FIELD OBSERVER
DISPLAY PROCESSOR
I-244
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PREFACE

This package has been developed by the Planning Section of the Incident Command System (ICS) Development Committee. This Committee was established to fulfill a contract under a FIRESCOPE Grant to the California Department of Forestry Fire Academy at Ione, California.

The committee is made up of representatives from the following agencies:

California Department of Forestry
Los Angeles City Fire Department
Los Angeles County Fire Department
Office of Emergency Services
Orange County Fire Department
Santa Barbara County Fire Department
USDA Forest Service
Ventura County Fire Department
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INTRODUCTION

Field Observer/Display Processor I-244 is a 32-hour course designed for implementation at the regional level Forest Service (FS) Regions, National Park Service (NPS) Regions, Bureau of Land Management (BLM) State, Bureau of Indian Affairs (BIA) areas. This course is designed to meet the training needs of the Field Observer/Display Processor position in the the Planning Section.

The material in this course should be presented primarily through short lectures, discussions, problem solving through role playing, and exercises. The exercises are provided to give the trainees an opportunity to apply the information and knowledge received.

The instructor(s) should present this course as effectively as possible and comply with the required procedures for presentation and evaluation (Appendix A of this guide).

Subjects covered in this course include:

- Identifying and interpreting maps
- Making map calculations
- Using observation aids
- Mapping from aircraft
- Making field observations
- Processing and displaying data

This workbook will help you organize your thoughts. If taken to the field on your Field Observer/Display Processor assignments, the notes and aids that you use will enable you to do not just a good job, but an excellent job. Remember, the effort you put into this course will determine what you have to take with you at completion.
FIELD OBSERVER/DISPLAY PROCESSOR I-244

COURSE OBJECTIVES

The following are broad measurable objectives that state what you, the Field Observer/Display Processor, will be able to do upon completion of the course:

1. Given a call from a dispatcher ordering you as a Field Observer/Display Processor, describe and list the materials and information you need to begin your job.

2. Given a simulated fire situation, demonstrate ability to identify and interpret maps by selecting appropriate maps for Field Observer/Display Processor tasks. Interpret symbology of selected maps and describe simulated fire area giving legal description, mapped land features and area represented by selected map.

3. Given a simulated fire situation, demonstrate ability to determine distance, elevation and slope of fire area. Calculate simulated fire acreage using mathematical calculations, acreage charts and overlays, and estimation.

4. Given a simulated fire situation, demonstrate the use of field observation aids - aneroid barometer, abney level, odometer, compass, and protractor - by calculating slope, distance, and map location within 2% slope, 5% of measured distance and 10 feet on a three-legged compass course.

5. Given a simulated fire situation, describe materials to include in an aircraft mapping kit. Describe step-by-step map dropping procedures.

6. Given a simulated fire situation, collect required field data for Incident Action Plan. List and describe types of information to be gathered, wildland fire behavior observations, and wildland fire weather observations. After collecting all required field data, transmit information to the Display Processor of the simulated fire situation.

7. Given a simulated fire situation, establish a centralized receiving location for all simulated fire data. Sort and analyze data and respond to requests
for information. Develop maps using ICS symbology for operational support, planning activities, logistical support and ICP displays. Prepare required incident and agency reports.

8. After participation in classroom lectures and field exercises, the student will pass the course with a 70% or higher score.
UNIT 1--MAP IDENTIFICATION AND INTERPRETATION

Upon successful completion of this unit, the trainee should be able to:

Lesson 1 -- Introduction to Maps

1. Define the term "planimetric map".
2. Define the term "topographic map".
3. Define quadrangle or "quad".
4. Define "orthophoto map".

Lesson 2 -- Map Interpretation Information

1. Determine the geographic area represented by a map.
2. Define map scale.
3. Define comparison scale.
4. Define representative fraction.
5. Determine cardinal directions on a map.
6. Interpret information from a map legend.
7. Locate the revision date on a map.
8. Explain how to determine adjoining maps.
9. Use the GEOLOC System to locate a 100-acre cell.

Lesson 3 -- Topographic Maps

1. Explain what the five basic colors used on a topographic map represent.
2. Explain the purpose or meaning of 10 U.S. Geological Survey (USGS) Topographic Map Symbols.
3. List 6 items found in the margin of a topographic map.
4. Explain how to use the USGS Topographic Map Index Circular.
5. Explain contour lines and their use.
6. Identify peaks, saddles, canyons, ridges, and drainages on a topographic map.

Lesson 4 -- System of Land Description in the United States

1. Define baseline.
2. Define principal meridian.
3. Define township lines.
4. Define range lines.
5. Define township.
6. Describe the Township Numbering System.
7. Define section.
8. Divide a section.
Lesson 5 -- Other Common Maps and Symbols

Interpret common symbology used by:
- National Fire Protection Association (NFPA),
- Street Atlas,
- ICS maps.

UNIT 2 -- MAP CALCULATIONS

Lesson 1 -- Determining Distance, Elevation, and Slope

1. Measure distance using a comparison scale.
2. Calculate distance using representative fractions.
3. Convert distances into other units of measure.
4. Determine elevations using bench mark and spot elevations.
5. Determine elevation from contour lines.
6. Determine percent of slope.

Lesson 2 -- Determining Area

1. Perform mathematical calculations
2. Use dot and acreage grid overlays
3. Practice estimation

UNIT 3 -- OBSERVATION AIDS

Lesson 1 -- Aneroid Barometer, Abney Level, and Odometer

1. Adjust an aneroid barometer.
2. Determine elevation with an aneroid barometer.
3. Adjust an abney level.
4. Measure percent of slope to within 2% with an abney level.
5. Determine distance with an odometer.
Lesson 2 -- Pacing

1. Establish a pace distance.
2. Calculate the distance between two points by pacing. The calculation must be within 5% of the measured distance.

Lesson 3 -- Compass and Protractor

1. List the essential parts of the compass.
2. Take a field azimuth on an object within 20°.
3. Walk a three-legged compass course and return to within 10 feet of the starting point.
4. Use a protractor to locate an object by intersection.
5. Calculate back azimuths.
6. Describe declination.
7. Locate True North using a compass.
8. Orient a map with a compass.
9. Locate self on a map by the process of resection.
10. Locate an object by the process of intersection.

UNIT 4--AIRCRAFT MAPPING

1. List the types of maps needed for mapping from aircraft.
2. List the advantages and disadvantages of various map types for aircraft mapping.
3. List the materials needed to draw a fire map while airborne.
4. Describe how to deliver a map to the Incident Commander.

UNIT 5--FIELD OBSERVATION

Lesson 1 -- General Observations

1. List seven types of information to be gathered while making observations.
2. Explain how to report a hazardous situation.
3. List four methods of transportation used for recon.
4. Explain one advantage and one disadvantage of each method of transportation.

Lesson 2 — Wildland Fire Observations

1. List 7 of the 10 Standard Firefighting Orders.
2. List 9 of the 13 Situations That Shout Watch Out!
3. List 4 factors to consider in access routes.
4. List 3 factors to consider in possible helispot locations.
5. List 5 factors to consider when looking for possible control line locations.
6. List 6 factors that influence resistance to control.
7. List 2 situations where specialized equipment, procedures, or personnel may be required.

Lesson 3 — Wildland Fire Behavior Observations

1. Use a sling psychrometer to measure dry bulb and wet bulb temperature.
2. Calculate relative humidity within 2% using relative humidity chart.
3. Calculate relative humidity within 2% using a slide rule.
4. Measure average wind speed and direction within 2 mph.
5. Complete weather Observation Record form.
6. List the four Fire Behavior Fuel Model groups.
8. Define flame length.
9. Explain how to estimate rate of spread for verification of fire behavior predictions.
Lesson 4 -- Transmit Field Data

1. Transmit field data by
   a. narrative description
   b. legal description
   c. audiogram
   d. mile coordinates

2. Identify telecommunication methods for transmitting field data.

UNIT 6---PROCESS AND DISPLAY DATA

Lesson 1 -- Collect and Analyze Data

1. Determine what sources of data are available for the incident.

2. Establish a centralized location for receiving incoming data and notify data sources to route information to this location.

3. Identify critical time frames so that data can be processed to meet incident needs and notify data sources of established time frames.

4. Date/time stamp data.

5. Sort data into safety, operational, logistical and environmental categories.

6. Assist the Situation Unit Leader in the analysis and evaluation of incident status information.

7. Respond to specific requests for information.

Lesson 2 -- Maps and Displays

1. Identify ICS symbology

2. Prepare maps for:
   a. Operational support
   b. Planning activities
   c. Logistical support
d. Incident Command Post (ICP) Displays

e. Specialized purposes

Lesson 3 -- Reports and Plans

1. Prepare an Incident Status Summary (ICS Form 209).

2. Prepare required agency reports.

Can you guess how many beans are in the Jar?
get through the MAZE!

see if you can find your way through this perplexing maze.
One of these is a square and one is not. Which one is the square?

A. Square
B. Geometric figure

Put your answer here □ or □
FIND THE ELEPHANT

can you find the elephant hidden in this picture?
Word Search!

Find the word in the word list by looking across, down, diagonally, forwards or backwards. Circle the word you find.

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The artist who drew this picture has cleverly left out a part of this drawing. Can you guess what this animal is by examining the incomplete drawing?

Then see if you can complete the drawing.

This animal is a ___________
WORD HUNT

We’ve hidden four words in this word puzzle. Can you find them?

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Words: DUCK
connect the
DOTS!

1.

2.
FIND THE AARDVARK IN THE BACK OF THE PICKUP TRUCK.

There is an Aardvark hiding in the back of this pickup truck. Can you find him?
Which one is different?

one of these pictures is different from the others
can you find it?

A

B

C

D

write the answer here ____________________
Tic Tac Toe challenge

You are battling for the tic tac toe championship of the world. You have the last move and one open square is left. Can you win the championship with only one move? You are x. Good luck!
FIND YOUR WAY THROUGH THE JUNGLE!

START

FINISH
WHICH ONE IS DIFFERENT? In each of the groups below can you tell which object is different? Try your skill.

Answer
INSTRUCTIONS: Write the answers in the blank spaces to the right of the page according to number.

1. If you went to bed at 8 o'clock at night and set the alarm to get you up at 9 o'clock in the morning, how many hours sleep would you get?

2. Do they have a Fourth of July in England?

3. How many birthdays does the average man have?

4. Why can't a man living in Winston-Salem, N.C. be buried west of the Mississippi?

5. If you had only one match and entered a room where there was an oil lamp, an oil heater, and a gas heater, which would you light first?

Some months have 30 days, some have 31, how many have 28?

7. If a doctor gave you three pills and told you to take one every half hour, how long would they last?

8. A man builds a square house. Each side has a southern exposure. He looks out a window and sees a bear. What color is the bear?

9. How far can a dog run into the woods?

10. There are four words on every United States coin. They are not "In God We Trust." What are they?

11. There are two U.S. coins that total 55¢. One is not a nickel. What are the two coins?

12. A farmer has 17 sheep. All but 9 died. How many were left?

13. Divide $\frac{1}{2}$ into 30 and add 10. What is the answer?

14. Two men were playing checkers. They played 5 games and each won 5 games. How was this done?
15. Take 2 apples from 3 apples and what do you have?

16. Archaeologists saying they found coins marked 46 B.C. were either kidding or lying. Why?

17. How many animals of each species did Moses take aboard the ark?

18. A woman gave a beggar 50¢. The woman is the beggar's sister, but the beggar is not the woman's brother. How come?

19. Is it legal in North Carolina for a man to marry his widow's sister?

20. An airplane crashed on the border between Arizona and New Mexico. All but three aboard were killed. Where will they bury the survivors?
May 8, 1991

Memorandum

To: Regional Directors
   Attention: Regional Chief Rangers
             Regional Employee Development Officers
             Regional Fire Management Officers

From: NPS Fire Director, BIFC

Subject: Field Observer Training Package

Over a year ago, an NPS 1244 "Field Observer" training cadre in Western Region felt that many students were coming to the course ill-prepared to deal with the required map and compass skills. Charisse Sydoriak (currently Resource Management Specialist, North Atlantic Regional Office) volunteered to develop a pre-study package to mitigate the problem. She recently finalized the attached package, done on personal time!

We feel that this "Field Observer/Display Processor Prestudy" not only does an admirable job for its intended purpose, but equally importantly, will serve as a stand-alone product for developing map and compass skills for other non-fire applications. For example, "Ranger Skills" type courses might well benefit from its use.

We would appreciate any comments or recommendations on the use of this package from your experience over time. Please contact Paul Broyles, Training and Safety Specialist at FTS 554-1080, with your thoughts. Kudos to Charisse should you visit with her.

Douglas D. Erskine

Attachments

cc: R. Hagood, Branch of Employee Development, WASO
    D. Karraker, Horace M. Albright Training Center
    M. Aikens, Stephn T. Mather Training Center
    P. Range, Division of Training, BLM, BIFC
I-244

FIELD OBSERVER/DISPLAY PROCESSOR
PRESTUDY

National Park Service
February, 1991
FIELD OBSERVER/DISPLAY PROCESSOR
I-244 Prestudy

The information in this prestudy package are critical to the successful completion of the Field Observer/Display Processor Course. The trainee should first read the prestudy materials and then take the open-book prestudy exam and bring it to class. A score of 80% or higher is required to enter the classroom portion of this course. Trainees are expected to seek out instructional assistance from within their work unit if they have difficulty understanding how to use a compass or how to interpret maps.

In addition to passing the prestudy exam, each trainee must successfully complete an orienteering skills test on the first day of class. Key skills to be tested are pacing on flat ground and up and down slopes, backsighting, and navigating and mapping a course established by the instructors.

The prestudy package has been divided into three units. Each unit contains several lessons:

Unit 1—Map Identification and Interpretation
   Lesson 1 - Introduction to Maps
   Lesson 2 - Map Interpretation Information
   Lesson 3 - System of Land Description in the U.S.
   Lesson 4 - Topographic Maps
   Lesson 5 - ICS Map Display Symbols

Unit 2—Map Calculations
   Lesson 1 - Determining Distance, Elevation, and Slope
   Lesson 2 - Determining Area

Unit 3—Observation and Navigation Aids
   Lesson 1 - Equipment for Measuring Elevation, Slope, and Distance in the Field
   Lesson 2 - Pacing
   Lesson 3 - Compass and Protractor

Tools and equipment needed to complete this prestudy and which you must bring to class are:

♦ 12" or 18" clear plastic rule (1/10th inch graduations)
♦ Suunto clinometer (graduated in degrees and percent)
♦ Silva Ranger CL-15 type compass (360°)
♦ 100 foot (preferred) or 30 meter measuring tape
♦ protractor
♦ calculator
♦ Cajon quad included with this prestudy package (please DO NOT WRITE ON THIS MAP or write very lightly in pencil)
♦ dot grids or acreage overlay transparencies (optional)
UNIT 1
MAP IDENTIFICATION AND INTERPRETATION

LESSON 1 - Introduction to Maps

Objectives: 1. Define and classify maps.
2. Understand the use of planimetric, orthophoto, and topographic maps.
3. Define and understand the use of the quadrangle or "quad" on topographic maps.

A map is designed to permit you to visualize a portion of the earth's surface with pertinent features properly positioned to facilitate planning and organizing operations. Different types of maps are used for different purposes.

Definition of a Map
A map is a line drawing, to some scale, of an area of the earth's surface or of the works of humans. It shows objects and features by conventional signs. A map is a graphic representation of a portion of the earth's surface drawn to scale on a plane. Although drawn to scale, maps are not absolutely accurate because they represent a curved and uneven surface on a flat piece of paper. The accuracy of a map depends on how big an area is represented, and on the type of projection used to make it (some projections are more accurate than others).

