITIONAL EQUIPMENT AVAILABLE FOR DISPATCH			
OVERHEAD	ICS TYPE	ETA	COMMITTED
La Mesa Chief 4300		:05	_____
San Diego Chief 3301		:10	_____
CDF Battalion Chief 3311		:10	_____
CDF Battalion Chief 3312		:15	_____
CDF Chief 3302		:20	_____

PRESENTATION		APPLICATION
	SLIDE DESCRIPTION	
H-1	Mt. Helix, homes and point of origin at base of slope. Road is Lemon Avenue	
H-2	Closer shot of H-1, point out white home	
H-3	Point of origin from pavement roller. Note same white home as point of reference	
H-4	Point of origin area	
H-5	General area - slide noting streets	
H-6	Homes above Lemon Avenue looking south	
H-7	General fuel types, close-up	
H-8	Exposed homes	
H-9	Road to white home	
H-10	Homes on slope	
H-11	Homes on slope	
H-12	Homes in brush area	
H-13	Homes in brush area	
H-14	Homes in brush area	
H-15	Fuel load	
H-16	Fire slide	

PRESENTATION		APPLICATION
TIME LAPSE:		ACTION/SOUNDS
(Narration)	This fire is burning in two jurisdictions. The original plan was a pincer action using progressive hoselays on both flanks coupled with airtanker drops at the head to slow spread. They were unable to move fast enough on the flanks and the fire has outflanked the air drops. The fire appears to be about 10 acres at this time. It looks like the fire will reach exposed structures on the Skyway in about 15 minutes. There are 3 engines, Paradise Air Attack and 2 airtankers at the scene. Paradise Engine 1R is on Skyway above the fire. Paradise Engines 1 and 2 are at the origin	Radio traffic
10 Sec	All units on the paradise fire (Paradise Chief 1 and CDF Battalion 2111 are Paradise IC)	
Anytime	If not already established, ask for location of staging area	
2 Min	Dispatch, CDF Engine 2186, at scene, origin	
2:30 Min	Dispatch, CDF Engine 2176, at scene, origin	
3 Min	Paradise IC, Paradise Engine 1R. The residents ahead of the fire are using so much water on their roofs that the hydrant system is useless. Do we have water tenders available? (If not asked for previously)	

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PRESENTATION		APPLICATION
TIME LAPSE:		ACTION/SOUND
5 Min	Paradise IC, Paradise Air Attack, emergency traffic (after answer). Your lead engine on the right flank is about to be overrun by the fire. The fire broke over the line between them and the second engine about 30 seconds ago. The fire will reach their location in less than 2 minutes. They are about 400 yards up the right flank from the origin	
7 Min	Dispatch, Butte County Engine 44, at scene	
8 Min	Dispatch, Butte County engine 33, at scene	
15 Min	Dispatch, Transport 2141, at scene, origin	

PRESENTATION			APPLICATION
EQUIPMENT AVAILABLE FOR DISPATCH			
ENGINES	ICS TYPE	ETA	COMMITTED
Paradise Engine 3	2	:10	_____
Paradise Engine 2R	2	:10	_____
Butte Co. Engine 34	3	:10	_____
Butte Co. Engine 33A	3	:15	_____
Butte Co. Engine 31	2	:15	_____
Butte Co. Engine 32	2	:15	_____
Butte Co. Engine 42	2	:20	_____
Chico Engine 4	2	:25	_____
CDF Engine 2162 (4WD)	3	:20	_____
CDF Engine 2178	3	:20	_____
Paradise Engine 3R	3	:20	_____
CDF Engine 2180	3	:35	_____
CDF Engine 2181	3	:35	_____
Butte Co. Engine 63	2	:35	_____
CDF Engine 2180	3	:35	_____
CDF Engine 2175	3	:35	_____
Chico Engine 1	1	:35	_____
CDF Engine 2161 (4WD)	3	:35	_____
CDF Engine 2176	3	:35	_____
Butte Co. Engine 45	2	:40	_____
Butte Co. Engine 25	2	:40	_____
Butte Co. Engine 12	2	:45	_____
Chico Engine 2	2	:45	_____
Butte Co. Engine 41	2	:45	_____
AIRTANKERS			
Tanker 147	1	:20	_____
Tanker 74	3	:25	_____
Tanker 75	3	:25	_____
Tanker 14	1	:25	_____
Tanker 99	2	:25	_____
Tanker 89	2	:25	_____

INSTRUCTOR GUIDE

PRESENTATION			APPLICATION
			COMMITTED
HELICOPTERS	ICS TYPE	ETA	
Copter 205	2	:20	_____
Copter 508	3	:30	_____
Copter 512	2	:30	_____
Copter 510	3	:30	_____
Helitender 205		1:10	_____
ENGINE STRIKE TEAMS			
CDF ST 9250-C	3	1:00	_____
CDF ST 9240-C	3	1:30	_____
CDF ST 9230-C	3	2:00	_____
TRANSPORT DOZERS			
Transport/Dozer 2140	2	:40	_____
Transport/Dozer 2540	2	1:30	_____
Dozer Tender 2140	2	:40	_____
HANDCREWS			
Butte Crew 1	1	:30	_____
Butte Crew 2	1	:45	_____
Butte Crew 3	1	2:00	_____
Ishi Crew 4	1	2:00	_____
Ishi Crew 5	1	2:00	_____
OVERHEAD			
Paradise Chief 2		:10	_____
Paradise Chief 3		:25	_____
Chico Battalion 5		:25	_____
CDF Battalion 2106		:25	_____
CDF Battalion 2114		:25	_____
CDF Chief 2100		:30	_____
CDF Chief 2103		:30	_____
WATER TENDERS			
Butte Co. Watertender 33	1	:15	_____
Butte Co. Watertender 12	1	:30	_____
Butte Co. Watertender 25	1	:30	_____
Butte Co. Watertender 45	1	:30	_____
Butte Co. Watertender 42	1	:30	_____

INSTRUCTOR GUIDE

PRESENTATION	APPLICATION
FINAL MORNING	
I. Survival Program	Display Items Distribute Handout #49 Heat Stress Pamphlet
II. Discuss Safety Equipment/Fire Shelters	Distribute Handout #51 Common Denominators
III. Heat Stress	Distribute Handout #52 13 Situations
IV. Survival Program	Distribute Handout #53 The Loop Fire Disaster Distribute Handout #54 Your in Your Car/Don't Panic
V. Review Homework	Distribute Handout #55 Wildland Fire Command Checklist
VI. Summary of Course and Review Of Student Goals	
VII. Final Examination	
VIII. Course Evaluations	

S-190 TESTS

INTRODUCTION TO FIRE BEHAVIOR
FOR INDIVIDUAL STUDY
S-190

APPENDIX B

UNIT AND FINAL TESTS

NFES 1988

For additional copies, contact:

BOISE INTERAGENCY FIRE CENTER, BLM WAREHOUSE

3905 Vista Avenue

Boise, Idaho 83705

Order NFES #1988

UNIT 1 TEST

1. Draw and label the fire triangle.

2. Name the three methods of heat transfer.

   A. _____

   B. _____

   C. _____

3. Within the fire environment three major factors play dominant roles. From the following description name the big three.