Classification of Maps
Generally, maps fall into two categories: 1) public records (such as a subdivision map), and 2) maps used to describe the earth and delineate the works of people.

Public record maps usually show the exact location and description of a piece or many pieces of property, including bearing and exact distance from known points (bench marks) permanently fixed on or in the ground.

Maps used to describe the earth and that delineate the works of people can be divided into three categories:

1. Planimetric Maps
A planimetric map is a map which does not depict the shape of the land, or only incidentally shows it, but allows the user to travel along roads, paths, utility lines, vegetation or soil divisions, from one known point to another. A road map is a commonly used planimetric map.

2. Orthophoto Maps
An orthophoto map is a map depicting terrain and other features by color-enhanced photographic images. It is an aerial photograph of the land. Some orthophoto maps are overlain with contour intervals and other features commonly
associated with topographic maps. Orthophoto maps can help the user navigate from one location to another, and to map incident progress. Orthophoto maps without contour intervals can be difficult to use from the ground in densely vegetated areas since points of reference identified aerially can be difficult to distinguish while travelling on the ground. Orthophoto maps, however, are extremely useful when navigating from aircraft.

3. Topographic Maps
A topographic map is a map depicting natural features such as hills, valleys, lakes, and streams. A topographic map may also depict principal human-made features such as structures, roads, trails, powerlines, and wells. The topographic map is the type of map most commonly used by persons travelling off roads to a fire location or to map fire progress. The majority of skills to be developed in this course will require a detailed understanding of how to interpret topographic maps.

Topographic maps are often referred to as quads or quadrangles. The United States has been divided into a large number of rectangles known as quadrangles. The term "quad" is an abbreviation of quadrangle. Each quad is a topographic map covering a certain area, and is designated by the name of a town or some natural feature within the area.
LESSON 2 - Map Interpretation Information

Objectives: 1. Determine the geographic area represented by a map.
2. Define and determine map scale, comparison scale, and representative fraction.
3. Determine cardinal directions on a map.
4. Interpret information from a map legend.
5. Locate the revision date on a map.
6. Determine which maps adjoin a known map.

Information needed to interpret a map includes the area represented, the scale, and a legend which explains the symbols used on the map. Other information may be necessary depending upon the intended use of the map. This additional information may include a grid system, adjoining maps, revision dates, legal descriptions, contour lines, natural and human-made features, and various other items.

Geographic Area
Geographic area represented may be determined by a narrative description (Figure 1) such as one would find on a street atlas or county map. Geographic area may be graphically displayed (Figure 2) using a commonly known area or a given grid for reference. Either way, determining the geographic area is the first step in interpreting a map. The geographic area information relates the specific area referred to by a map to a much larger, relatively well-known area.

---

**Figure 1:** Narrative Description of Geographic Area

**Figure 2:** Graphical Representation of Geographic Area
Map Scale
The scale of a map is the ratio of the horizontal distance on the map to the corresponding horizontal distance on the ground. The scale expresses the ratio of the map distance to the ground distance. It is usually written as a fraction or ratio and called the representative fraction (RF).

Example: Representative Fraction = \( \frac{\text{Map Distance}}{\text{Ground Distance}} \)

\[ RF = \frac{MD}{GD} \quad \text{or} \quad RF = \frac{MD}{GD} \]

A representative fraction is always written with the map distance as 1 (one). A RF of 1/24,000 (1:24,000) means that one UNIT of measurement (inches, millimeters, feet, etc) on the map is equal to 24,000 of the SAME UNITS on the ground (see Figure 3). You cannot mix units in a representative fraction. If it is one INCH on the map, it is 24,000 INCHES on the ground.

A graphic or comparison scale is entirely different. It usually compares inches to miles (or like scale figures). Usually comparison scales are printed on the map and show you that so many inches or millimeters equal so many feet, yards, chains, or miles on the ground (see Figure 3). This type of scale is NOT a representative fraction.

**SCALE 1:24 000**

![Figure 4: Representative Fraction and Comparison Scale](image)

Cardinal Directions
Most maps are oriented with north at the top of the page. North is usually delineated by an arrow pointing to the north or by a cardinal wheel (Figure 4). If north is the top of the page, east is oriented to the right margin, south is at the bottom, and west is oriented to the left margin.

![Figure 4: North Arrow](image)

Map Legend
Most maps have a legend to help interpret the map. Legends describe map symbols, such as what color line delineates a road or land ownership boundary, or what figure represents a building, stream, spring, or heliport (see Figure 5).

<table>
<thead>
<tr>
<th>Legend</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>--------</td>
<td>-------------</td>
</tr>
<tr>
<td>National Forest Boundary</td>
<td>Unimproved Road</td>
</tr>
<tr>
<td>Adjacent National Forest Boundary</td>
<td>Route Junction</td>
</tr>
<tr>
<td>Ranger District Boundary</td>
<td>Trail</td>
</tr>
<tr>
<td>Game Refuge Boundary</td>
<td>National Recreation Trail</td>
</tr>
<tr>
<td>Wilderness Boundary - No Motorized Vehicles at Any Time</td>
<td>Power Transmission Line</td>
</tr>
<tr>
<td>State Boundary</td>
<td>Pipeline</td>
</tr>
<tr>
<td>U.S. Highway</td>
<td>Permanent Lookout Station</td>
</tr>
<tr>
<td>State Highway</td>
<td>Horizontal Control Station</td>
</tr>
</tbody>
</table>

![Figure 5: Example of a Map Legend](image)

Revision Date
Some maps have a revision date. This is the date the map was last updated to reflect changes in the landscape and human developments (Figure 6). If a map is very old it may not be very accurate.

PRODUCED BY THE UNITED STATES GEOLOGICAL SURVEY
CONTROL BY USGS, NOS/NOAA
COMPiled FROM AERIAL PHOTOGRAPHS TAKEN 1952
FIELD CHECKED 1965. MAP EDITED 1966. MAPPED, EDITED, AND PUBLISHED BY THE GEOLOGICAL SURVEY
Control by USGS and USGS
Topography from aerial photographs by photogrammetric methods
Aerial photographs taken 1952. Field check 1966

![Figure 6: Examples of Topographic Map Revision Dates](image)
Adjoining Maps
Some areas are too large to be shown on a single map. Adjoining maps are frequently indicated in the margin of a U.S. Geological Survey (USGS) topographic map or by an adjoining quadrangle legend on the map (Figure 7).

![Quadrangle Names]

**Figure 7:** Two Types of Adjoining Map Instructions Located on the Margins of Topographic Maps.

Grid Reference
Some maps are divided into grids to help locate areas. Grids are usually identified alpha-numerically (Figure 8). However, some grids use only letters or only numbers. Many road maps and atlases use a grid reference system to locate streets or other features. An alphabetical index is usually included to help locate an area. For example, in Figure 8, Kington, Wilse, and Laport are located in grid unit 2E.

![Typical Grid]

**Figure 8:** Typical Reference Grid.
LESSON 3 - System of Land Description in the United States

Objectives:
1. Define baseline, principal meridian, and Township, Range and Section used in describing land.
2. Describe the Township numbering system.
3. Give the legal description of a fire location.
4. Divide Townships, Ranges and Sections and give the amount of acres represented by these divisions.
5. Be able to identify your location from "location posters" found in the field.
6. Determine the latitude and longitude of a point or area using a map.

The use of a map for locating an incident requires some knowledge of the system of public land survey. In many areas, land is subdivided into rectangular tracts, and a knowledge of this system enables you to refer to or find blocks of land in the mountains as simply as you find or refer to city blocks by the street names and numbers.

The United States system of surveying public lands (often referred to as the rectangular system) was instituted in 1784 by the Continental Congress and remains in use today. This system divides the land into squares that are defined by north-south and east-west running lines. Before much of the United States was developed, north-south running lines called meridians or principal meridians, and east-west running lines called baselines divided the country into blocks. Each meridian and baseline originated from a known landscape feature such as a mountain peak. When a meridian and baseline intersect, that spot on the earth is called an initial or reference point and all further subdivisions of the land are based on this system of initial points.

Land surveys in California are based on one of three initial points (see Figure 9 on the next page) known as the:

1. Humboldt Base and Meridian on Mount Pierce (HB&M) located in northern coastal California
2. Mount Diablo Base and Meridian on Mount Diablo (MDB&M) located in southern coastal California
3. San Bernardino Base and Meridian on Mount San Bernardino (SBB&M) located in south central California
From these baselines and meridian reference points, land was divided into approximately 6 mile by 6 mile squares known as **Townships**. These Townships are numbered from the initial point, starting with 1 and increasing as the Township falls further north or south from the reference point (Figure 10). A row of Townships running east-west is called a **Range**. Ranges are also numbered from the reference point with Range 1 east (R1E) and Range 1 west (R1W) lying closest to the reference point. Proper descriptions of locations have the Township written first followed by the Range. Often the baseline and meridian are included; for example T45N, R3E (MDB&M).

**Figure 10: Township-Range Grid**
Each Township has been divided into approximately 36 square miles. Each one of the 36 square miles is called a Section of land and contains approximately 640 acres or one square mile. Townships and Sections are often smaller or larger where survey corrections have been made.

Each section is numbered based on its position within the Township. The rule of thumb is that Section 1 always lies in the northeast (top right) corner and the numbering of the remaining sections proceeds to the left, then to the right, left, and so on as you progress south (down) the square (Figure 11). A properly written section location (also called the legal description) in Figure 11 would read: Section 22, T5N, R7W, MDB&M).

![Diagram of Township]

Figure 11: Typical Township

A typical section of 640 acres may be readily divided into smaller areas, each successively smaller piece having a unique location description and from which size can be readily calculated. Let's look at the simplest possible division first - \( \frac{1}{4} \) section:

**Example 1:**

![Diagram of Section 22]

The area identified by A would be described as \( \frac{1}{4} \) Sec. 22, T5N, R7W, MDB&M; the area identified as B would be described as \( \frac{3}{4} \) Sec. 22, T5N, R7W, MDB&M. (Remember that, unless otherwise noted, the top of the map is north, the right is east, the left is west, and the bottom is south). Half-sections A and B are each 320 acres (640 ÷ 2).
Example 2:

Area C would be described as N\(\frac{3}{4}\) Sec 22, T5N, R7W, MDB&M.
Area D would be described as S\(\frac{1}{2}\) Sec 22, T5N, R7W, MDB&M.
Each half of the section would be equal to 320 acres (640 + 2).

Each section can be further divided into \(\frac{1}{4}\) sections (divisions are not shown on field maps but must be envisioned or drawn by the user) as shown in Figure 12.

Figure 12: Subdivision of Section into Quarter-sections.
Partial section divisions and combinations of divisions can also be made:

**Example 1:**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

Sec. 22  

Descriptions:
- A/C = W1/2 Sec 22; 320 ac
- B = NE1/2 Sec 22; 160 ac
- D = SE1/2 Sec 22; 160 ac

**Example 2:**

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>D</td>
</tr>
</tbody>
</table>

Sec. 22  

Descriptions:
- A/B = N1/2 Sec 22; 320 ac
- C = SW1/2 Sec 22; 160 ac
- D = SE1/2 Sec 22; 160 ac

Quarter-sections can be further divided into halves (80 acres \((160 \div 2)\)) or quarters (40 acres \((160 \div 4)\)). Figure 13 shows how a Quarter-section can be further subdivided into quarters.

---

These lines not normally shown on map.

<table>
<thead>
<tr>
<th>NWNW</th>
<th>NENW</th>
<th>NWNE</th>
<th>NENE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWNW</td>
<td>SENW</td>
<td>SWNE</td>
<td>SENE</td>
</tr>
<tr>
<td>NWSW</td>
<td>NESW</td>
<td>NWSE</td>
<td>NESE</td>
</tr>
<tr>
<td>SWSW</td>
<td>SESW</td>
<td>SWSE</td>
<td>SESE</td>
</tr>
</tbody>
</table>

Section number is placed in center.

Equivalent to: Southeast quarter of Southwest quarter or section.

This is a sixteenth corner (1/16 cor.) and in general practice is seldom established.

---

Figure 13: Subdivision of Quarter-sections

12
In the example that follows a quarter-section of Sec. 8, T45N, R3E, MDB&M has been subdivided. A quarter-section is \( \frac{1}{4} \) of 640 acres, or 160 acres.

```

\[
\begin{array}{c|c|c|c}
\text{A} & & \text{B} \\
\hline
\text{C} & & \text{F} \\
\hline
\text{D} & \text{E} & & \\
\end{array}
\]

NW\(\frac{1}{4}\) of Sec. 8 (160 acres)
```

Each subdivision is part of the NW \( \frac{1}{4} \) of Section 8 and is described below. Acreages are also calculated.

- **A** = W\(\frac{1}{2}\), NW\(\frac{1}{4}\), NW\(\frac{3}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{1}{2} \times \frac{1}{4} \times \frac{3}{4} \times 640 \text{ acres} = 20 \text{ acres} \]
- **B** = S\(\frac{1}{2}\), NE\(\frac{1}{4}\), NW\(\frac{1}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{1}{2} \times \frac{1}{4} \times \frac{1}{4} \times 640 \text{ acres} = 20 \text{ acres} \]
- **C** = NE\(\frac{3}{4}\), SW\(\frac{1}{4}\), NW\(\frac{3}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{3}{4} \times \frac{1}{4} \times \frac{3}{4} \times 640 \text{ acres} = 10 \text{ acres} \]
- **D** = W\(\frac{3}{4}\), SE\(\frac{1}{4}\), SW\(\frac{1}{4}\), NW\(\frac{3}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{3}{4} \times \frac{1}{4} \times \frac{1}{4} \times 640 \text{ acres} = 5 \text{ acres} \]
- **E** = SE\(\frac{3}{4}\), SE\(\frac{3}{4}\), SW\(\frac{1}{4}\), NW\(\frac{3}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{3}{4} \times \frac{3}{4} \times \frac{1}{4} \times 640 \text{ acres} = 2.5 \text{ acres} \]
- **F** = SE\(\frac{1}{4}\), NW\(\frac{1}{4}\), Sec 8, T45N, R3E, MDB&M;
  \[ \frac{1}{4} \times \frac{1}{4} \times 640 \text{ acres} = 40 \text{ acres} \]
If you have trouble remembering what order the description is written, replace the commas in your mind for OF THE or OF. For example E above would be described as the southeast quarter of the southeast quarter of the southwest quarter of the northwest quarter of Section eight Township 45 north, Range 3 east, from the Mount Diablo Base and Meridian. The key is to start from the smallest parcel and progress to the successively larger parcel.

Sections can be reasonably divided into 10 acre parcels on a one-half inch equals one mile map (1:126,720), and to 2.5 acre parcels on one inch equals one mile (1:62,500) or larger scale maps. Two and one-half acre parcels are the smallest that will be used in this course.

To describe non-rectangular or non-square parcels and to calculate their size you use the same principles described previously but you must use the word "AND" in the description and you must add together portions of known areas. For example, in Figure 14, A is located in Sec. 3, T45N, R3E, MDB&M, and is legally described as: N\(\frac{1}{2}\) AND SW\(\frac{1}{4}\), SE\(\frac{1}{4}\), Sec 3, T45N, R3E, MDB&M. It can also be described as W\(\frac{1}{2}\) AND NE\(\frac{1}{4}\), SE\(\frac{1}{4}\), Sec 3, T45N, R3E, MDB&M. This area would be 120 acres \((\frac{1}{2} \times 160) + (\frac{1}{4} \times \frac{1}{4} \times 160) = (80 + 40) = 120\) acres.