   A. _____

   Temperature, relative humidity, wind, atmospheric stability, and precipitation.

   B. _____

   Fuel type (ground or aerial) continuity, volume, loading, moisture content, and chemistry.

   C. _____

   Aspect, elevation, position on slope, shape of country, box canyons, narrow canyons, ridges, flat terrain.

4. Describe how slope affects fire spread.

   _____

   _____

   _____

UNIT 1 TEST

5. Match the following statements with the appropriate

L = Light fuels H = Heavy fuels

A. _____ Burn out faster

B. _____ More intense heat

C. _____ Longer mopup

D. _____ Faster rates of spread

E. _____ More hazardous

F. _____ Heat required to reach ignition is less

G. _____ Fuel moisture changes more slowly

H. _____ Dry out faster

I. _____ Prolong burnout

J. _____ Are usually more available for combustion

K. _____ Likely to be present for the start and spread of wildfire

6. Describe how wind affects fire spread.

_____

_____

_____

_____

_____

UNIT 1 TEST

7. From the following descriptions, list five weather factors that affect fuel moisture.

   A. _____

   A measurement of the warmth or coldness of a substance.

   B. _____

   The ratio of the actual amount of water vapor in the air to the possible amount the air could hold at any given temperature and pressure.

   C. _____

   Moisture in any form that falls from the atmosphere and reaches the ground.

   D. _____

   A point within a 12-month period at which vegetation becomes more or less available for combustion.

   E. _____

   A horizontal movement of air.

8. Explain how the arrangement of fuels affects the start and spread of wildfires.

_____

_____

_____

_____

_____

UNIT 1 TEST

9. Match the following statements to the items at the right of the page.

A.	_____ Is the side of hill or canyon	1.	Steep slopes
B.	_____ Fire burns fastest	2.	Mountains
C.	_____ Is the direction a slope faces	3.	Slope
D.	_____ Features of the earth's surface	4.	Conduction
E.	_____ Increases radiant heat transfer	5.	Downhill
F.	_____ Most hazardous aspect or exposure	6.	Topography
G.	_____ Least important method of heat transfer	7.	Southwest
		8.	Uphill
		9.	Exposure

10. Explain how the size of fuels affects the start and spread of fires.

_____

_____

_____

_____

_____

UNIT 2 TEST

1. List two ways or methods of breaking <u>each</u> of the legs of the fire triangle.

   Fuels

   A. _____

   B. _____

   Heat

   A. _____

   B. _____

   Oxygen

   A. _____

   B. _____

2. Explain some various ways in which a constructed line can be threatened by fire inside the fireline.

_____

_____

_____

_____

_____

_____

_____

UNIT 2 TEST

3. Define the blackline concept.

_____

_____

4. What effect does building a cup-trench, turning logs on slopes, and falling snags have on burning fuels located on a slope?

_____

_____

5. List three ways that aerial spotting can be prevented or reduced near a fireline.

A. _____

B. _____

B. _____

6. List six tools or pieces of equipment which are effective in breaking the fire triangle in your area.

A. _____

B. _____

C. _____

D. _____

E. _____

F. _____

UNIT 3 TEST

1. List five elements of weather which firefighters monitor and get forecasts to predict fire behavior.

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

2. List four common weather processes that can occur daily in mountainous terrain which will affect wildfires.

   A. _____

   B. _____

   C. _____

   D. _____

3. Name four sources of unusually strong winds which can occur on wildfires.

   A. _____

   B. _____

   C. _____

   D. _____

4. Give four weather situations which can cause rapid shifts in wind direction or erratic wind behavior.

   A. _____

   B. _____

   C. _____

   D. _____

UNIT 3 TEST

5. Give four visual indicators that can suggest changing weather.

   A. _____

   B. _____

   C. _____

   D. _____

6. List five visible parts of cloud development to indicate it is a thunderhead.

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

7. Where would the safest place be on this fire? (Place an X)

UNIT 4 TEST

1. Describe the dangerous conditions that can develop in a box canyon or steep narrow canyon.

   _____

   _____

   _____

2. List three fuel situations which could produce explosive fire behavior conditions.

   A. _____

   B. _____

   C. _____

3. List six dangerous situations that call for posting a lookout.

   A. _____

   B. _____

   C. _____

   D. _____

   E. _____

   F. _____

4. Give four alternatives which could be available to escape a threatening fire situation.

   A. _____

   B. _____

   C. _____

   D. _____

UNIT 4 TEST

5. List the four major common denominators of fire behavior on fatal and near-miss fires.

A. _____

_____

B. _____

_____

C. _____

_____

D. _____

_____

UNIT 4 TEST

6. List the ten standard firefighting orders.

UNIT 4 TEST

7. List the 13 situations that shout "watch out".

INTRODUCTION TO FIRE BEHAVIOR FOR INDIVIDUAL STUDY

S-190 FINAL TEST

100 Points

1. Label the three sides of the fire triangle. (6 Points)

= COMBUSTION

2. Describe in detail three ways of breaking the fire triangle when suppressing a fire. (6 Points)

_____

_____

_____

3. List four common weather processes that can occur daily in mountainous terrain which will affect wildfires. (8 Points)

_____

_____

_____

_____

4. Describe three fuel situations which could produce explosive fire behavior conditions. (6 Points)

_____

_____

_____

S-190 FINAL TEST

5. List six dangerous situations that would call for posting a lookout. (12 Points)

6. Describe the dangerous conditions that can develop in a box canyon or steep narrow canyon. (5 Points)

7. List five visual indicators that can suggest changing weather. (10 Points)

S-190 FINAL TEST

8. List five elements of weather which firefighters monitor and get forecasts to predict fire behavior. (10 Points)

9. Define the blackline concept and define when it is used. (5 Points)

10. Describe three ways in which aerial spotting can be prevented or limited near a fireline. (9 Points)

11. Describe how wind affects fire spread. (5 Points)

S-190 FINAL TEST

12. Name three methods of heat transfer. (9 Points)

_____

_____

_____

13. Give the three environmental factors affecting fire behavior. (9 Points)

_____

_____

_____

QUIZZES

QUIZ #1

	Points
What is the definition of a plan?	3

_____

_____

_____

What are the three elements of the planning process?	3

1. _____

2. _____

3. _____

QUIZ #2

Points

Briefly describe the statutory responsibility for wildland fire protection of your own department, CDF and the U.S. Forest Service.