![Figure 14](image)
If a Section is delineated on a map, comparison to it of an unknown area such as a fire, makes estimating the size of the fire easier. For example, Map #1 on page 16, has a fire mapped on it; by comparison to a known area (Section 26 which is 640 acres) we can see that the fire occupies about $\frac{1}{4}$ of a section which is about 160 acres.

On Map #2 (page 17), the fire has burned an area outside of the section lines, but the area of this fire can be estimated by following these steps:

1. Note that a Section of a 7-\(\frac{1}{4}\) minute topographic map is approximately 2-6/10 inches on a side or 2-6/10 inches = 1 mile.

2. The fire is 3-4/10 inches long (over a 1-\(\frac{1}{2}\) mile long).

3. The fire is 1-9/10 inches wide (over \(\frac{1}{4}\) mile wide (1-3/10 inch = \(\frac{1}{4}\) mile).

4. The fire is irregular in shape; this irregularity should be considered.

5. The fire is smaller than a Section (640 acres) which is 2-6/10 inches by 2-6/10 inches.

6. It approximates 3/4 of a Section (2-6/10" by 1-8/10") which is 480 acres, but is a little longer (9/10"). This slightly longer length compensates for the irregular shape. Therefore it is safe to say that this fire is approximately 480 acres.
Location posters
Location posters, sometimes called Section corner markers, Section line markers, "K" tags, or cruiser tags (see Figures 15 and 16) are used by State and Federal agencies, lumber companies, and private landowners to indicate the location of section corners and points where roads or trails cross section lines. These metal posters are 4 1/2 or 5 inches in size with black lines on a yellow background. In recent years, unpainted aluminum tags with the lines and lettering stamped on them have been used. The Township, Range, and Section are marked on the poster. A tack driven at the appropriate place on the poster shows where the poster is located according to the public land survey. Usually, the distance to a section corner is marked on the poster. On the map in Figure 17, points B and C would probably be identified in the field by location posters similar to Figure 15, and point A by a location poster similar to Figure 16.

Figure 15: Location Poster for Indicating Section Corners.
Figure 16: Location Poster for Indicating Section Lines.

Figure 16 is an example of a type of poster used at a road or trail crossing of a section line, or at a quarter-section corner.

A. Where roads cross section line.
B. At section corners.
C. At quarter section corners.

Figure 17: Portion of a Map Showing Typical Points Where Location Posters are Commonly Placed.
Latitude and Longitude
Many forest maps include rectangular blocks with sides parallel to longitude and latitude lines. These lines with map scales aid in comparing various scale maps.

If a fire or incident occurs, location should be referenced and recorded by latitude and longitude for later use in completing the individual fire report. Enter the latitude and longitude at the point of the fire's origin. Report degrees in whole numbers and minutes to the nearest tenth. In some aircraft, navigation equipment (called a LORAN) that indicate latitude and longitude are standard.

A description of latitude and longitude follows.

**Latitude**
Is measured in degrees, (0° through 90°), north and south of the equator. Lines of latitude are parallel; therefore, the distance between two lines of latitude remains constant (Figure 18). One degree of latitude = 60 nautical miles (NM); one NM = 6075 feet, or 1.15 statute mile.

**Longitude**
Is measured in degrees (0° through 180°), east and west of the "prime meridian" which runs between the north and south poles, through Greenwich, England (Figure 18). (When you invent the system of latitude and longitude, as the British did, you get to decide where the lines are.) Lines of longitude are not parallel; the closer to the poles, the smaller the distance between them.

When specifying a position, latitude is normally given first. For instance, Boise, Idaho would be located as: 43° 35' (45 degrees, 35 minutes) north latitude, 116° 15' (116 degrees, 15 minutes) west longitude.

This will locate you within approximately 1 nautical mile (1 minute of latitude is equal to 1 nautical mile). By extending the reading to 0.01 minute, the accuracy is down to approximately 60 feet (0.01 minute of latitude = 60.75 feet).
Other Location Methods

In some areas the land survey system may not include Township and Section divisions. Some land surveys follow natural geographic features such as ridge tops, stream bottoms, or similar features. This system is called a metes-and-bounds survey.

In many cases, local people may describe a location by naming the drainage, identifying local landmarks, and including the compass direction and distance from a known point to the location being described. For example, fire towers or road junctions are frequently used as checkpoints in directing pilots to specific fires.
Complete the following exercises to test your knowledge of Unit 1 information:

School solutions are available at the end of Unit 1.

Q1: In which direction (East-West or North-South) do Baselines pass through initial points? ________________.

Q2: Define Principal Meridian: ________________________________

Q3: The lines that parallel the Baseline at 6 mile intervals are called ________________ lines.

Q4: The lines that parallel the Principal Meridian at 6 mile intervals are called ________________ lines.

Q5: The area inside the above large square is __________ square miles.
Use the large square on the last page to answer questions Q6-Q8.
Q6: This square is called a ____________.

Q7: The small squares are called ____________.

Q8: Each small square contains _______ acres. Number the small squares in accordance with the Rectangular System of Survey.

Use the Cajon quad to answer questions Q9 through Q11.

At the bottom margin of the Cajon quad, Highway 395-66 is shown as a double purple line. Follow this Highway north to the Cajon Campground.

Q9: What Township and Range does the campground lie in? ______ ______.

Q10: What Section does the campground lie in?______________.

Q11: Lost Lake lies west of the campground. What is the Section, Township, and Range of Lost Lake?___________________________.

To answer questions Q12-Q14, describe the section divisions with letters in them. The Township and Range is T5N, R7W, MDB&M

Q12: A = ________________

Q13: B = ________________

Q14: C = ________________

D = ________________
The following three questions refer to the diagram below; assume it represents one Section.

Q15: How many acres in area A?__________

Q16: How many acres in area B plus C?____

Q17: How many acres in area D?__________
LESSON 4 - Topographic Maps

Objectives: 1. Describe the meaning of the five basic map colors.
2. Interpret the purpose or meaning of USGS topographic map symbols.
3. Become familiar with the USGS topographic map index circular.
4. Use contour lines to identify topographic features.
5. Determine magnetic declination.
6. List and interpret information located in the margin of topographic maps.

A topographic map depicts natural features such as mountains, valleys, lakes, and streams. It also depicts principal human-made features such as buildings, roads, trails, powerlines, and wells. These maps are especially useful to field observers and search and rescue parties since they show the shape of the land.

Throughout this lesson you should refer to the Cajon topographic map and to topo maps representing your home unit. Do not write on the Cajon quad; this map will be reused.

Before starting this section, read the USGS booklet called "Topographic Maps".

If you were directed to reach a fire or other cross-country destination, you could use an administrative or road map (planimetric maps) to see how far away it is and to calculate how long it should take you to get near your destination. But if there was a 300 foot cliff between you and your destination, the administrative or road map would not show you the cliff and your calculations could be off by hours or days as you would be forced to detour.

Topographic maps are commonly used to navigate because they do show you the shape of the land and allow you to determine the best possible route, which is very often not a straight line. You can also calculate slope, predict the best possible control line locations, determine where your water sources are, and estimate how much elevational gain or loss you will experience.

A topographic map is printed on a flat piece of paper. It is, therefore, necessary to use symbols to represent relief (change in elevation). Hachures, shading, and contours are the most common methods of showing topographic relief.
Colors and Symbols
Symbols are used on maps to indicate objects on the ground. Topographic map symbols are usually printed in colors—each color identifying a class of features. Refer to the Cajon quad as we go through the following color and symbol definitions.

Colors
BLACK: most cultural or human-made features, land use boundaries, unpaved roads, and trails. Buildings are usually represented as black squares.

BLUE: water features such as lakes, streams, rivers, or swamps. Permanent bodies of water are represented in solid blue and ephemeral streams, lakes, and ponds are represented in hachured blue (lakes and ponds) or dashed blue lines (streams and creeks).

GREEN: vegetated areas.

BROWN: all relief (vertical change) features, such as contour lines, cuts, and hills; and barren or rocky areas.

RED: main roads, urban areas (red tint), special features such as a campground, and Township, Range, and Section boundaries.

PURPLE: aerial photo generated revisions that have not been field checked.

Symbols
Take the "Topographic Maps" booklet published by the USGS and find symbols on the Cajon quad and on a topographic map for your home base. Be sure you know the symbols for all types of roads, for railroad tracks, a trail, houses, school, church, ranger station, powerlines, mines, marsh or swamp, and all bodies of water.

Complete the following exercises Using the Cajon quad.
School solutions are available at the end of the Unit.

Q1. Due east of Lost Lake, you will see this symbol: _______________. What does it represent? _______________.

Q2. In Section 8, T3N, R5W, there is a cistern. Write the legal description to the nearest quarter of the Quarter-section.

________ ¼ of the ______ ¼ of Section _____ T _____ R ____
________________ Base and Meridian.

Q3. Assuming Section 8 is 640 acres, how many acres are in the parcel of land you just described? ______________ acres.
Topographic Map Index Circular
The Topographic Map Index Circular contains a map of the state divided into quadrangles (remember that topographic maps are often referred to as quadrangles or quads). If you are working on a large incident, you can use the Index Circular to help you identify and order topographic maps outside the area of the incident, but into which the incident could move.

Using Contour Lines to Identify Terrain Features
Relief is the variation in elevation or height of geographic features such as ridges and valleys. Geographic features can be measured both vertically and horizontally. Vertical measures can be easily obtained from topographic maps, but horizontal distance can only be estimated. On the map, one acre of flat land is equal to one acre of hilly land (Figure 19). In reality, the hilly land contains more surface area.

![Diagram showing 470' total ground distance and 384' flat map distance]

Figure 19: Surface Length Difference on Flat and Rough Land.
A topographic map is very useful to field observers in locating fires and in locating control lines on fires. The topographic map, commonly used for all types of orienteering, shows features such as elevation, grades, and shape or contour of land with its ridges, peaks, and drainages. These features are shown by means of contour lines. Each contour line represents a constant elevation on the ground surface. These lines may appear as more or less parallel or concentric (Figure 20). All points on the same contour are at the same elevation. Other features include survey lines (Section and Township), roads, trails, streams, lakes, and cities.

![Diagram of topographic map with labels A to F]

**Figure 20:** Sample of topographic (contour) map.

The steepness of the topography (relief) is shown by the contour interval, or difference in elevation between the contour lines. The elevation of certain contour lines is marked on all contour maps. Heavier or darker colored contour lines are called index contours; the thinner or lighter colored contour lines are called intermediate contours.
To use a topographic map you must be familiar with the following terms and features:

1. A contour line is an imaginary line representing a constant elevation on the ground surface.
2. Contour interval is the vertical distance or difference in elevation between contours.
3. Widely separated contour lines indicate gentle slopes.
4. Close contour lines indicate steep slopes.
5. Merging contour lines indicate very steep slopes, banks, or cliffs.
6. Contour lines point downhill on ridge tops. Sharp contour points indicate pointed ridges and rounded contour points ("U" shaped) indicate wider or broader ridges.
7. Contour lines point uphill or upstream where they cross drainages, and a sharp narrow "Y" indicates a narrow canyon or ravine. A rounded contour line indicates a flatter or wider drainage.
8. Approximate elevations can be figured for any point on a contour map.
9. Contour lines never cross or fork, although they may appear to when the contour lines are very close or are on top of each other where there are cliffs, banks, or very steep slopes. Contour lines always connect, that is they never end in space, but may appear to end at the edge of a map.
10. Contour lines can be drawn at any elevation, but in practice they are drawn at intervals of 1, 5, 10, 20, 40, and 80 feet. Occasionally you may find a 25 foot contour interval.
11. To make the contour intervals easier to read, every fifth one is printed darker (index contour) and has the elevation marked periodically on the line.

To find the elevation of a point, locate the index contour nearest the point, then count the number of contour lines up or down from the point. Add or subtract the elevational difference represented by the number of contour intervals from the index contour. For example, if your contour interval is 20 feet and your index contour is 3 contour lines below your point (in this case index contour line is at 6,000 feet elevation), your point is at 6,060 feet (6,000 + (3 × 20)).
To calculate the difference in elevation between two points, first find the elevation of each point, then subtract the lower elevation from the higher; i.e. 5,600 ft - 4,800 ft = 800 ft.

To determine which direction is uphill or downhill from your point, look at the nearest index contour in the direction of interest; if the index contour interval is higher than your starting point you will be going uphill, if it is lower you will be going downhill.

**Visualizing Landscapes**

On the next page you will find a contour lines interpretation sheet (Figure 22). On the lower-right quarter of this sheet is a vertical representation of a land feature using contour lines. Study this diagram and then draw a profile (sideview) of the land from point "a" to point "b" on the diagram below (Figure 21). Draw the profile in the space provided with elevation lines marked in 100 ft increments. Hint: the elevation rises from the 100 ft contour line. After completing this exercise examine the school solution at the end of this unit.

---

**Figure 21:** Relation Between Contour Map and Profile (An Exercise).
Figure 22: Interpreting Contour Lines

The brown lines on the map are called CONTOUR lines. Each line shows the height above sea level. Contour lines never cross one another. Printed at the bottom of the map is the CONTOUR INTERVAL, which is the difference in height (elevation) between one brown line and the next. On a map with a scale of 1:50,000 contour interval is usually 20 feet. This would make point 'A' 80 feet higher or lower than point 'B'.

When the contour lines are close together at the top of a hill, the hilltop is pointed. The hilltop is flat when the contour lines are widely spaced at the top.

How can you tell from the brown lines whether it's uphill or downhill? Well, every fifth line is heavier than the rest and has a number that gives its elevation. If the contour interval is 20 feet, point 'A'

is 80 feet higher than point 'B'. Also, if you know the ground distance between 'A' and 'B', you could get an idea of how steep the slope was.

Contour lines widely spaced show a gentle slope. When they are close together the slope is steep.

Remember: A contour line is a brown line on your map that connects points of the same elevation. You can find the contour interval in the margin at the bottom of your map. The heavy brown lines (every fifth one) have the elevation printed on them. You can tell from looking at your map what the slopes, hills, and valleys will look like on the ground.
Topographic Map Directions; or How to Find True and Magnetic North

A quick glance at a map will show you the relative direction in which any point lies from any other point. But when you want to find the actual direction between two points as related to north you must know where north is oriented on your map.

In general, north is at the top on a topographic map that is oriented face up with the words right-side-up; south is at the bottom, west is to the left margin, and the right margin is east. To be sure of your topographic map's orientation look at the bottom margin.

Below, you will find a diagram (Figure 23) of an angle with the vertical leg indicated as true north and the other leg indicated as magnetic north. The angle (in degrees) between these two legs is called the magnetic declination (16° in this example). The magnetic declination must be noted and used to adjust your compass for field work (Unit 3).

Figure 23: The declination diagram in the bottom margin of the map indicates the angle between the true north and the magnetic north direction of the map area.

Information Located in the Map Margin
Locate the following information in the margin of a topographic map:

♦ geographical area represented (Unit 1, Lesson 2)
♦ map scale (Unit 1, Lesson 2)
♦ revision date (Unit 1, Lesson 2)
♦ adjoining maps to the north, northeast, east, southeast, south, southwest, west and northwest (Unit 1, Lesson 2)
♦ legal descriptions (Unit 1, Lesson 3)
♦ longitude and latitude (Unit 1, Lesson 3)
♦ contour interval (Unit 1, Lesson 4 and Unit 3)
♦ magnetic declination (Unit 1, Lesson 4 and Unit 3)
**LESSON 5 - ICS Display Symbols**

Objective: 1. Determine the color and pattern of symbols used to display field information using the Incident Command System.

Most commonly used maps and map symbols are approved and adopted by the U.S. Board of Surveys and Maps. However, some maps and mapping information systems, such as the Incident Command System (ICS) use a specific set of symbols, not commonly used by the public, to display information. For this course you must be able to interpret and draft maps with the ICS map display symbology presented below.

**ICS MAP DISPLAY SYMBOLOGY**

<table>
<thead>
<tr>
<th>SUGGESTED FOR PLACEMENT ON BASE MAP</th>
<th>SUGGESTED FOR PLACEMENT ON OVERLAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MINIMUM RECOMMENDED</strong></td>
<td></td>
</tr>
<tr>
<td><strong>BLACK</strong></td>
<td></td>
</tr>
<tr>
<td>RIDGE</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>BLACK</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>Completed Dozer Line</td>
<td>10 AUG 1730 Uncontrolled Fire Edge</td>
</tr>
<tr>
<td>Completed Line</td>
<td>10 AUG 1730 Spot Fire</td>
</tr>
<tr>
<td>Line Break Completed</td>
<td>10 AUG 1700 Hot Spot</td>
</tr>
<tr>
<td>RED</td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>Fire Origin</td>
<td>10 AUG 2000 Fire Spread Prediction</td>
</tr>
<tr>
<td>Hazard (Identify Type, e.g., Power Lines)</td>
<td></td>
</tr>
<tr>
<td><strong>BLUE</strong></td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>Incident Command Post</td>
<td><strong>PLANNED FIRE LINE</strong></td>
</tr>
<tr>
<td>Incident Base</td>
<td><strong>PLANNED SECONDARY LINE</strong></td>
</tr>
<tr>
<td>Camp (Identify by Name)</td>
<td></td>
</tr>
<tr>
<td><strong>BLUE</strong></td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>Helispot (Location and Number)</td>
<td><strong>BRANCHES</strong></td>
</tr>
<tr>
<td>Helibase</td>
<td><strong>DIVISIONS</strong></td>
</tr>
<tr>
<td><strong>BLUE</strong></td>
<td></td>
</tr>
<tr>
<td>[ ]</td>
<td></td>
</tr>
<tr>
<td>Repeater/Mobile Relay</td>
<td><strong>WIND SPEED AND DIRECTION</strong></td>
</tr>
<tr>
<td><strong>OPTIONAL</strong></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td><strong>PROPOSED DOZER LINE</strong></td>
</tr>
<tr>
<td>Telephone</td>
<td><strong>FIRE BREAK (PLANNED OR INCOMPLETE)</strong></td>
</tr>
<tr>
<td>Fire Station</td>
<td><strong>STAGING AREA (IDENTIFY BY NAME)</strong></td>
</tr>
<tr>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Water Source (Identify Type, i.e., Pond, Cistern, Hydrant)</td>
<td><strong>WIND SPEED AND DIRECTION</strong></td>
</tr>
<tr>
<td>Mobile Weather Unit</td>
<td><strong>FIRE BREAK (PLANNED OR INCOMPLETE)</strong></td>
</tr>
<tr>
<td>X</td>
<td><strong>STAGING AREA (IDENTIFY BY NAME)</strong></td>
</tr>
<tr>
<td>In Ground Link</td>
<td><strong>FIRE BREAK (PLANNED OR INCOMPLETE)</strong></td>
</tr>
<tr>
<td>First Aid Station</td>
<td><strong>STAGING AREA (IDENTIFY BY NAME)</strong></td>
</tr>
</tbody>
</table>

* To be used on Incident Briefing and Action Plan Maps (No Color)
Identify the ICS Display Symbols below:

Q1: □

Q2: ⬇

Q3: 🔄
This symbol is displayed with the _____ & ______.

Q4: ✗
This symbol is displayed with the _____ & ______.

Q5: ⬆
This symbol is displayed with the _____ & ______.

Q6: (A)

Q7: [IV]

Q8: ☮

Q9: ☮
Solutions to Exercises in Unit 1

System of Land Description in the United States:
Q1: East-West; Q2: A north-south line which passes through an initial point; Q3: Township; Q4: range; Q5: 36 mi²; Q6: Township; Q7: Sections; Q8: 640 acres and diagram below.

<table>
<thead>
<tr>
<th></th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
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</tr>
<tr>
<td>18</td>
<td>17</td>
<td>16</td>
<td>15</td>
<td>14</td>
<td>13</td>
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<td>19</td>
<td>20</td>
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<td>22</td>
<td>23</td>
<td>24</td>
<td></td>
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<td>30</td>
<td>29</td>
<td>28</td>
<td>27</td>
<td>26</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>32</td>
<td>33</td>
<td>34</td>
<td>35</td>
<td>36</td>
<td></td>
</tr>
</tbody>
</table>

T5N

R7W

Q9: T2N, R5W; Q10: 7; Q11: Section 12, T2N, R6W; Q12: A = N¹⁄₂, Sec 3, T5N, R7W, MDB&M; Q13: B = E¹⁄₂, Sec 3, T5N, R7W, MDB&M; Q14: C = SW¹⁄₂, Sec 33, T5N, R7W, MDB&M; D = SE¹⁄₂, Sec 33, T5N, R7W, MDB&M; Q15: 160 acres; Q16: 40 acres; Q17: 10 acres
Visualizing Landscapes:

Topographic Map Symbols:
Q1: power transmission line; Q2: SW\textsubscript{4}, SE\textsubscript{4}, Sec. 8, T3N, R5W, San Bernardino BM; Q3: 40 acres.

ICS Display Symbols:
Q1: ICP; Q2: base; Q3: spot fire, time, date; Q4: origin, time, date; Q5: uncontrolled perimeter, time, date; Q6: division boundary; Q7: branch boundary; Q8: staging area; Q9: water source
UNIT 2
MAP CALCULATIONS

LESSON 1 - Determining Distance, Elevation, and Slope

Objectives:
1. Measure distance using a comparison scale.
2. Calculate distance using representative fractions.
3. Convert distances into other units of measure.
4. Determine elevation using bench mark or spot elevations.
5. Determine elevation from contour lines.
6. Determine percent slope.

One of the most common uses of maps is to determine the distance between points. A topographic map can also be used to determine the elevation of any specified point. This lesson covers how to measure and calculate distance and elevation. Answers to exercise questions presented in this unit are located at the end of the unit.

Common Unit Conversions

<table>
<thead>
<tr>
<th>English Units</th>
<th>Metric Units</th>
<th>English to Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>LENGTH</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 in = 1 ft</td>
<td>10 cm = 1 m</td>
<td>1 in = 2.54 cm</td>
</tr>
<tr>
<td>5,280 ft = 1 mi</td>
<td>1,000 m = 1 km</td>
<td>1 ft = 30.48 cm</td>
</tr>
<tr>
<td>1 ch = 66 ft</td>
<td></td>
<td>1 ft = 0.305 m</td>
</tr>
<tr>
<td>80 ch = 1 mi</td>
<td></td>
<td>1 yd = 0.91 m</td>
</tr>
<tr>
<td>AREA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ac = 10 ch²</td>
<td>1 ha = 10,000 m²</td>
<td>1 ac = .402 ha</td>
</tr>
<tr>
<td>1 ac = 43,560 ft²</td>
<td></td>
<td>2.49 ac = 1 ha</td>
</tr>
<tr>
<td>1 ac = 208 ft x 208 ft</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 ac = 3.16 ch x 3.16 ch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mi² = 640 ac</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 mi² = 1 section</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations Legend
in = inch
ft = feet
yd = yard
ch = chain
mi = mile
ac = acre
cm = centimeter
m = meter
km = kilometer
ha = hectare

37
Measuring Distance Using a Comparison Scale

The comparison scale is a direct representation of distance between a map and the ground. A graphic or comparison scale compares inches to miles (or like scale figures). Usually comparison scales are printed on the map and show you that so many inches equals so many feet, yards, chains, or miles on the ground (Figure 24); or so many millimeters equals so many meters or kilometers on the ground.

![Comparison Scale Diagram](image)

Figure 24: Example Comparison Scale.

Exercises

To complete the following exercises refer to the "Common Unit Conversion" table on the last page and the Cajon topographic map. School solutions are available at the end of this Unit.

Q1: Using the Cajon quad determine the distance in feet between spot elevation 4927 in the SW ¼ of Section 9, T2N, R5W and spot elevation 5461 in NW ¼ of Section 15, T2N, R5W:_________.

Q2: How far is it in miles? _______________________.

A road passes through spot elevation 4927 and goes to spot elevation 5461. What is the length of the road in feet and miles between these points?

Q3: How many feet?_________.  Q4: How many miles?_________.

Hint: Use a piece of paper and put one corner at 4927. Lay the edge of the paper along the road. Where the road leaves the edge of the paper, place your pencil point on the paper then pivot the paper until the road is lined up again. Keep repeating this process until you reach elevation 5461. Compare the distance from your final mark to the starting corner of the paper with the comparison scale.
Measuring Distance Using a Representative Fraction
A representative fraction (RF) is different from a comparison scale in that the distance is related in LIKE UNITS. For example, the RF on a 7-\(\frac{1}{2}\) minute topographic map is 1:24,000; 1 map inch equals 24,000 inches on the ground.

The distance on a map can be measured in inches with a ruler and then converted by multiplying the measured value by the RF. This will give you the on-the-ground distance in inches, which if divided by 12 (12 inches equals 1 foot) will give you the horizontal distance in feet.

Exercises
To complete the following exercises refer to the "Common Unit Conversion" table on the page 37 and the Cajon topographic map. School solutions are available at the end of this Unit.

You have measured the distance between two points on the Cajon quad as 4 inches. Using the quad RF, calculate:

Q1: How many on-ground inches are between the two points?______.

Q2: How many feet are between the two points?__________________.

The Cajon quad depicts an area 18-\(\frac{1}{2}\) inches wide.

Q3: How many miles does this represent?______________________.

Determine Elevation from a Topographic Map
Elevation can be determined by using spot elevations and bench marks. Spot elevations can be shown as an "X" with the elevation designated. Bench marks are exact elevations that have been permanently marked on the ground and recorded on the map. Bench marks can be shown on maps as a triangle with a dot in the center, or as an "X" followed by the elevation. The letters "BM" or "VABM" (vertical angle bench mark) usually precede the symbol and elevation.

Elevation can also be determined by reading contour lines. First, the distance between contour intervals must be determined by reading the map legend, or by calculating the difference between index contours (the darker contour lines) and dividing by the number of intervening (intermediate) contour lines. For example, an index contour reads 5,800 and the next index contour reads 6,200. The difference between these index contours is 400 ft (6,200 - 5,800). On most maps, contour intervals come in sets of five with an index contour as number one and four intermediate
contour lines before the next index contour. To calculate the elevational difference between contour intervals in this example (no legend available), divide 400 by 5 to get 80 foot contour intervals; this means there is 80 feet of elevational gain or loss between each contour interval.

To determine the elevation of an intermediate contour line or point, simply count the number of intermediate contour lines to an index contour where the elevation is known. Multiply the number of lines by the contour interval previously determined and add or subtract this value from the known elevation, depending upon whether the intermediate contour line or point is above or below the known index contour.

If you wish to determine the elevation between contour lines, interpolate the difference. For example, the contour interval is 40 ft and your point is one-half way between intervals, the half way point would be 20 feet.

**Exercises**
To complete the following exercises use the Cajon topographic map. School solutions are available at the end of this Unit.

Q1: The contour interval of this map is ____________________.

Q2: The distance between index contours is how many feet? ____.

Q3: What is the elevation of Lost Lake?__________________________.

Q4: In the NW ¼ of Section 17, T2N, R5W, what is the elevation of the X labeled "Prospect"?__________________________.

Q5: Is the Prospect on a ridge or in a draw?______________________.

Q6: If you are standing at the corner of Sections 8, 9, 16, and 17 of T3N, R5W and walked due south 80 chains, what would the elevation be? ____________________.
Calculating Slope from a Map

Slope is an important input variable for predicting fire behavior. Fire spreads faster upslope than downslope or on level ground, even if wind conditions are constant. In the presence of slope, the flame tilts toward the upslope fuel bed, preheating these fuels which then ignite more rapidly.

Slope can be determined in several ways in the field (discussed in detail in Unit 3). Slope can also be calculated from a topographic map. A number of slope calculation aids are available in the form of tables (that show the relationship between map scale and contour interval (Figure 25)); contour overlays (Figure 26 - 2 pages) and slope indicator overlays or templates (Figure 27). (Copy Figures 26 and 27 onto clear transparencies to create overlays.) Use of slope calculation aids is limited by map scale and contour intervals; you must, also, carry them with you. These aids are designed for USGS 7-1/2 minute and 15 minute quadrangles.

The most common method of calculating slope (and the method used in this course) is to find the change in elevation and divide it by the change in horizontal distance, then multiply this value by 100 to get percent. The key to remember is the "rise over the run" multiplied by 100.

Formula: \[ \text{Slope percent} = \frac{\text{rise in elevation}}{\text{horizontal distance}} \times 100 \]

Example: Using Map #3, page 46, determine the slope between points A and B.

Step 1: Determine the rise (there are two methods of determining elevational change):

Method 1: Rise = contour interval \( \times \) # of contours.

In this case count the number of contour lines starting at point A and ending at point B. Point A is zero; point B is 5. There are 5 contour lines. Each contour line represents 20 feet in elevation.

Rise = 20 ft contour intervals \( \times \) 5 contours = 100 ft

Method 2: Rise = difference in elevation between two points.

Point B lies at 5100 ft and Point A lies at 5000 ft.

Rise = 5100 - 5000 = 100 ft
**Step 2:** Determine the run (horizontal distance):

Using a ruler measure the distance in inches between points A and B, which in Map #3 (page 46) is 6/10 inches. Since we need to determine a unitless value for slope, we must convert inches to feet so that the units in the formula will cancel. To convert 6/10 inches into feet look at the map scale. In this case 1 inch equals 2000 ft.

Run = \( \frac{6}{10} \) inches \( \times \) 2000 feet/inch = 1200 feet

**Step 3:** Calculate percent slope:

percent slope = \( \frac{\text{rise}}{\text{run}} \times 100 \) = \( \frac{100 \text{ ft}}{1200 \text{ ft}} \times 100 = 8\% \)

---

### SLOPE CONVERSION

<table>
<thead>
<tr>
<th>MAP SCALE</th>
<th>CONTOUR INTERVAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>INCH/MILE</td>
<td>20FT</td>
</tr>
<tr>
<td>1</td>
<td>--</td>
</tr>
<tr>
<td>2</td>
<td>0.8%</td>
</tr>
<tr>
<td>2.64</td>
<td>1.0%</td>
</tr>
<tr>
<td>4</td>
<td>1.5%</td>
</tr>
<tr>
<td>8</td>
<td>3.0%</td>
</tr>
</tbody>
</table>

1 Slope value for one contour per inch on map. To estimate slope percent, count contours over one inch of map, then multiply this value by the slope conversion from the table. For example: there are 15 contours on one inch on a map with a scale 2.64 miles per inch and a contour interval of 20 feet.

SLOPE = 15 \( \times \) 1.0\% = 15\%

---

Figure 25: Slope Conversion Table.
### Distance Scales

**MILES:**
- 1
- 1/2
- 0
- 1

**YARDS:**
- 1000
- 0
- 1000
- 2000

**FEET:**
- 1000
- 0
- 3000
- 6000
- 9000

### Slope

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.