Your own department is: 3

_____

_____

_____

_____

California Department of Forestry and Fire Protection is responsible for: 3

_____

_____

_____

United States Forest Service is responsible for: 3

_____

_____

_____

QUIZ #3

	Points
Define direct attack.	3
_____	
_____	
_____	
Two advantages of direct attack are:	2
1. _____	
2. _____	
Two disadvantages of direct attack are:	2
1. _____	
2. _____	

QUIZ #4

	Points
Define indirect attack.	3

_____

_____

_____

Two advantages of indirect attack are:	2

1. _____
2. _____

Two disadvantages of indirect attack are:	2

1. _____
2. _____

QUIZ #5

Points

List 5 factors which limit dozer capabilities. 5

1. _____

2. _____

3. _____

4. _____

5. _____

Approximately how long should it take a Type 2 dozer to construct 4 miles of single blade wide line in medium brush over rolling foothills? 1

a. 4 hours
b. 6 hours
c. 8 hours
d. 16 hours

List 3 safety considerations when working around dozers. 3

1. _____

2. _____

3. _____

QUIZ #6

	Points
The two types of wildland hoselays are:	2
1. _____	
2. _____	

There are several rules-of-thumb regarding basic hoselays. Fill in the following.

You should allow ____ to ____ minutes per 100' of progressive hose lay while suppressing a wildland fire.	2
Based on the minimum required hose compliments, ICS Type ____ engines are normally most suitable for wildland progressive hoselays.	1

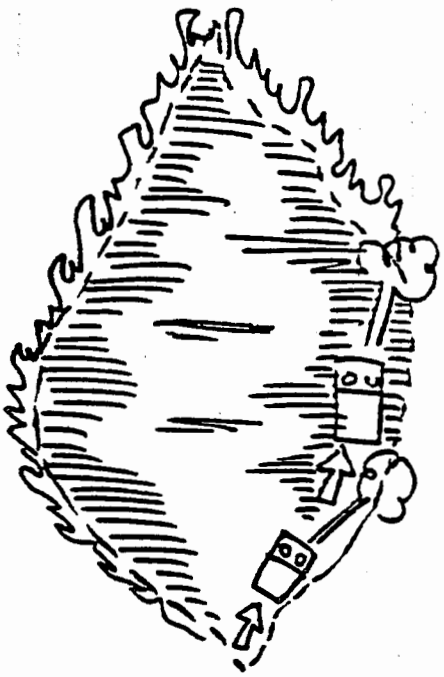
QUIZ #7

Points

Fill in the proper name of the control actions pictured below.

1

2



1. _____ 1

2. _____ 1

QUIZ #8

	Points
List the minimum retardant capacity of air tankers by ICS type.	
TYPE 1: _____	1
TYPE 2: _____	1
TYPE 3: _____	1
Describe at least 3 safety procedures to be taken in an air tanker drop zone.	3

1. _____

2. _____

3. _____

QUIZ #9

	Points
Describe six air and ground safety procedures relating to the use of helicopters.	6

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Describe five uses of helicopters on a wildland fire.	5

1. _____
2. _____
3. _____
4. _____
5. _____

QUIZ #10

	Points
List four critical safety practices to apply when protecting structures on a wildland fire.	4

1. _____

2. _____

3. _____

4. _____

QUIZ #11

	Points
Use your ICS Field Operations Guide (ICS 420-1) to list the minimum components of an ICS Type 1 Crew Strike Team including the minimum required personnel total.	2

_____

_____

_____

List the average hour fireline construction capabilities of a 15 person crew in the following fuel types

3 foot wide line in grass	_____	1
6 foot wide line in medium brush	_____	1
9 foot wide line in heavy brush	_____	1
12 foot wide line in very heavy brush	_____	1

QUIZ #12

Points

List three key components of fire behavior and their specific effects on wildland fires.

1. _____ 3

_____

_____

_____

_____

2. _____ 3

_____

_____

_____

_____

3. _____ 3

_____

_____

_____

_____

QUIZ #13

Points

Define the following components of the National Fire Danger Rating System.

IGNITION COMPONENT (IC) 2

_____

_____

_____

SPREAD COMPONENT (SC) 2

_____

_____

_____

BURNING INDEX (BI) 2

_____

_____

_____

QUIZZES

KEY

QUIZ 1

Points

What is the definition of a plan? 3

A plan is an order sequence of events over a specific period of time to accomplish specific objectives.

What are three elements of the planning process? 3

1. An information gathering system.
2. An evaluation and prediction system.
3. A re-evaluation system.

QUIZ 2

Points

Briefly describe the statutory responsibility for wildland fire protection for:

Your own department is _____

_____

_____

_____

_____

California Department of Forestry and Fire Protection is responsible for: 3

protection of lands classified as State Responsibility Area by the State Board of Forestry. These are mostly private grass, brush and timber covered lands.

United States Forest Service is responsible for protection of federal lands 3

designated by Congress as part of the National Forest System.

QUIZ 3

Points

Define direct attack 3

The application of effort directly on or adjacent to the edge of the fire.

Two advantages of direct attack are: 2

Close to burn - safest

Takes advantage of dead line

Don't contend with dangerous back fires

Keeps fire from gathering momentum or size

Keeps fire from crowning

Two disadvantages of direct attack are: 2

Personnel are working in heat and smoke

More irregular fire line

Does not make use of natrual breaks

More mop-up

QUIZ 4

Points

Define indirect attack: 3

The control line is located along natural firebreaks, favorable breaks in topography or at considerable distance from the fire.

Two advantages of indirect attack are: 2

Fire fighters not working in heat and smoke

Takes advantage of natural breaks

Easier mop-up, patrol

Less irregular line

Two disadvantages of indirect attack are: 2

Uncertainties of backfiring

Sometimes puts fire fighters in unsafe place

Increases size of fire

Fails to take advantage of cold portions of fire edge

Allows fire to build momentum or crown

QUIZ 5

Points

List 5 factors which limit dozer capabilities: 5

Time of day _____

Intensity of fire _____

Terrain, rocky _____

Age of dozer _____

Accessories on dozer _____

Operator experience _____

Slope _____

Size of dozer _____

Approximately how long should it take a Type 2 dozer to construct 4 miles of single blade wide line in medium brush over rolling foothills? 1

a. 4 hours
b. 6 hours
c. 8 hours
d. 16 hours

List 3 safety considerations when working around dozers: 3

Rolling rocks _____

Working in pairs _____

Working below dozers _____

Working at night without lights _____

QUIZ 6

Points

The two types of wildland hoselays are _____simple_____ and ___progressive_____. 2