<table>
<thead>
<tr>
<th>Contour Interval</th>
<th>Number of Contour Lines Counted</th>
<th>Percent Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>12 12 20 28 30 32 36 40</td>
<td>25 40 55</td>
</tr>
<tr>
<td>40</td>
<td>6   10 14 15 16 18 19</td>
<td>40 55 60</td>
</tr>
<tr>
<td>50</td>
<td>5   8  11 12 13 14 15</td>
<td>60 65 70</td>
</tr>
<tr>
<td>80</td>
<td>3   5  7  8  8  9  10</td>
<td>70 75</td>
</tr>
</tbody>
</table>

(1000 ft. I.D.)
DISTANCE SCALES

MILES:

1000 0 2000 4000 6000

YARDS:

3000 0 6000 12000 18000

FEET:

SLOPE

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.

(1000 FT. I.D.)

<table>
<thead>
<tr>
<th>CONTOUR INTERVAL</th>
<th>NUMBER OF CONTOUR LINES COUNTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>6 10 14 15 16 18 19</td>
</tr>
<tr>
<td>50</td>
<td>5 8 11 12 13 14 15</td>
</tr>
<tr>
<td>80</td>
<td>3 5 7 8 8 9 10</td>
</tr>
<tr>
<td>100</td>
<td>2 4 5 6 6 7 8</td>
</tr>
<tr>
<td>PERCENT SLOPE</td>
<td>25 40 55 60 65 70 75</td>
</tr>
</tbody>
</table>
SLOPE INDICATOR OVERLAY

SLOPE INDICATOR
Scale 1:62,500
Contour Interval: 80'
Instructions:
To measure percent of slope, place indicator sheet over an equivalent topographic map so that contours on the Slope Indicator match contours on the topographic map.
Slope Calculations Exercises - Part 1

All questions refer to the map on the next page (Map #4). School Solutions are available at the end of Unit 2.

Q1: The contour interval is _______ feet.

Q2: The Map Scale is: 1" = _______ feet.

_______ inches = 1 mile

(Hint: G-H is one side of a normal section)

Q3: Compute the percent slope from:

<table>
<thead>
<tr>
<th>Points</th>
<th>Elevation Change</th>
<th>Distance</th>
<th>% Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>A to B</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C to D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E to F</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Slope Calculations Exercises - Part 2

All questions refer to the map on page 46 (Map #3--Drews Reservoir). School Solutions are available at the end of Unit 2.

Points A, B, C, and D are on contour lines.

Q1: What are the contour intervals on the Drews Reservoir 7.5 minute topographic map?

________________________

Q2: The map scale is ________ inches equal one mile.

Q3: Give the elevations of the following points:

Point A ________ feet.

Point B ________ feet.

Point C ________ feet.

Point D ________ feet.

Q4: Give the distance between the following points and the percent slope.

A to B = ________ feet  ________ % slope

B to C = ________ feet  ________ % slope
Slope Calculations Exercises - Part 3

Use the Cajon quad to complete the following exercises. School Solutions are available at the end of Unit 2.

Remember when you calculated the distance between elevations 4927 and 5461?

Q1: Now determine the percent slope between these points _____.

You get into your vehicle and drive north on I-15 from San Bernardino until you reach the section line between Sections 18 and 7 of T2N, R5W. You park your vehicle and follow the section line east on foot.

Q2: What is the steepest percent slope you will encounter within 2,000 meters of I-15? ________________.
LESSON 2 - Determining Area

Objectives: 1. Be able to mathematically calculate area from a map.
2. Determine area using dot and acreage grid overlays.
3. Estimate area using Sections and Townships.

When evaluating the progress of a fire it is important to calculate the fire's size or area. When you arrive at an incident, one of your first duties will probably be to estimate acreage. Practice and a knowledge of acreage estimation techniques will make this important task much easier. In this lesson, we will look at means of calculating or estimating area from a topographic map.

In this course, area will usually be expressed as acres, but area may also be expressed in square miles, square feet, or any other unit of linear measurement, squared.

Mathematically Determining Area
Area is two dimensional, that is it has boundaries within a plane. Area is frequently determined by a length and a width which are both linear measures that when multiplied give you a value squared. One acre represents a space that can be defined as being 208 feet long and 208 feet wide, or 43,560 ft²; one acre can also be defined as 10 ch² (remember "ch" means chain).

To mathematically determine an area, outline the perimeter and then calculate its size by measuring the length and a perpendicular width, and then multiply these two measurements. Most area calculations will require conversion of units, such as from map inches to on-the-ground feet and square feet to acres. On page 37 is a list of common unit conversions that will help you calculate area from a map.

Example

How many acres are there in a rectangular area that is 5 chains × 10 chains?

10 ch (length) × 5 ch (width) = 50 ch²

50 ch² ÷ 1 acre/10 ch² = 5 acres

(Remember: 1 acre = 10 ch²).
How to Determine the Area of an Irregular Shape
To compute an irregularly-shaped area, it is often necessary to take two or more measurements across the area to obtain an average length and an average width.

Example 1

How many acres are there in this area?

The area outlined above is 32 chains wide at one end and 16 chains wide at the other. The length is 48 chains. In this example the width is not constant, and therefore, an average width must be calculated to determine the area.

\[(32 \text{ ch} + 16 \text{ ch}) \div 2 = 48 \div 2 = 24 \text{ ch} \text{ (average width)}\]

The area is: \[24 \text{ ch (width)} \times 48 \text{ ch (length)} = 1152 \text{ ch}^2\]

\[1152 \text{ ch}^2 \div 10 \text{ ch}^2/\text{acre} = 115.2 \text{ acres}\]

Example 2

How many acres would there be in the above area if the length was actually 5,500 ft and the left width was 2,500 feet and right side width was 1,100 feet?

\[(2,500 \text{ ft} + 1,100 \text{ ft}) \div 2 = 1,800 \text{ ft} \text{ (average width)}\]

The area is: \[1,800 \text{ ft} \times 5,500 \text{ ft} = 9,900,000 \text{ ft}^2\]

\[9,900,000 \text{ ft}^2 \div 43,560 \text{ ft}^2/\text{acre} = 227.3 \text{ acres}\]
Determining Area Using Dot or Acreage Grids

Transparent overlays can be used to rapidly estimate acreage. First check your map scale; the grid overlay must be of the same scale or have a conversion chart or formula written on it. If the overlay and map are compatible, the overlay is laid over the area to be calculated and the user counts the number of dots or grids within the area. In addition to counting all dots that fall within the perimeter, count every other dot or grid (square) that falls on the perimeter. Multiply the number of dots by the conversion factor or formula written on the overlay.

Using Dot Grids on Different Scale Maps

A dot grid can be used on maps of a different scale, but a conversion factor must be determined by the user. To develop a conversion factor (acres per dot), count the number of dots in one section of your map. (Most topographic maps have Sections, Townships, and Ranges delineated.) Divide this number by 640 (there are 640 acres per Section).

For example, you count 400 dots in a section; 640 acres ÷ 400 dots = 1.6 acres/dot. This value is your conversion factor. A problem with this system is that many sections are irregularly shaped or are not 1 mi². Always look for the most perfectly square and regular-sized section for this process.

After determining your conversion factor, count the number of dots within the area of unknown size. Multiply the number of dots by the conversion factor to determine acres.

Example

You have counted 347 dots. The conversion factor previously determined is 1.6 acres/dot.

\[ 347 \text{ dots} \times 1.6 \text{ acres/dot} = 555 \text{ acres} \]

Estimating Area by Comparison

Quick estimations of area can be made by comparisons with an area known to the estimator. For example, a football field is one acre.

This estimation process can be extended to map areas. For example, use your knowledge of section (640 acres) and quarter-section (160 acres) size to estimate an unknown area. If the fire is entirely within a section it must be less then 640 acres. By comparison, and the process of elimination, relatively accurate and fast estimations of area can be made. Unit 1, Lesson 3 contains two maps (Maps #1 & #2) where fire size was estimated by comparison with section area.
Complete the Following Area Determination Exercises
School solutions are available at the end of Unit 2.

Use the Cajon quad for the following exercises.

Q1: This quad is 7.1 miles wide. How many square miles are depicted on this map?

Q2: How many total acres?

Examine the E$\frac{1}{4}$ of Section 17, T3N, R5W. A black dashed-line road runs diagonally from the north section line to the south section line. Use chains to calculate the area east of this road bounded by the section lines.

Q3: What is the average width in chains of this area?

Q4: The area is ________ acres?

Examine the NW$\frac{1}{4}$ of the SW$\frac{1}{4}$ of Section 8, T2N, R5W. Locate spot elevation 4905. Now locate contour interval 4800.

Q5: The area inside this contour interval is ________.

Locate Cajon Junction on I-15. Follow Highway 138 northeast 2-1/2 miles to BM 3515. Turn right on the private road and follow it southwest back to I-15. From here, drive back to Cajon Junction. Use a dot or acreage grid (obtain from someone in your home base) to determine the acreage inside the route you just traveled.

Q6: There are ________ acres.

About halfway up the Cajon quad on the right-hand margin is a black dash-dot-dash line that designates the National Forest boundary. Estimate the acreage of the area north of this boundary. Use sections, half-sections, and quarter-sections for your estimate.

Q7: The area is roughly ________ acres.
Solutions to Unit 2 Exercises

Comparison Scale:
Q1: 6,200 feet; Q2: 1.2 miles; Q3: 8,200 feet; Q4: 1.5 miles

Representative Fraction:
Q1: 96,000 inches; Q2: 8,000 feet; Q3: 7.1 miles

Determining Elevation:
Q1: 40'; Q2: 200'; Q3: 2,780'; Q4: 3,500-3,520'; Q5: ridge; Q6: 4,120 (you cross contour 4120 twice).

Calculating Percent Slope - Part 1:
Q1: 40'; Q2: 2,000'; Q3: A-B 600', 1,250', 48%; C-D - 640', 1,875', 34%; E-F 260', 1,000', 26%

Calculating Percent Slope - Part 2:
Q1: 20'; Q2: 2.64; Q3: 5,000', 5,100', 5,400', 6,000';
Q4: A-B 1,100 ft, 9% slope; B-C 1,200 ft, 25% slope

Calculating Percent Slope - Part 3:
Q1: 3.4%; Q2: 67%

Area Determination Exercises
Q1: 60.5 mi² (between 60.3 and 61.0 mi²);
Q2: 38,720 ± ac; Q3: 14.4 ch; Q4: 100-120 ac;
Q5: 10-11 ac; Q6: 650-720 ac;
Q7: 9,600 (between 9,040 and 9,800 ac)
UNIT 3
OBSERVATION AND NAVIGATION AIDS

LESSON 1 - Equipment for Measuring Elevation, Slope, and Distance in the Field

Objectives: 1. Understand how to adjust an aneroid barometer (altimeter)--OPTIONAL.
2. Determine elevation with an aneroid barometer--OPTIONAL.
3. Determine slope using a clinometer.

How to Adjust and Use an Altimeter
The aneroid barometer (altimeter) is a convenient instrument for determining elevational change where a relatively low order of accuracy will suffice. It can be a valuable tool for mapping when distances are paced and 50 foot or greater contours intervals are used on the map. It can be especially useful for mapping and navigating at night. Because barometer readings respond to changing weather (atmospheric pressures) they are best used during periods of constant weather when you can tie into points of known elevation every 2 hours or less.

Locate an altimeter. Tap the glass lightly. The needle should move slightly each time as it returns to its original position. Read the instrument at points having known elevations; choose at least two points that are at least 50-100 ft higher or lower in elevation. Several repetitions of this process should establish how accurate the instrument is.

Read the instructions that accompany your altimeter. The following adjustments and recording technique should be applicable to most altimeters.

On the movable foot-scale set the known or assumed elevation of your location. As you travel over hilly terrain, read and record time of reading and successive elevations.

Observe the following precautions: 1) Gently handle the altimeter when the movable foot-scale is set. Record a reading opposite a graduation on the immovable scale (inches of pressure). This will allow you to detect accidental movement of the foot-scale. 2) Tap the glass gently before reading. Wait a few minutes to allow the needle to adjust to the new elevation. 3) Always hold the altimeter in the same position to read. 4) Take every opportunity to check the altimeter's accuracy at points of known elevation.
Determining Slope with a Suunto Clinometer

Obtain a clinometer graduated in degrees and percent. Ask for assistance on how to use it if you get confused by the following instructions.

Read the dial on the left side of the clinometer to determine how it is graduated, or look into the hole and tilt your head back so that the clinometer is 90° from its prior position. The inside scale units should be readable from this position. A degree scale is usually indicated by a "°" symbol and a percent scale is usually indicated by a "%" symbol.

Stand so that you are facing directly uphill or downhill. Keep both eyes open. Use one eye to read the scale inside the hole and the other eye to sight on an object that is about the same height above the ground as your eye level height. For example, if you are 5'5" tall, sight on something (ideally the eyes of another 5'5" tall person) that is 5' tall.

Read the appropriate scale and record your data in the proper units. A common mistake is to read the degree scale and record it as percent slope, or vice versa.

The Silva Ranger CL-15 compass has a built-in clinometer. This scale is only graduated in degrees. 45° = 100% slope; or 1° = (approximately) 2% slope. Read the instructions that accompany this compass on how to use the built-in clinometer.

Measuring Distance Using an Odometer

One of the most useful tools for mapping a large incident near roads is the odometer on a vehicle. The odometer measures miles traveled by the vehicle in one-tenth mile increments. The odometer may be used to estimate width and length for area estimations or it may be used to estimate the distance of a known location (such as base camp) to another location (fire).
LESSON 2 - Pacing

Objectives: 1. Be able to establish a pace distance on flat ground, and up and down steep slopes.

2. Calculate the distance between two points by pacing. The calculation must be within 5% of the measured distance.

One of the easiest methods of estimating distance is pacing. All that is required is that you know your pace over varying terrain.

A pace is actually two steps at normal stride. Since everyone's "normal stride" is different, everyone's pace is unique to them. A pace is the distance on level ground between the heel of one foot and the heel of the same foot where it next touches the ground while walking normally; that is, two normal steps.

Pacing to Measure Distance
Pacing is the measuring of horizontal distance on the earth's surface by counting steps of a known length. With practice a person can attain accuracy sufficient for most field measurements needed. To determine your pace requires practice.

Determining Your Pace
Because the length of pace varies with the individual, it is necessary for you to learn the length of your normal pace. In order to pace a given distance to an incident, you need to know how many paces you take to move a unit of distance such as 1 chain (66 ft) or 100 feet.

To determine the length of your pace, and how many paces you normally take to walk 1 chain or 100 feet, lay out a pre-measured 100 ft course on flat ground. (You may lay out a longer course (the longer the better) or walk back and forth on the same course).

Walk normally from one end of a 66 ft, 100 ft, or longer course, counting the paces as you go. Record the number of paces per distance traveled. Repeat this process until you can develop an average pace count for the unit distance. Divide this average by 1 chain or 100 ft depending on the distance paced to determine your pace length.

Example
Assume the measured course is three chains, or 198 feet (66 × 3). You walk this distance in 36 normal paces. Therefore, the pace is 36/3 or 12 paces per chain. Each pace is 198/36, or 5\(\frac{1}{2}\) feet long.
Determining Your Pace on Sloping Ground

Steepness of slope affects pacing in two distinct ways. First, the natural length of step in walking or climbing up or down varies with the steepness of slope, so the number of paces per unit distance must change.

The second effect of slope is that land surveys are based on horizontal distances, not slope distances. In order to measure a given horizontal distance (for example: one chain) a person must travel more than one chain when walking on a slope. This is equally true whether going uphill or downhill. The difference between the horizontal distance and the slope distance (Figure 28) becomes increasingly pronounced as the steepness of the slope increases.

![Difference Due to Slope](image)

Figure 28: Difference Due to Slope.

When measuring distance to a fire or other location, a person may find several changes in slope. The distance traveled on the surface in measuring one mile is much greater than the horizontal distance. The allowance for slope (Figure 29) or any other factor is usually made as each pace is covered so that a single pace count always indicates the horizontal distance covered. In other words, if a person uses 12 paces to cover one chain on level ground, each pace counted should equal 1/12 chain horizontal distance measured regardless of slope or any other factor.
Figure 29: Allowance Needed Due to Slope.

The allowance for slope is applied continually as the pacing progresses. The allowance that is needed will vary with the steepness of slope. The extra steps taken to cover the additional distance traveled due to slope are not counted.

Determining Your Paces per Chain on Sloping Ground
Follow these instructions to determine how much to correct for horizontal distance when pacing on a slope.

Lay off a pre-measured horizontal distance (in this case we'll use chains) with a steel tape on a medium slope. This can be done by holding the tape level on each measurement and using a plumb bob on the downhill end of each measurement (takes two persons to set up the course). Mark both ends of the course. Using normal steps, pace upward on this course the number of paces needed to cover the three chains on the level. Pace the distance remaining to the end of the course. The latter is the amount which must be added to get level distance on a three chain distance traveling uphill. Divide this figure by three to get the amount for one chain. Divide the latter figure by the paces per chain to get the amount to add to each pace.

Example

You walk upslope 36 paces. There are 18 feet left to the end of course.

\[18 \text{ ft} + 3 \text{ ch} = 6 \text{ feet per chain (addition per chain to get level distance)}\]

\[6 \text{ ft/ch} ÷ 12 \text{ paces/ch} = \frac{1}{2} \text{ foot per pace (addition per pace to get level distance)}\]
Repeat this process on the same course going downhill. Record all figures in a notebook. Use them until such skill in pacing has been acquired as to make frequent reference no longer necessary. On steeper slopes add more slope correction, and on gentler slopes reduce the slope correction allowance.

**Adjusting Your Pace to Accurately Measure Distance on Slopes**

In the prior discussion we gave you instructions on how to compensate your pace when your objective is to match map distance to distance traveled in steep terrain.

What if you are asked to determine the length of a fire's perimeter so that the overhead can calculate how many chains of fireline need to be cut? This fire has burned an area with many steep slopes. In this case, actual distance over rolling terrain must be determined. One chain on flat ground will have the same relative horizontal distance on a map, but will have a very different horizontal distance if measured on a slope. You must adjust your pace calculations to measure actual distance on slopes. For example, your pace may be 20 for 100 feet of horizontal distance on flat ground. This means that you take 40 steps per 100 feet. On a moderate upslope hike you may have to take 42 steps (21 paces) to travel one hundred feet.

On very steep slopes your pace usually shortens as the body tries to brace itself against the combined force of gravity and body weight. For example, on a very steep slope you may take 46 steps (23 paces) to move 100 feet.

**Other Factors Affect Pacing**

Human factors must be considered. A person's vitality may decrease during a day's work, after a poor night's sleep, or with illness, and as a result, paces may shorten. A step is shorter when traveling slowly than when moving at a normal rate. Generally, you will lengthen your step in the early morning, when in a hurry, or on gentle slopes after leaving rough country. All of these factors must be considered in pacing.

On loose, rocky, or swampy soils it is more difficult to pace than on firm soil, and allowance must be made for these conditions.

Here are several good rules of thumb to adjust pace calculations:

♦ your pace lengthens on moderate downgrades and shortens on the upgrade or very steep downgrades.

♦ walking into strong winds causes the pace to shorten; walking with a tail wind causes it to lengthen.

♦ soft surfaces such as sand and gravel tend to shorten the pace.

♦ when its snowing or raining, or you are walking over ice your pace shortens.
Visually Estimating Distance
Occasionally, you will encounter a stream too deep to wade or a slope too steep to cross, and the distance must be estimated. In rough country or dense brush, it is more accurate to estimate a short distance to some object than it is to pace the distance. First, practice estimating the units of paces, and then increase the estimate to units of chains or 100 foot increments. Verify each estimate by pacing the distance during practice. Continue practicing until the desired accuracy is reached.
LESSON 3 - Compass and Protractor

Objectives: 1. List the essential parts of the Silva Ranger compass.
2. Locate true north using a compass.
3. Adjust compasses or readings for magnetic declination.
4. Take a field azimuth on an object within 2°.
5. Use a protractor to locate an object by intersection.
6. Orient a map with a Silva Ranger compass.
7. Calculate back azimuths.
8. Find a location on a map by resection.

The Compass
The compass is an instrument which enables the user to determine direction even in the dark. The most important part of the compass is the magnetic needle that always points to magnetic north and from which true north is determined. The north-pointing end of the needle is usually marked by an arrow or painted red with a luminous dot.

A compass also consists of a graduated circle for laying off angles from true or magnetic north; a sighting line for prolonging a line of sight while following a course of direction; and a base plate (Figure 30). Some compasses also have a mirror to assist in sighting.

![Figure 30: The Parts of a Compass.](image-url)
Magnetic Declination

Compass directions always refer to true north, but the compass needle always points toward magnetic north. The difference (angle in degrees) between true north and the magnetic north is called \textit{magnetic declination}, or simply the declination (Figure 31).

![DECLINATION](image)

\textbf{Figure 31: The Effect of Magnetic North on a Compass.}

On USGS topographic maps, the declination diagram (degrees of magnetic declination for an area) is located on the bottom margin (Figure 32).

![TRUE NORTH](image)

\textbf{Figure 32: USGS Topographic Map Declination Diagram}

Map bearings are true bearings and uncompensated compass bearings are magnetic. This means that all topographic maps are drawn in reference to true north, but the compass does not point to true north unless a magnetic declination adjustment can be made on the compass.
Adjusting for magnetic declination can be very confusing since you must remember a set of rules for when your declination is east of north or west of north, and for when you are looking at terrain from a map azimuth or vice versa.

**East Declination**
To adjust a compass azimuth for an *east* magnetic declination *(west of the Mississippi River)* follow these steps:

**FROM COMPASS BEARING TO MAP BEARING (MAGNETIC TO TRUE)**
Suppose you have a compass reading (bearing) and want to plot that bearing on your map.

1. Find your map declination (as an example we will use Seattle, Washington which has a declination of 22° right (east) of true north). Study Figure 33.

   ![Diagram of East Declination](image)

   Figure 33: East declination must be added to a magnetic bearing to obtain TRUE direction.

2. To change any magnetic bearing to a true bearing, add the east declination. For example, your magnetic bearing (compass azimuth) to an object is 33°. To determine the true bearing so that you can plot a course on your map, ADD the declination. In this case the true bearing will be 55°.

   Rule of thumb: Mag to True (compass to map); Add East.
FROM MAP BEARING TO COMPASS (TRUE TO MAGNETIC)
Now you have a course plotted on your map and you want to follow this course using your compass (declination cannot be pre-set on your compass for this exercise). Reverse step 2 taken above.

1. Find your map declination.

2. To put the map bearing back into the magnetic form the compass works with, SUBTRACT the declination.

3. Twist the compass housing so that magnetic needle is pointing to this new value.

Example: Your declination is 17° E. You set your compass for a certain direction on the map and get a reading of 150°. Subtract 17 from 150 and get 133°. Now reset your compass to this new number (133°) and you are ready to proceed.

West Declination
To adjust a compass azimuth for a west magnetic declination (east of the Mississippi River) follow these steps:

FROM COMPASS BEARING TO MAP BEARING (MAGNETIC TO TRUE)
Suppose you have a compass reading (bearing) and want to plot that bearing on your map.

1. Find your map declination (as an example we will use Cape Cod, Massachusetts which has a declination of 15° left (west) of true north). Study Figure 34.

![Diagram showing West Declination]

Figure 34: West declination must be subtracted from a magnetic bearing to obtain TRUE direction.
2. To change any magnetic bearing to a true bearing, **subtract** the west declination. For example, your magnetic bearing (compass azimuth) to an object is 70°. To determine the true bearing so that you can plot a course on your map, **subtract** the declination. In this case the true bearing will be 55° (70 - 15).

**Rule of thumb: Mag to True (compass to map); Subtract West.**

**FROM MAP BEARING TO COMPASS (TRUE TO MAGNETIC)**
Now you have a course plotted on your map and you want to follow this course using your compass (declination cannot be pre-set on your compass for this exercise). **Reverse step 2 taken above.**

1. **Find your map declination.**

2. **To put the map bearing back into the magnetic form the compass works with, ADD the declination.**

3. **Twist the compass housing so that the magnetic needle is pointing to this new value.**

**Example:** Your declination is 8° W. You set your compass for a certain direction on the map and get a reading of 253°. Add 8 to 253 and get 261. Now reset your compass to this new number (261°) and you are ready to proceed.

**Compass Use**
To find a fire or other cross-country destination, the field observer must know the direction and distance to the fire or destination. This direction is usually determined by a compass. Distance which must be covered on foot is generally measured by pacing.

The azimuth compass is best to determine directions. An azimuth compass is graduated with a full circle of 360 degrees (360°) called an azimuth circle (Figure 35). Numbering begins with zero (0°) which is north, and proceeds clockwise. The azimuth graduations are usually etched in to the aluminum or plastic dial that sits on the base plate of the compass.

Ninety degrees is east, 180° is south, 270° is west, and 360°, the same as zero, is north. This circle is used to measure azimuth—the angle measured clockwise between any line and true north (Figure 36).
Figure 35: Azimuth Circle.

Figure 36: Azimuth (or Azimuth Angle).

Silva Ranger Compass
The Silva Ranger compass is a liquid-filled compass and is probably the most common field compass in use today (see Figure 37). The Silva Ranger azimuth compass will be the standard compass used in this course. Its correct operation will be described below. You must be comfortable using this compass to pass this course.
How to Use the Silva Ranger Compass
The proper way to stand while using a compass is illustrated in Figures 38 and 39.

Figure 38: Holding the Compass.
Hold the compass in both hands, keep elbows firmly against sides, and distribute weight evenly on both feet.

Figure 39: Prolonging the Line of Sight.
Look along the sighting line then raise eyes to prolong the line of sight ahead. Do not move head; raise eyes.
It is often best to hold this compass at eye level rather than at or below the chest. This makes prolonging the line of sight much easier and increases accuracy. When in use, the compass should always be held as level as possible.

**Warning:** Belt buckles, mechanical pencils, wire fences, and other objects containing iron or steel will influence the position of the needle. If allowed too near the compass, while taking a sight, they may deflect the needle, thus causing an error.

**How to Set a Compass Azimuth**

Follow these steps to set the Silva Ranger compass for a desired azimuth.

**Step 1**

Adjust the compass for Magnetic Declination (i.e.: add east, subtract west) by doing the following:

Determine what the magnetic declination is for the area of work.

**Mechanical Adjustment**

If your compass has a declination adjustment screw, turn this set screw for the appropriate declination. The set screw key is usually attached to a nylon cord that hangs from the compass. The set screw causes the etched or painted arrow on the base plate (that the floating compass needle sets in) to turn.

Once the proper declination has been set mechanically, it need not be changed while the compass is used in the same area.

**Mathematical Adjustment**

Some liquid-filled compasses do not have a set screw to adjust for magnetic declination. Magnetic declination can only be adjusted for by calculations from true north or the desired azimuth. Example 1 demonstrates how this is done.

**Example 1**

The magnetic declination is determined to be 16°E according to your topographic map. Turn the azimuth dial so that the azimuth and floating needle reads 0° (0° is the same as 360°) along the "direction of travel arrow" (see left compass in Figure 37) or "line of sight marks"; the compass is now pointing toward magnetic north. (Usually, the compass casing will be divided down the middle by a thin solid black line, which is called the "direction of travel" line; or by a series of white or yellow marks, which are called the "line of sight" marks.)
(also indicates the "direction of travel"). To find true north, which is 16°E of magnetic north in this example, orient your body and compass so that the floating needle points 16° to the right (east) of 0°.

**Step 2**

Set the compass for the desired azimuth by doing the following: Turning the aluminum or plastic dial so that the desired azimuth is aligned with the "line of sight mark" centered at the top of the compass (same as the "direction of travel arrow"). The following examples demonstrates how to set compass azimuths.

**Example 2--When Declination Has Been Mechanically Adjusted.**

Set the azimuth to 0°, or any other desired azimuth by simply turning the dial so that the azimuth is aligned with the "direction of travel arrow", or the white or yellow "line of sight mark" at the top and center of the compass.

**Example 3--When Declination Must be Mathematically Adjusted.**

The magnetic declination is determined to be 16°E, and you want to travel on a line due southeast. In this case, southeast is 16° east of 135°, or 151°; your direction of travel would be 151°, so turn your azimuth dial to read 141°.

**Step 3**

Turn the body (and the compass) until the floating (magnetic) needle is centered over the "etched needle box" on the base plate of the compass. The floating compass needle will be pointing to magnetic north, which is usually not the correct direction unless the declination is 0°. The top of the compass, however, will now by pointed to the desired azimuth.

For example, to orient the body and compass to face true north, set your azimuth to north (0°) as described in Steps 1 and 2. Now turn your body until the floating needle (remember it is usually a red arrow) lies directly over the etched arrow (on the base plate). If magnetic declination has been set, look in the direction of the "line of sight mark" centered at the top of the compass; that direction should be true north.

**Step 4**

Follow the "line of sight" or direction indicated by the compass.

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How to Determine an Unknown Azimuth
Follow these steps to determine the direction of an object (an unknown azimuth).

Step 1
To determine direction where the azimuth is unknown, hold the compass so that an imaginary straight line can be drawn from you to an object (such as a peak).

Step 2
While holding the compass very steady (and level) and keeping your eyes alternately on the object and the compass, turn the plastic or aluminum dial so that the magnetic north (red) arrow is floating directly over the etched arrow on the base plate.

Step 3
Read the azimuth directly opposite the "direction of travel arrow", or opposite the line of sight mark at the top, center of the compass. This is the direction (azimuth) that must be traveled to reach the object if magnetic declination has been mechanically adjusted for. If declination must be adjusted for mathematically, you must reverse the declination rule, i.e., subtract for east and add for west, if west of the Mississippi River to plot this direction on a map.

It is difficult to learn how to set a compass azimuth or to determine an unknown azimuth from reading an instruction set. Find a knowledgeable person to show you these skills and practice them repeatedly on different objectives. You must possess these skills before you enter the classroom portion of the course; and more importantly, before you are on assignment!
How to Use a Liquid-Filled Compass with Reflecting Mirror Cover

Some liquid-filled compasses are equipped with reflecting mirror covers (see Figure 37; page 69); the Silva Ranger CL-15 is one such compass. The reflecting mirror, if used properly, can greatly improve accuracy. Follow these steps when using the reflecting mirror cover type compass. If you have problems following these instructions, have someone show you how to use this type of compass.

Step 1

Set the desired azimuth by turning the aluminum or plastic dial. (Make sure you have adjusted the azimuth or compass for declination). The desired azimuth line should be directly under the "line of sight" mark at the top of the compass (just below the hinge).

Step 2

Hold the compass horizontally on the same level with the sighting eye and adjust the cover (by folding it toward the face of the compass) so that the reflected image of the compass housing fills the mirror (Figures 40 and 41).

Step 3

Move the sighting eye sideways in relation to the compass until the sighting line intersects the reflecting image of the center point (Figure 40).

Figure 40: Aligning Sight- ing Line with Center Point of the Compass.  
Figure 41: Sighting with the Compass.
Step 4

Without changing the relationship between compass and eye, turn until the head of the floating needle (red end) points to the azimuth line on the compass base, and the floating needle is centered in the etched needle box inside the compass housing.

Step 5

The direction of travel (or objective in the field) will now lie straight beyond the sight on the upper edge of the cover. The line of sight should fall in the "V" notch in the middle of this upper edge of the mirror casing.