There are several rules-of-thumb regarding basic hoselays. Fill in the following:

You should allow __4__ minutes per 100' of progressive hoselay while suppressing a wildland fire over an extended period. 2

Based on the minimum required hose compliments. ICS Type __3__ engines are normally most suitable for wildland progressive hose lays. 1

QUIZ 7

Fill in the proper name of the control actions pictured below:

1 2

1. Pincer 1

2. Tandem 1

QUIZ 8

Points

List the minimum retardant capacity of airtankers by ICS type:

TYPE 1 2000 _____ 1

TYPE 2 1000 _____ 1

TYPE 3 800 _____ 1

Describe at least 3 safety procedures to be taken in airtanker drop zone. 3

Lie down facing the airtankers

Hold tools firmly to one side

Hold helmet on

Spread your feet

Head down with goggles on

If possible get behind a large rock or tree (not a tree with dead load)

QUIZ 9

Points

Describe six air and ground safety procedures relating to the use of helicopters. 6

1. Always approach helicopter in full view of the pilot
2. Carry tools, eqiupment parallel with the ground
3. Have helmet on with chin strap down or carry helmet
4. Approach helicopter from level ground, never from higher
5. Do not slam doors
6. Buckle seat belt
7. No smoking in or around helicopter
8. Do not throw anything from helicopter
9. Always advise the pilot of obstacles, power lines, etc.

Describe five uses of helicopters on a wildland fire. 5

1. Observation
2. Water drops
3. Transport fire fighter
4. Transport injured
5. Transport tools, fuel, food
6. Mapping

QUIZ 10

Points

List four critical firefighter safety practices to apply when protecting structures threatened by a wildland fire. 4

1. Use buildings or natural barriers to protect from heat

2. Back into driveways

3. Try to remain mobile -- short hoselays only

4. Have charged 1-1/2" or larger line available

5. Have an escape route

6. Personnel in proper protective clothing

7. Maintain a full tank of water -- don't rely on hydrants

8. Don't park at top of draws or natural funnels

9. Don't park in dead fuels

QUIZ 11

Points

Use your ICS Field Operations Guide (ICS 420-1) to list the minimum components of an ICS Type 1 Crew Strike Team including the minimum required personnel total. 2

Minimum of 35 persons plus a S/T Leader for a total of 36 persons

Personnel, tools, transportation

List the average hourly fireline construction capabilities of a 15 person crew in the following fuel types.

3 ft. wide line in grass	900 ft.	1
6 ft. wide line in medium brush	450 ft.	1
9 ft. wide line in heavy brush	300 ft.	1
12 ft. wide line in very heavy brush	225 ft.	1

QUIZ 12

Points

List three key components of fire behavior and their specific effects on wildland fires:

1. FUEL _____ 3

Ground fuels _____ Dead fuel moisture _____

Aerial fuels _____ Arrangement _____

Continuity _____ Fuel temperture _____

Volume loading _____ Age _____

Compactness _____ Chemical content _____

Live fuel moisture _____

2. WEATHER _____ 3

Temperature _____

Wind - most important _____

Humidity _____

Fronts _____

Thunderstorms _____

3. TOPOGRAPHY _____ 3

Slope _____

Aspect -- SO & SO/West _____

Longitude / Latitude _____

Elevation _____

QUIZ 13

Points

Define the following components of the National Fire Danger Rating System.

IGNITION COMPONENT (IC) 2

A rating of the probability that a firebrand will cause a fire requiring suppresion action expressed in a range from 0-100.

SPREAD COMPONENT (SC) 2

A rating of the forward rate of spread of a headfire. Open ended expressed in feet per minute.

BURNING INDEX (BI) 2

A number related to the contribution of the fire behavior to the effort of containing a fire. Open ended. Calculation of flame length divided by 10.

PROBLEMS

FIRE COMMAND 2E
PROBLEM #1

At 1145 hours Battalion Chief Doe is dispatched to a grass fire reported by a fire lookout as starting along a state highway. The lookout further states that the fire appears to be headed into a brushy canyon that has scattered homes in it.

The weather is: Temp. 97 - Humidity 21% - Wind North 5-8 MPH

Dispatch advised Doe that the responding first alarm is: 5 engines, Type 2 dozer (D6C), 2 Type 3 (S-2) air tankers, and Air Attack Supervisor, and 2 hand crews.

At 1205, the first engine arrives and gives the following report on conditions:

> The fire is 10-12 acres, rate of spread moderate to rapid and just beginning to hit 2 foot high brush. Air tankers have just dropped on the head of the fire and have slowed it considerably. With a little luck, we can stop the fire with three or four more engines, but it will be touch and go.

The area involved has a past history of severe fires.

Chief Doe (who is still responding) hears the report on conditions and advises dispatch to "keep the first alarm coming, have the air tankers reload and return, but hold up on further dispatch until I get there."

At 1220, 15 minutes later, Chief Doe arrives at scene. The fire has burned through the air drops and a second fire head is forming. At 1223, one hand crew, two engines, and the dozer arrive and call Doe on the radio and ask him where he wants them to start work. Doe begins to feel that the whole situation is going to pot rapidly.

Doe tells the dozer and the two engines to attack the fire head, and the hand crew to stand by until he determines where they can be used.

At 1235, the dispatcher advised Doe that several residents in the brushy canyon are reporting spot fires. Doe advises that everything has gone to pot. Doe advises dispatch, "You better pull the pin and send everything you have."

HANDOUT #6

QUESTIONS	ANSWERS
1. List Doe's major problems.	
2. What could Doe have done better?	
3. How would you have planned this fire situation?	

FIRE COMMAND 2E
PROBLEM #2

It is 1500 hours and Battalion Chief Lumfitzer is at scene on a 20 acre fire along Metcalf Canyon Road. The fire started along the road and is burning up a 30 percent slope in medium brush towards the ridge top. The rate of spread is 72 feet per minute, temperature 94, humidity 24%, wind is light and variable at 4 MPH up canyon but is having little effect on the fire.

Dispatch advises Chief Lumfitzer that two additional air tankers have been dispatched ETA 15 minutes, also one Type 2 (D6-C) dozer, ETA 5 minutes. A Type 3 (D-4) dozer has arrived at the same time as Chief Lumfitzer and is unloading at the point of origin. Two tankers are working the fire, four Type 3 engines and one Type 1 hand crew are regrouping, having lost the initial attack. An additional hand crew has arrived and is tooling up.

Chief Lumfitzer advises the Type 3 dozer to start from the point of origin and flank the fire, trying to cut off the head before it reaches the ridge top, building a single pass line. He instructs the hand crew to hold the dozer line.

At 1505, the Type 2 dozer arrives and Chief Lumfitzer advises him to build a flanking line on the other side of the fire, and to open up and old road so that four-wheel drive engines can make it to the top of the fire.