When sighting uphill or downhill, lower or raise the sighting eye in relation to the compass. Remember to keep the base plate horizontal so that the compass needle can turn freely.

Precautions to Take When Using a Compass

♦ Be sure that the correct declination is set on the compass or adjusted for mathematically.

♦ When running lines always follow the line of sight and not the direction of the needle.

♦ The compass is a delicate instrument; handle it carefully.

♦ Always follow the line indicated by the compass rather than relying on judgment as to the direction.

♦ Remember the tree, rock, or other object sighted on your line of sight. When in doubt, take another compass reading.

♦ Keep articles containing steel or iron (such as radios) sufficiently far away from the needle to avoid influencing it.

♦ Do not attempt to repair the compass except in emergencies.

Practical Exercises (will be tested in class)

A. Set your compass to east (90°) as described in Steps 1-4 of "How to Set a Compass Azimuth" (pages 70-71) and travel due east for a few paces. Repeat these procedures to travel south (180°) and west (270°). Remember to compensate for magnetic declination (Step 1--page 70); practice compensating with a compass that has a magnetic declination set screw and one that does not. For example, try adjusting for a magnetic declination of 0°E, 15°E, 20°W, etc.
B. Go outside and find a building, tree, or hill. Locate a point at the top or bottom of this object and determine the azimuth (direction) between you and the object by following Steps 1-3 in "How to Determine an Unknown Azimuth" (page 72).

**Protractor**

A protractor (Figure 42) is a circle or semi-circle marked in degrees used to determine compass degrees to a point.

![Figure 42: A Protractor.](image)

**How to Use a Protractor**

1. Draw a line from an initial point to the object (Figure 43).

2. Set the protractor on an east-west axis.

3. Place the center mark of the protractor on the initial point with the 0 on the outer ring at north.

4. The compass degree is read where the line intersects the outer ring. This may be the true compass reading from the initial point to the object, depending upon your protractor's graduations.

5. With a true compass reading and a distance from a given point, a line can be drawn on a map and a location on this line found (Figure 43). This is the principle used by fire lookouts.
Figure 43: Using the Protractor

A protractor can be a circle or a semi-circle and can be variously graduated. Remember to convert degrees to the proper azimuth (study Figure 44 if you don't know how). For example, in Figure 45, your protractor gives you a reading of 80° in the southwest quarter, but the azimuth is actually 260°.

BEARINGS

Bearings: are measured from N & S to the E & W.

AZIMUTHS

Azimuths: are the clockwise angle measured from N. Figure 44: Difference Between Bearings and Azimuths
Figure 44: Protractor and Azimuth Circle Overlay

Exercises
Use the Cajon topographic map for the following three exercises. School solutions are located at this end of this Unit.

Locate Cleghorn Mountain in Section 4, T2N, R5W.

Q1: What is the true bearing from Cleghorn Mountain to spot elevation 4217 in Section 33, T3N, R5W? ________________.

Locate Cajon Mountain Lookout, about a mile and a half south of Cleghorn Mountain. The lookout reports a smoke at 229°, 2 miles.

Q2: Describe the area where you think the smoke would be. 
______________________________
______________________________

A newly constructed lookout at spot elevation 3240 in Section 12, T2N, R6W gives a cross reading of 166°, just under 2 miles.

Q3: Does this line cross with the line from Cajon Lookout within a tenth of a mile from your answer above? If not, check your readings.

77
Orienting a Map
Maps can be oriented in two ways. The most accurate method is to use a compass; this method is called compass orientation. The next best method is to move the map to fit known landmarks; this is referred to as topographic orientation or terrain association.

Compass Orientation

1. Lay out your map on a flat, non-metallic surface.

2. Adjust your compass for the magnetic declination specified on the map margin. If your compass cannot be adjusted for magnetic declination skip to step 3.

3. Lay the compass on the map and adjust the compass so that the compass is pointing to true north (if declination has been preadjusted) or magnetic north (if declination cannot be mechanically adjusted).

4. Rotate the map so that the map is physically oriented to the north (parallel to the north/south running line(s) on the compass). If magnetic declination has been preadjusted, the map is now oriented to true north. If not, the map is oriented to magnetic north and you must move on to step 5.

5. Rotate the map the number of degrees west (rotate to the left) or east (rotate to the right) of magnetic north specified as the magnetic declination (i.e. 15° west would be 345°; or 17.5° east would be 17.5°).

Practice orienting a map with a compass. Ask for assistance if you do not understand these instructions.

Topographic Orientation

1. Find your approximate location on the map.

2. Select two prominent landmarks visible to you and shown on the map.

3. Turn the map until the map landmarks are in proper relation to actual landmarks.

4. The map is now oriented generally to true north.
Calculating Back Azimuth or Backsighting

While following a line of sight, or an azimuth, you may sometimes lose the landmark (tree or rock) and find it necessary to recheck your location and its relation to the original line of sight or azimuth. To do this, sight back toward the starting point and then check by compass. This requires sighting a back azimuth which is in the opposite direction from the azimuth. Since there are 360° in the azimuth circle, the opposite direction would be half of 360°, or 180°, difference from the azimuth. A back azimuth is calculated by adding 180° to the azimuth when the azimuth is less than 180°, or by subtracting the 180° from the azimuth if it is more than 180°. Checking your line of sight by using a back azimuth is called backsighting.

![Diagram](image)

Figure 46: Azimuth and Back Azimuth.

In Figure 46, the north end of the needle indicates the azimuth, which in this case is 90°, or east. The back azimuth is in the opposite direction, or it would be 90° plus 180° which is 270°, or west.

Using a back azimuth to check a line of sight or to sight back on a starting point or lookout point is called backsighting.

Getting on Line

It is not always possible to keep the lookout point or the starting point in view when traveling to a destination. When a point is reached where the lookout, or starting point, can be seen and it is desirable to get on the line between the lookout point and your destination, proceed as follows:

1. Face the general direction of the backsight.
2. Hold the compass as previously described.
3. Set the back azimuth (on the dial).
4. When the needle is centered in the etched needle box, sight along direction of travel line (line of sight).
5. Note on which side and the approximate distance from which the line of sight misses the lookout point.
6. If the lookout point is to the right of line of sight, move to the right. If the lookout point is to the left, move to the left.

7. Estimate the distance that the line of sight misses the lookout point. Move over this distance, either to the right or to the left, as required. Take another backsight on the lookout point. Repeat this procedure until the line of sight passes through the lookout point.

8. This then is the line between the lookout point and the fire. Then turn the compass to the azimuth reading and proceed along the line toward your destination (Figure 47).

---

**Figure 47:** Getting on Lookout's Line of Sight.
**Resection**

Resection is a technique used to locate yourself or an object on a map when that location is unknown or is uncertain. Resection can best be performed during the day in terrain that has some relief.

To resection follow these steps:

1. Orient your map to true north (page 78).

2. Select two obvious landmarks that you can clearly discern on your map.

3. Take a compass bearing on both landmarks (adjust for declination) and WRITE them down (Figure 48).

   ![RESECTION](image)

   Figure 48: Taking Resection Compass Bearings.

4. Calculate the back azimuth of both bearings.

5. Transfer these bearings onto your map:
   - set the compass for one of the recorded bearings (landmark A) adjust for declination
   - place the compass on the map so that one edge touches landmark A
   - pivot the compass (not the map!) so that the magnetic needle is aligned over the base plate needle, and the edge of the compass is still touching landmark A
   - hold the map and compass very still and draw a line (pencils are usually best in case of error) from landmark A to a point well beyond your suspected location.
   - repeat last step for landmark B
Your location should be the intersection of these two lines; the "X" marks the spot (Figure 49). A protractor, if available, can also be used for resection calculations.

Figure 49: Resection X Marks the Spot
Solutions to Unit 3 Questions

Protractor
Q1: 23°; Q2: At the three structures near the corner of Sections 24, 13, 18, and 19; Q3: Check yourself

UNIT 3 FIELD EXERCISES

Complete the following field exercises to prepare yourself for a timed, in-class skills test on the first day of class. Have a knowledgeable person check your work.

Exercise #1
Lay out a 100 ft course on level ground. Establish a mark one chain (66 ft) from the 0 point. Determine your pace and the number of paces required to walk (normal stride) 1 chain and 100 feet.

Length of pace_________; # paces per 1 chain_________; # paces per 100 feet__________.

Exercise #2
Repeat exercise 2 on a slope of 20% or more. Establish your pace for both upslope and downslope travel.

Uphill:
For a ______% slope, my length of pace_______; # paces per 1 chain_________; # paces per 100 feet__________.

Downhill:
For a ______% slope, my length of pace_______; # paces per 1 chain_________; # paces per 100 feet__________.

Exercise #3
Obtain a topographic map of your home base that includes your place of work. Answer the following questions:

What is the magnetic declination?__________________.

What is the legal description of your place of work?__________________

(Include the Base and Meridian). Bring this quad to class.
Exercise #4
Calculate the distance between two points (i.e. two buildings or two trees) by pacing. Measure this distance. The difference between the distance estimated by pacing and the measured distance must be within 5 percent.

Exercise #5
Walk the following three-legged compass course on relatively flat terrain and return to within 10 feet of the starting point. Go into the field and mark your starting point, then use these distances and azimuths:

Three-legged Course
Go 200 ft at 39.5°; then go 170 ft at 180°; and return to your starting point by going 140 ft at 270°.

REFERENCES
Kjellstrom, Bjorn. 1976. Be expert with map and compass; the complete "orienteeering" (tm) handbook. Charles Scribner's Sons; New York, NY.


National Wildfire Coordinating Group. 1986. I-244; Field observer/display processor instructor guide; Units 1, 2, and 3. September.

FIELD OBSERVER/DISPLAY PROCESSOR
PRESTUDY EXAMINATION

Student's Name ___________________________  Page 1 of 7

Points

1. Describe a "planimetric map".  
   1

2. Describe a "topographic map".  
   1

3. Describe an "orthophoto map".  
   1

4. Define the term "quad".  
   1

5. Define "comparison scale".  
   1

6. Define "representative fraction".  
   1

7. What is a map legend?  
   1

8. Where would you usually find the information relating to revision date, adjoining maps, contour interval, and magnetic declination on a topographic map?  
   1
The next five questions refer to the basic colors used on a topographic map. Briefly explain what features the colors represent.

9. Black  

10. Blue  

11. Green  

12. Brown  

13. Red  

14. List two items found in the margin of a topographic map. Do not list those items referred to in Question #8.  

15. Briefly define the USGS Topographic Map Index Circular.
Briefly define the following terms.

16. Baseline

17. Principal Meridian

18. Township lines

19. Range lines

20. Township

21. Section

Draw the ICS display symbol for each of the following items:

22. ICP

23. Uncontrolled perimeter

24. Origin

25. Staging Area

26. A ridge
Questions 27 through 33 require referencing a drawing next to each question.

27. Number the Sections in this typical Township

Points

2
To answer questions 28 through 30, describe the section divisions with letters in them. The Township and Range is T5S, R3W, MDB&M.

28. A = ____________________________  
   [Diagram: 5 4 3 8 A 10]  
   Points 2

29. B = ____________________________  
   [Diagram: 17 16 B]  
   Points 2

30. C = ____________________________  
   D = ____________________________  
   [Diagram: 30 C D]  
   Points 2

Questions 31 through 33 refer to the diagram below; assume it represents one Section.

31. How many acres in area A?__________  
   Points 2

32. How many acres in area B plus C?_____  
   Points 2

33. How many acres in area D?__________  
   Points 2
Use the Cajon Topographic Map to answer questions 34 through 39. You may use any mapping aids you wish. DO NOT WRITE ON THE QUAD. ATTACH ALL WORKSHEETS TO RECEIVE FULL CREDIT FOR EACH ANSWER.

34. In the lower left corner of the map there is a road which goes to Stockton Flat Campground to the west and to Scotland to the south.
   A. Calculate the distance of the road, in feet. 6

   B. Using the road and the map margin as boundaries, calculate the acreage of the area inside this road. 6

35. The measured distance from the northwest end of Lost Lake to the Gaging Station near the weighing station is 1-1/2 inches.
   A. How many inches does this represent on the ground? 6

   B. How many chains does this represent? 5

36. What is the elevation at the junction of State Route 138 and Interstate 15? Calculate from directly under the "U" in junction. 5
37. What is the average slope between the highway junction (described in question 36) and Hill 3690, which is due north of this junction.

38. What is the average slope between BM 3257 near the Glenn Ranch in Section 15, T2N, R6W and VABM 4306 on Lower Lytle Creek ridge north of the ranch?

39. You are trying to determine your location on the map. You use your compass and determine that Cleghorn Mountain bears 70° from your location. Cajon Mountain Lookout bears 145°. Both of these are true azimuths. Describe your location.

100 possible points
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1. Describe a "planimetric map".  1
   A planimetric map does not depict the shape of the land; it only incidently shows it.

2. Describe a "topographic map".  1
   A topographic map depicts the shape of the land.

3. Describe an "orthophoto map".  1
   An orthophoto map depicts terrain and other map features by color-enhanced photographic images. It is a picture of the land taken from the air.

4. Define the term "quad".  1
   The term "quad" is an abbreviation of quadrangle. A quad covers a specific area and is usually designated by the name of a town or some natural feature within the area.

5. Define "comparison scale".  1
   Comparison scales show distance in inches or millimeters on the map equal to so many feet, yards, chains, or miles on the ground.

6. Define "representative fraction".  1
   A representative fraction is the ratio of map units of measure to ground units of measure.

7. What is a map legend?  1
   The legend shows information needed to interpret that map.

8. Where would you usually find the information relating to revision date, adjoining maps, contour interval, and magnetic declination on a topographic map?  1
   In the margins.
The next five questions refer to the basic colors used on a topographic map. Briefly explain what features the colors represent.

9. Black
   Most cultural or human-made features, boundaries.

10. Blue
    Water features such as lakes, rivers, or swamps.

11. Green
    Vegetation such as woods, orchards, or vineyards.

12. Brown
    All relief features, contours, cuts, and hills.

13. Red
    Main roads, township and range lines, section numbers, urban areas, special features.

14. List two items found in the margin of a topographic map. Do not list those items referred to in Question #8.

   a. Geographic area represented
   b. Scale
   c. Legal descriptions
   d. Longitude
   e. Latitude
   f. North arrow
   g. Quad name
   h. Series size
e.g., 7.5” or 15”

15. Briefly define the USGS Topographic Map Index Circular.

   The Topographic Map Index Circular contains a map of the state divided into quadrangles.
Briefly define the following terms.

16. Baseline
   A line running East-West (1 pt) through an initial point (1 pt).

17. Principal Meridian
   A line running North-South (1 pt) through an initial point (1 pt).

18. Township lines
   A series of lines which run parallel to the Baseline (1 pt) at 6 mile intervals (1 pt).

19. Range lines
   A series of lines which run parallel to the Principal Meridian (1 pt) at 6 mile intervals (1 pt).

20. Township
    A 36 square mile area (1 pt) bounded by Township and Range lines (1 pt).

21. Section
    A division of a Township which is usually one square mile (1 pt) and contains 640 acres (1 pt).

Draw the ICS display symbol for each of the following items:

22. ICP
    ![ICS Display Symbol]

23. Uncontrolled perimeter
    ![Date and Time]
    (with date and time)

24. Origin
    ![Date and Time]
    (with date and time)

25. Staging Area
    ![Name]
    REDFERN
    (with name)

26. A ridge
    ![Line]
    (with name)
Questions 27 through 33 require referencing a drawing next to each question.

27. Number the Sections in this typical Township

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To answer questions 28 through 30, describe the section divisions with letters in them. The Township and Range is T5S, R3W, MDB&M.