The Air Attack Supervisor advises that the head of the fire has burned through the drops and is making a run towards the ridge top; if it slops overs the ridge, it will go into the next drainage.

Air Attack also advises that the dozer is about 300 yards from the head of the fire and the fire has about 300 yards to go before it reaches the ridge top. Chief Lumfitzer advises no problem, the Type 3 dozer will make it to the ridge top in about one hour, but keep the air tankers working on the head of the fire.

Chief Lumfitzer advises dispatch he would like another hand crew and two more Type 3 engines, and that they should be able to pick up the fire in about an hour.

At about 1600 hours, the fire has reached the ridge top and there is no containment on the head. It is apparent that the fire will be into the next drainage within 30 minutes and that control is not going as anticipated.

HANDOUT #13

QUESTIONS	ANSWERS
1. Identify the major problems.	
2. Who was at fault?	
3. How could this problem have been solved?	

FIRE COMMAND 2E
PROBLEM #4

You are the Incident Commander on a 100 acre fire burning grassy woodland and light brush. At scene you have: 5 Type 3 engines, 3 Type 1 handcrews, 2 Type 2 dozers, a Type 2 helicopter with a ten member helitack crew, 2 Type 3 (S-2) air tankers, a Battalion Chief, and a fire investigator. The rate of spread is temporarily stopped. The time is 1530, the temperature is 95 degrees, humidity 20%, wind is south approximately 8 MPH. Even though you haven't checked with Battalion Chief Dolittle and most of the other forces (mainly because no one has radio contact), you release two air tankers who have been orbiting the fire because, even though you can't see the whole fire, it looks good to you with not much smoke showing.

At 1535 you notice a rather large smoke over the ridge near the head of the fire. Again you start calling for Chief Dolittle, who is supposed to be Operations Section Chief. He answers but can't help you because he's helping Investigator Bullshipper locate the origin of the fire. Finally you contact Engineer Clutch who states the fire jumped her wet line and is burning rapidly up a moderate slope. She states they are making a hose lay to try to flank one side and that Captain Hook and his handcrew are starting up the other flank of the slop-over.

You call back the two air tankers. They arrive and tanker pilot Missmore advises that the slop-over amounts to about 1500 feet of moderately burning fireline. You have both air tankers make trail drops across the head. Pilot Missmore advises the fire is knocked down. Figuring the handcrew and the hose lay should pick up the slop-over, you release the air tankers. You try to call Engineer Clutch, but can't contact her. Neither can you contact Captain Hook who you think has a handi-talkie. You call Chief Dolittle, and ask if he can check the slop-over for you and report back. You wait 15 minutes and notice two columns of smoke in the vicinity of the slop-over. Chief Dolittle finally calls you and states that the crew working on the slop-over had pulled back because they thought more drops were coming and they didn't want to get hit, and that the slop-over was developing into two heads and to call for more air tankers.

The fire continues to burn into the night, and it's necessary for Chief Neverfails to assume command and finish up controlling the fire by morning.

HANDOUT #19

WORK IN GROUPS OF 4 TO 6

QUESTIONS	ANSWERS
1. Identify the major problems.	
2. Who was at fault?	
3. How could these problems have been solved?	

FIRE COMMAND 2E
PROBLEM #5

Date: Sunday, September 29, this year

Time: 0600

Weather: Temperature 78 degrees
Rel. Hum. 9%
Fuel Moisture 1.5
Wind Northeast 22, Gusts to 45

Scenario: A brush fire of potentially major proportions is burning about 2 miles east of the community of Fuego Beach. The fire, which is approaching on a wide front, looks like it will burn through Fuego Canyon into town. It will pose a major threat to the numerous homes that dot the hillsides of Fuego Canyon and the surrounding areas. The weather forecast calls for increasing winds this morning and warmer and drier conditions. The fire is advancing at about 1 mile per hour.

If the fire reaches the coast highway, the losses would be tremendous. There are over 300 homes in outlying areas of Fuego Beach.

The topography is steep and fuel is a mixture of grass and medium to heavy brush. Most of the streets are narrow and winding, creating a difficult ingress and egress situation.

You are at the Command Post located at the Municipal Parking Lot on Fuego Canyon Road. You have been assigned as Group Supervisor (see map) in charge of structure protection on the east side of Fuego Canyon. Group Z starts at Fuego Canyon Road and Ridge Road and runs southerly along Fuego Canyon Road, then easterly along Third Street to E Street, then up to the fire's edge. You have 5 strike teams located at the Command Post Staging Area. (ICS Types 1, 2, 3 - one each, you pick the ICS Types of the remaining 2). You are not responsible for perimeter control of your group's area.

HANDOUT #24

Your assignment is to develop an overall plan for structure protection. Please answer the following questions:

1. How long do you have to get ready?

2. How would you handle evacuations?

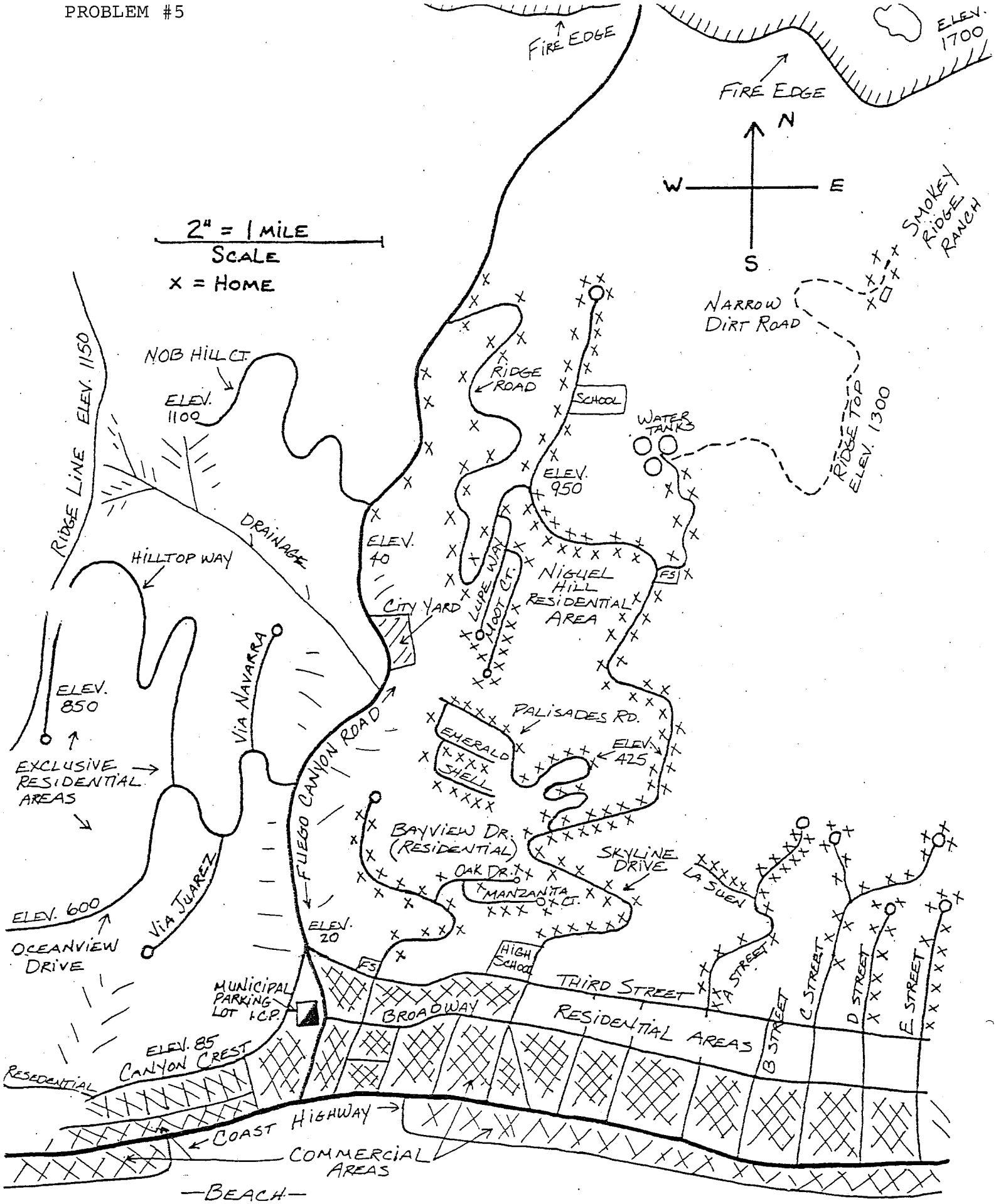
3. How and where would you deploy the strike teams?

4. What safety instructions would you give?

5. What instructions would you give strike team leaders?

6. What logistics problems would you anticipate?

HANDOUT #24
PROBLEM #5



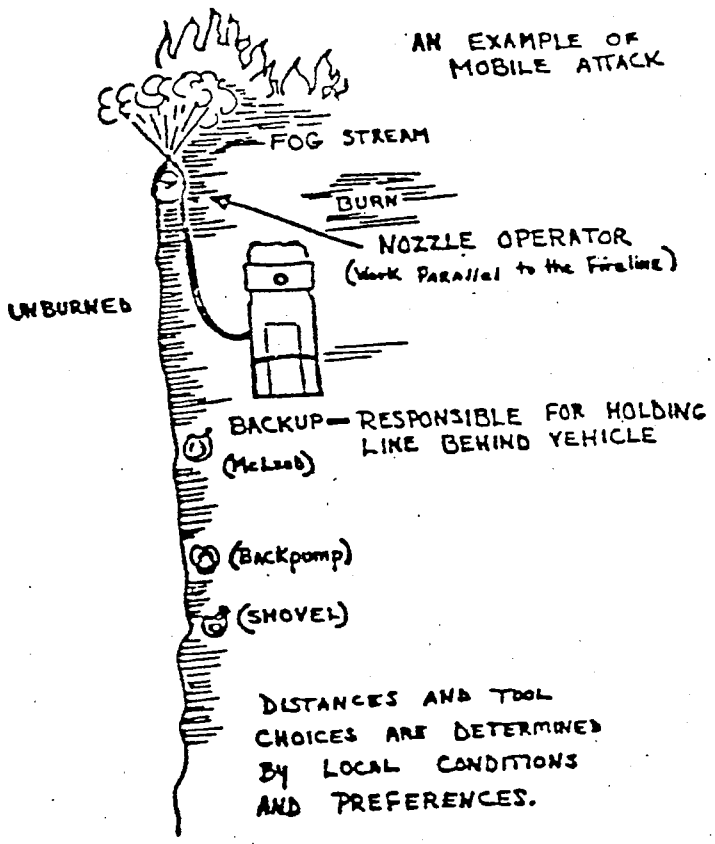
FIRE COMMAND 2E
MAPPING PROBLEM

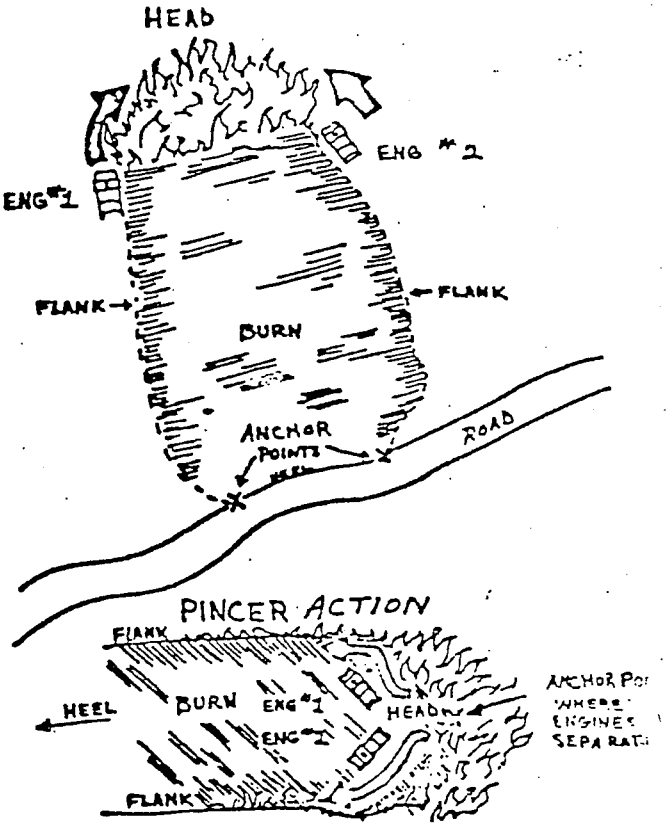
This assignment will be solved by first locating Sec. 15, T27N, R6W of the Oxbow Ridge 7.5 min. quad.

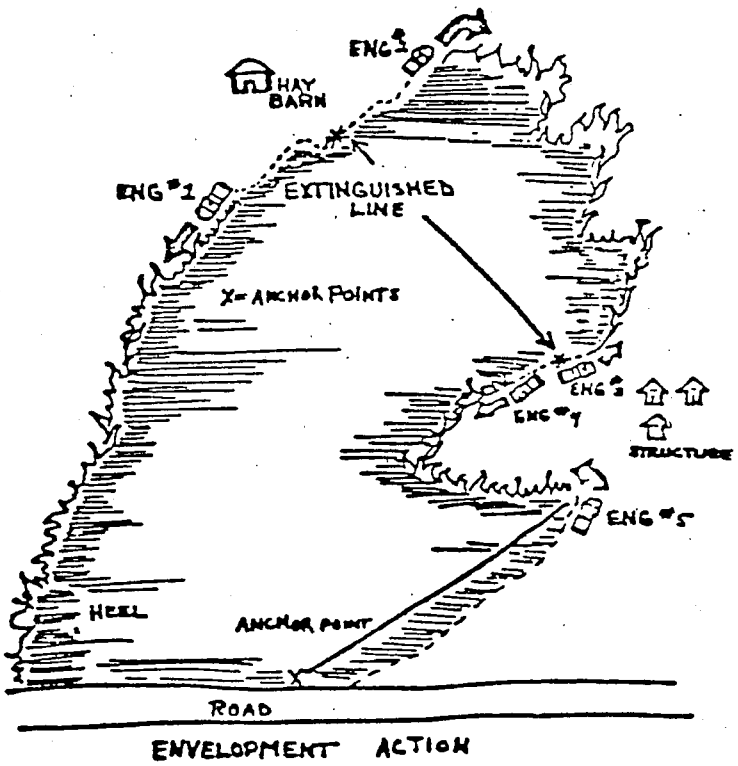
Divide Sec. 15 into equal quarters

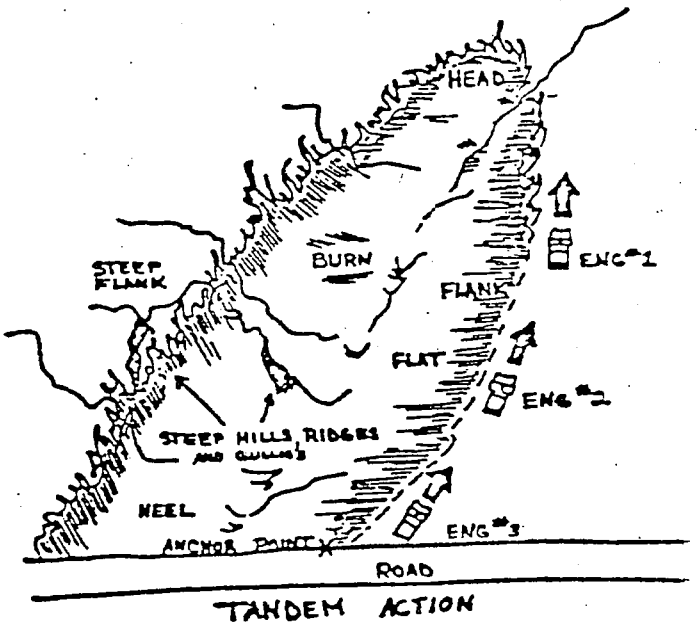
		Answers
1.	How many peaks are there in the N.W. quarter?	1.
2.	What does the symbol B.M. mean?	2.
3.	Does the trail from Cannon Road to point 1068 generally follow the ridge or a canyon?	3.
4.	What is the elevation of the lake in Sec. 15?	4.
5.	What are the contour intervals of this map?	5.
6.	What side of Vestal Road is the steepest?	6.
7.	In a straight line how far is it from point 969 to point 1068 in feet?	7.
8.	What is the percent of slope of the trail beginning at Cannon Road and running North to point 1068?	8.
9.	Are the streams in Sec. 15 intermittent?	9.

OFIC: Firefighting Operations
Mobile Attack









FIRE COMMAND 2E
PROBLEM #6

A fire has started next to the structure shown on the map at 1340 hours. An ICS Type 3 engine arrived at 1400 hours and is working on the right flank between the structure and the road. An ICS Type 4 (FWD w/3 personnel) engine arrived at 1405 and is starting to work the east flank. You and a Type 3 dozer (w/transport and 1 operator) arrive at 1410. The fire is now 7 acres as shown on the map.

Weather: Temperature 97, Humidity 18%, Fuel Moisture 3.5, Wind - North 6-8 MPH. Ignition Component 84, Spread Component 60' per min.

Fuel: Mixed brush and oak, 30 years old. Brush height averages 10 feet.

Additional Information: Contour interval = 40'

Map Scales 1" = 660' — Use 7.5 min. overlay
1 square = .156 acres

1" = 24,000" — Use 7.5 min. overlay
1 square = 1 acre

Predicted weather for evening: Diminishing winds at sundown. Slow cooling with slightly higher humidity. No appreciable change in fuel moisture.

Solution Required:

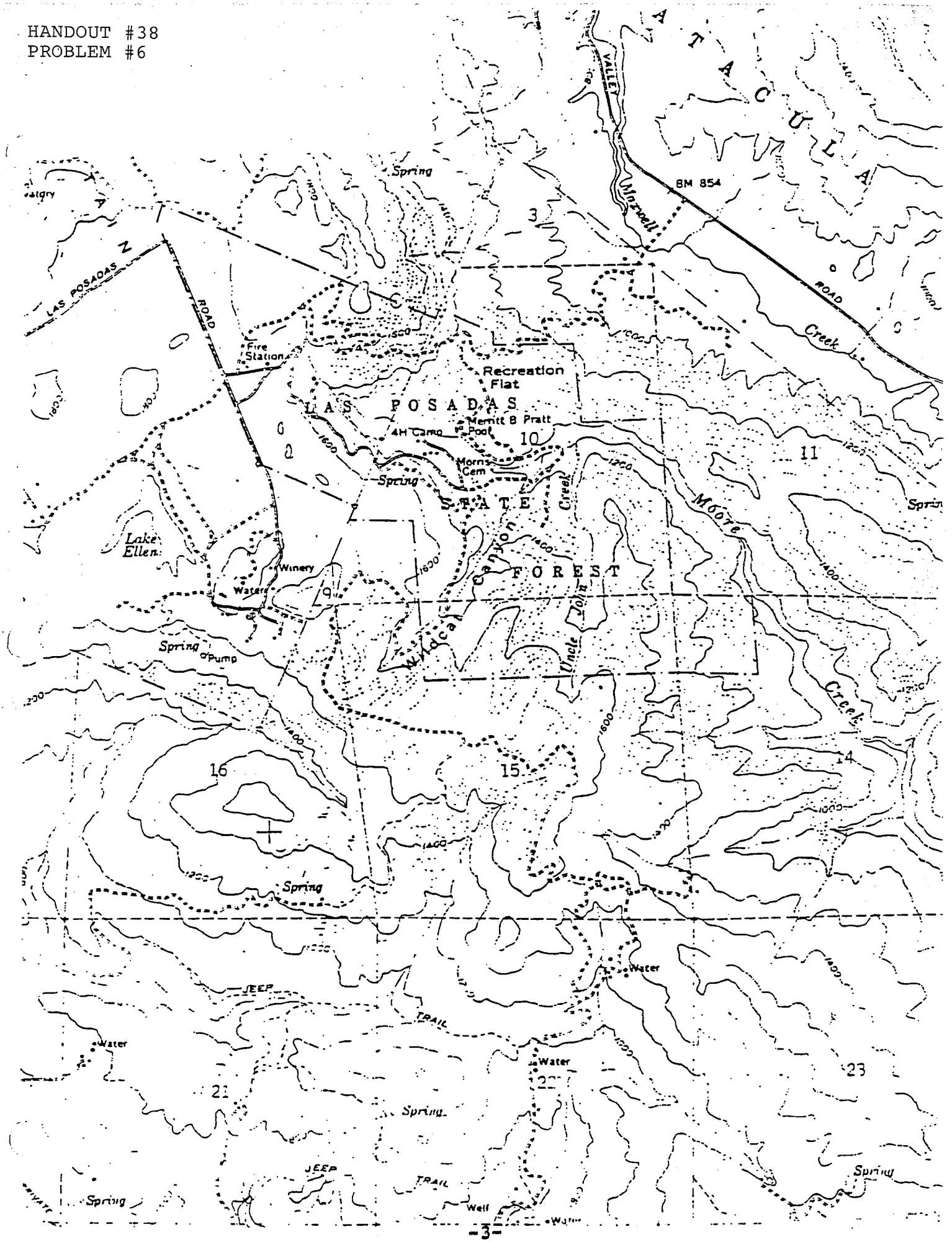
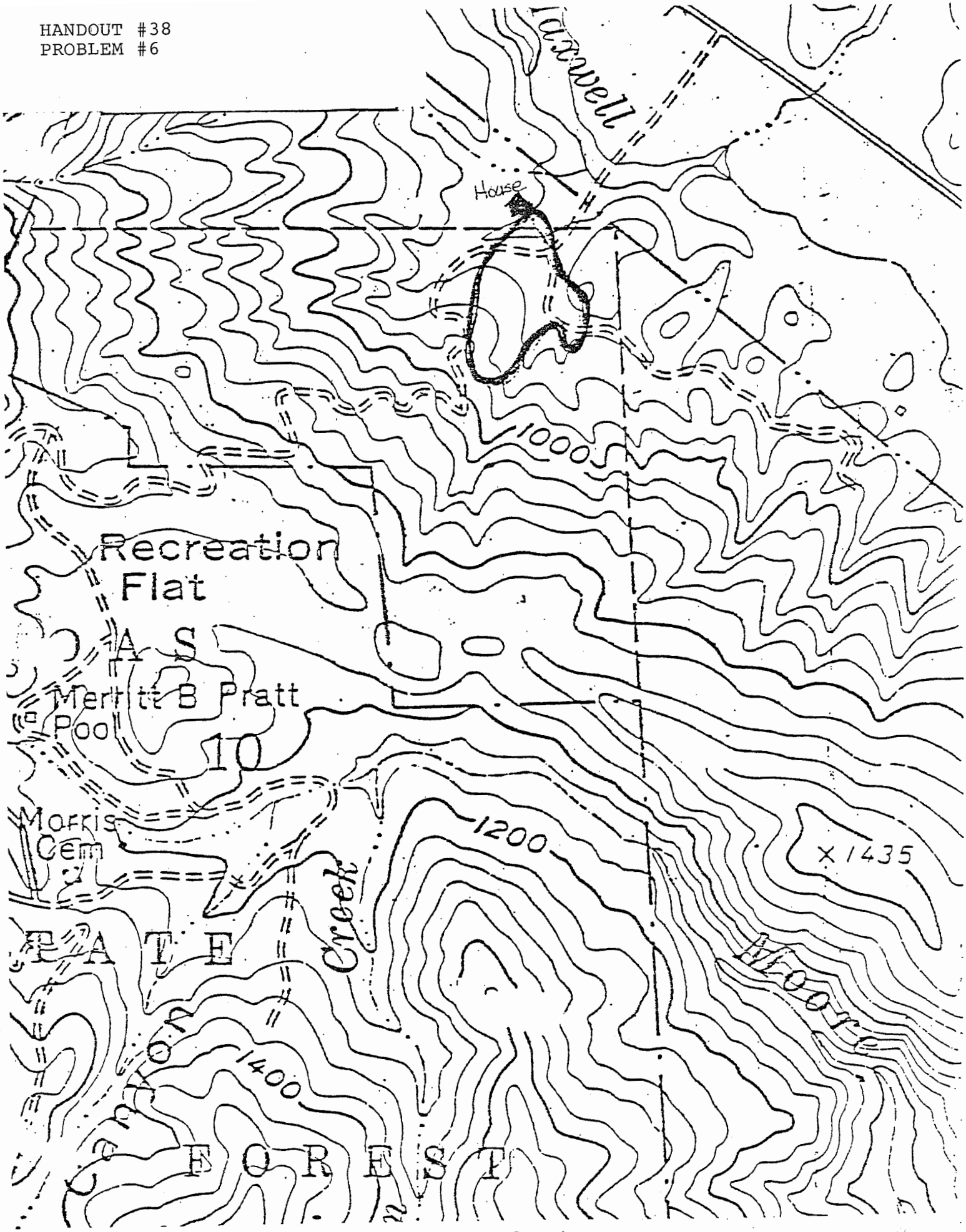
1. Show final fire perimeter and control lines on an overlay.
2. Show containment and control times.
3. Show final acreage.
4. List resources used.
5. Be prepared to explain your strategy.

FIRE COMMAND 2E
PROBLEM #6
RESOURCES AVAILABLE

Enroute to Fire:	ICS Type	ETA
St. Helena engine	3	1430
St. Helena engine	4 (4WD)	1430
St. Helena dozer	2	1445

Available for Dispatch	ICS Type	Arrival Time After Dispatch
Spanish Flat Battalion Chief		:30
Spanish Flat engine	3 (4WD)	:30
Napa engine	3	:45
Napa engine	4 (4WD)	:45
Konocti handcrew	1	:45
Napa Battalion Chief		1:00
Gordon Valley engine	4 (4WD)	1:00
Napa City engine	2	1:00
Konocti handcrew	1	1:00
Boggs Mtn. Copter	3	1:00
St. Helena Fire Investigator		1:00
Black Mt. handcrew	1	2:00
Black Mt. handcrew	1	2:00
Black Mt. dozer	2	3:00
Rental dozer	1	3:00
Glen Ellen engine	3	3:00

HANDOUT #38
PROBLEM #6



HANDOUT #38
PROBLEM #6