28. A = N¼, Sec. 9, T5S, R3W, MDB&M
   (½ pt) (½ pt) (½ pt) (½ pt)
   8 A 10

29. B = W½, Sec. 15, T5S, R3W, MDB&M
   (½ pt) (½ pt) (½ pt) (½ pt)
   17 16 B

30. C = NW¼, Sec. 29, T5S, R3W, MDB&M
   (½ pt) (½ pt) (½ pt) (½ pt)
   D

D = SE¼, Sec. 29, T5S, R3W, MDB&M
   (½ pt) (½ pt) (½ pt) (½ pt)

Questions 31 through 33 refer to the diagram below; assume it represents one Section.

31. How many acres in area A? ______ 160 ______ 2

32. How many acres in area B plus C? ______ 80 ______ 2

33. How many acres in area D? ______ 10 ______ 2
Use the Cajon Topographic Map to answer questions 34 through 39. You may use any mapping aids you wish. DO NOT WRITE ON THE QUAD. ATTACH ALL WORKSHEETS TO RECEIVE FULL CREDIT FOR EACH ANSWER.

34. In the lower left corner of the map there is a road which goes to Stockton Flat Campground to the west and to Scotland to the south.

A. Calculate the distance of the road, in feet. 6
   3.04 inches map distance \times 2,000 \text{ feet/inch} = 5,900 \text{ to } 6,100 \text{ feet}

B. Using the road and the map margin as boundaries, calculate the acreage of the area inside this road.
   Looks like \frac{1}{4} of a section (160 acres) plus a little more
   OR
   1.2 inches map distance \times 2,000 \text{ feet/inch} = 2,400 \text{ feet}
   2 \text{ inches map distance} \times 2,000 \text{ feet/inch} = 4,000 \text{ feet}
   2,400 \text{ feet} \times 4,000 \text{ feet} = 9,600,000 \text{ feet}^2
   9,600,000 \text{ feet}^2 / 43,560 \text{ feet}^2 \text{ per acre} = 220 \text{ acres}

35. The measured distance from the northwest end of Lost Lake to the Gaging Station near the weighing station is 1-1/2 inches.

A. How many inches does this represent on the ground? 6
   2,000 \text{ feet/inch} \times 12 \text{ inches/foot} = 24,000 \text{ inches/foot}
   1.5 \text{ inches of map (measured with ruler)} \times 24,000 \text{ inches/inch} = 36,000 \text{ inches}

B. How many chains does this represent? 5
   1.5 \text{ inches} \times 2,000 \text{ feet/inch} = 3,000 \text{ feet}
   3,000 \text{ feet} \times 1 \text{ chain/66 feet} = 45.4 \text{ chains}

36. What is the elevation at the junction of State Route 138 and Interstate 15? Calculate from directly under the "U" in junction.

3,200 \text{ feet} - 2 \text{ contour intervals} = 3,200 \text{ feet} - 80 \text{ feet} = 3,120 \text{ feet}
37. What is the average slope between the highway junction (described in question 36) and Hill 3690, which is due north of this junction.

Rise = 3,690 feet - 3,120 feet = 570 feet
Run = 0.45 inches x 2,000 feet = 900 feet

570 feet/900 feet x 100 = 63%

38. What is the average slope between BM 3257 near the Glenn Ranch in Section 15, T2N, R6W and VABM 4306 on Lower Lytle Creek ridge north of the ranch?

Rise = 4,306 feet - 3,257 feet = 1,049 feet
Run = 1.45 inches x 2,000 = 2,900 feet

1,049 feet/2,900 feet x 100 = 36%

39. You are trying to determine your location on the map. You use your compass and determine that Cleghorn Mountain bears 70° from your location. Cajon Mountain Lookout bears 145°. Both of these are true azimuths. Describe your location.

(3 pts) (1 pt ) (1 pt ) (1 pt)
Top of hill "4542" in NE¼, SE¼, Sec. 6, T2N, R5W, SBB&M

100 possible points
Unit 1

Map Identification & Interpretation
On page two, there is a graphic representation of a land feature using contour lines. Use the contours to draw a profile of the land from a Point A to Point B. Draw the profile above the contours using the elevation intervals marked in 100' increments.
CONTOUR MAP

RELATION BETWEEN CONTOUR MAP AND PROFILE

CONTOUR INTERVAL 100'
STUDENT WORKBOOK

Unit 1

In which direction do Baselines pass through initial points? (East-West) (North-South)

Define Principal Meridian.

NORTH-SOUTH LINE THROUGH THE INITIAL POINT

The lines that parallel the Baseline at 6 mile intervals are called TOWNSHIP lines.

The lines that parallel the Principal Meridian at 6 mile intervals are called RANGE lines.
The area inside the above square is $36$ square miles.

This square is called a **Township**.

The small squares are called **Sections**.

Each small square contains $640$ acres. Number the small squares in accordance with the Rectangular System of Survey.
Use the Cajon Topographic Map for the following exercise.

At the bottom margin of the Cajon Topographic Map, Highway 395-66 is shown as a red line. Follow this highway north to Cajon Campground.

What township and range does the campground lie in? (The initial point is San Bernardino B & M).

- Tan, RSW, SBMM

What section does the campground lie in?

- 7

Lost Lake lies west of the campground. What is the Section, Township and Range of Lost Lake?

- Sec. 12, Tan, RSW, SBMM
Due east of Lost Lake, you will see this symbol: 

What does this symbol represent? 

In Section 8, T3N, R5W, there is a cistern. Write the legal description to the nearest quarter of the quarter Section.

SW 1/4 of the SE 1/4 of Section 8
T 3N R 5W Sam Bernard Base and Meridian.

Assuming Section 8 is 640 acres, how many acres are in the parcel of land that you just described? 40
Identify the ICS Display Symbols below. You have 10 minutes.

- ICP (Blue)
- CAMP (Blue)
- Spot Fire
  - This symbol is displayed with (Red) the Date and Time.
- Fire Origin
  - This symbol is displayed with (Red) the Date and Time.
- Uncontrolled Fire Edge
  - This symbol is displayed with (Red) the Date and Time.
- Division (Black)
- Branch (Black)
- Staging Area (Blue)
- Water Source (Blue)
- Wind Direction (Black)
  - This symbol is displayed with (Black) the Date, Time, and Wind Speed.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 1-Identify and Interpret Maps

LESSON: 1-Introduction to Maps

SUGGESTED TIME: 

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Define the term "planimetric map".
2. Define the term "topographic map".
3. Define quadrangle or "quad".
4. Define "orthophoto map".

TRAINING AIDS: Chalkboard, handouts, one state road map for each student, student workbook, overhead projector, transparencies, one topographic map and one orthophoto map for each student.
I  Introduction

PRESENT LESSON OBJECTIVES

A map is designed to permit you to visualize a portion of the earth's surface with pertinent features properly positioned to facilitate planning and organizing operations. Different types of maps are used for different purposes. One map with every possible detail would be so cluttered as to make reading and interpretation difficult.

II  Presentation

A. Definition of a Map:

A map is a line drawing, to some scale, of an area of the earth's surface. It shows objects and features by conventional signs. Or: A map is a graphic representation of a portion of the earth's surface drawn to scale on a plane.

EXPLAIN INADEQUACIES OF MAPS. ALTHOUGH DRAWN TO A SCALE, MAPS ARE NOT ABSOLUTELY ACCURATE BECAUSE THEY REPRESENT A CURVED AND UNEVEN SURFACE ON A FLAT PIECE OF PAPER. THE ACCURACY OF A MAP DEPENDS ON HOW BIG AN AREA IS REPRESENTED, AND ON THE TYPE OF PROJECTION USED TO MAKE IT, AS SOME PROJECTIONS ARE MORE ACCURATE THAN OTHERS.

B. Classification of Maps

Generally, maps fall into two categories: (1) Public Records (such as subdivision maps), and (2) those maps which are used to study the earth and delineate the works of people.
1. Public Records maps usually show the exact location and description of a piece or many pieces of property, including bearing and exact distance from known points permanently fixed on or in the ground.

EXPLAIN BENCHMARKS, EXACTNESS OF PUBLIC RECORDS MAPS AND THE NEED FOR LEGAL SURVEY/BOUNDARIES TO DELINEATE PROPERTY. MENTION HISTORY OF USING METES AND BOUNDS.

2. In contrast, other maps have a few dimensions but contain a larger area and delineate the natural and human-made features in that area. These maps can be divided into three categories which are the subject of this lesson: planimetric maps, topographic maps, and orthophoto maps.

a. Planimetric Maps

1) A planimetric map is a map which does not depict the shape of the land, or only incidentally shows it.

PROVIDE EACH STUDENT WITH ROAD MAP OF THE STATE.

2) A road map is a planimetric map.

EXPLAIN THAT ROAD MAPS ARE GENERALLY DESIGNED BY MAPPING COMPANIES FOR BUSINESSES SUCH AS AUTO CLUBS AND GAS COMPANIES TO AID THE PUBLIC IN TRAVELING.

Road map
01-01-I244 BO
OUTLINE

DISCUSS LACK OF DETAIL IN ROAD MAPS.
ASK OF ONE STUDENT, "AS A FIELD
OBSERVER/DISPLAY PROCESSOR, HOW COULD A
ROAD MAP BE OF USE TO YOU?"

SOLUTIONS:

MAPS GIVE GENERAL DIRECTIONS, SHOW TOWNS,
ROADS, ALLOW YOU TO QUICKLY ORIENT YOURSELF
AND ARE EASY TO READ. ANOTHER TYPE OF
PLANIOMETRIC MAP USED IN EMERGENCY SERVICES
IS THE FLOOR PLAN. THE FLOOR PLAN IS OFTEN
USED AS PART OF A PRE-FIRE PLAN.

HAND OUT FLOOR PLAN. EXPLAIN CONCEPT,
USEFULNESS AND LIMITS OF FLOOR PLAN.

ASK OF A STUDENT: "CAN YOU THINK OF ANY
OTHER PLANIOMETRIC MAPS THAT YOU MAY USE AS
FIELD OBSERVER/DISPLAY PROCESSOR?"

MAKE SURE STUDENT COVERS:

- DISTRICT RESPONSE MAPS
- SYSTEM SCHEMATICS
  - PIPES
  - DUCTS
  - UTILITIES
  - ETC.
- UNDERGROUND FUEL LINE MAPS
- SEWER MAPS
- STORM DRAIN MAPS
- STREET ATLAS (E.G., THOMAS GUIDES)
- WATER SYSTEM MAPS
- SOIL/VEGETATION MAPS
- AVIATION MAPS
- PUBLIC RECORDS (SUB-DIVISION MAPS)
b. Topographic Maps

1) A topographic map is a map depicting natural features such as hills, valleys, lakes, and streams. A topographic map may also depict principal human-made features such as structures, roads, power lines, and wells.

ASK STUDENTS WHAT ELSE A TOPOGRAPHIC MAP CAN DEPICT. (VEGETATION TYPE, STOCK PONDS)

2) Each state is divided into rectangles, known as quadrangles. The term "quad" is an abbreviation of quadrangle. Each quad is a topographic map covering a certain area, and is designated by the name of a town or some natural feature within the area.

EXPLAIN USEFULNESS AND LIMITS OF TOPOGRAPHIC MAPS.

HAND OUT ORTHOPHOTO MAPS.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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<tbody>
<tr>
<td>c. Orthophoto maps</td>
<td></td>
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<tr>
<td>An orthophoto map is a map depicting terrain</td>
<td></td>
</tr>
<tr>
<td>and other map features by color-enhanced</td>
<td></td>
</tr>
<tr>
<td>photographic images. It is a picture of the</td>
<td></td>
</tr>
<tr>
<td>land taken from the air.</td>
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</table>

EXPLAIN USEFULNESS AND LIMITS OF ORTHOPHOTO MAPS.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 1-Identify and Interpret Maps

LESSON: 2-Map Interpretation Information

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Determine the geographic area represented by a map.

2. Define map scale.

3. Define comparison scale.

4. Define representative fraction.

5. Determine cardinal directions on a map.

6. Interpret information from a map legend.

7. Locate the revision date on a map.

8. Explain how to determine adjoining maps.

9. Use the GEOLOC System to locate a 100 acre cell.

TRAINING AIDS: Overhead projector, chalkboard, and Firescope sample response booklet.
<table>
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<td>Introduction</td>
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<tr>
<td>PRESENT LESSON OBJECTIVES</td>
<td></td>
</tr>
</tbody>
</table>

Unless a map can be interpreted, it is not very useful. Information needed to interpret a map includes the area represented, the scale, and a legend which explains the symbols used on the map. Other information may be included depending on the intended use of the map. This information may include a grid system, adjoining maps, revision dates, legal descriptions, contour lines, natural and human made features, and various other items.

<table>
<thead>
<tr>
<th>II</th>
<th>01-03-I244 VG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presentation</td>
<td></td>
</tr>
</tbody>
</table>

A. Geographic Area Represented
   1. May be a narrative description.
   2. May be graphically displayed.

B. Scale
   The scale of a map is the ratio of horizontal distance on the map to the corresponding horizontal distance on the ground. The scale expresses the ratio of the map distance to the ground distance.

   1. Comparison Scale

DRAW ON CHALKBOARD

USE ROAD MAP COMPARISON SCALE AS EXAMPLE.  

Road Map  
01-01-I244 HO
A graphic or **COMPARISON** scale compares inches to feet, miles, or other distances. Usually, graphic scales are printed on the map and show you that so many inches or millimeters equal so many feet, yards, chains, or miles on the ground.

2. **Representative Fractions**

**DRAW ON CHALKBOARD.**

**USE TOPOGRAPHIC MAP AS EXAMPLE**

A representative fraction (RF) is always written with the map distance as 1 (one). An R.F. of 1/24,000 (1:24,000) (1:24000) means that one UNIT of measurement (inches, millimeters, feet, etc.) on the map is equal to 24,000 of the SAME UNITS on the ground. You CANNOT mix units in a representative fraction. If it's one INCH on the map, it's 24,000 INCHES on the ground.

**HAVE STUDENTS USE R. F. TO DETERMINE NUMBER OF FEET ONE INCH REPRESENTS ON TOPOGRAPHIC MAP. SHOW SAMPLE CALCULATIONS ON BLACKBOARD.**

**C. Cardinal directions**

1. Most maps are oriented with North at the top.

2. Most maps have an arrow pointing to North.
HAVE STUDENTS FIND NORTH ARROW ON ROAD MAP.

DISCUSS LEGENDS ON ROAD, TOPOGRAPHIC, AND ORTHOPHOTO MAPS.

D. Legend
   The legend shows information needed to interpret that map.

E. Revision Date
   Some maps may have a revision date. A 22-year-old map of an urban interface area will bear little resemblance to the area it currently represents.

HAVE STUDENTS DETERMINE REVISION DATE OF TOPOGRAPHIC MAP.

F. Adjoining Maps
   Some areas are too large to be shown on a single map. Adjoining maps are frequently indicated in the margin of the map you are using. Examples would be street atlases and USGS topographic maps.

HAVE STUDENTS IDENTIFY ADJOINING MAPS FROM ORTHOPHOTO QUAD.

G. Grid Reference
   1. Many maps are divided into grids to help locate areas.
   2. Grids are usually identified alpha-numerically. However some maps may use only letters or only numbers.

01-05-1244 VG
### OUTLINE

3. Many road maps and atlases use a grid reference system to locate streets or other features. An alphabetical index is included to help locate an area.

USE GRID SYSTEM ON ROAD MAP AS EXAMPLE.

4. GEOLOC (Geographic Locator)

   a. The GEOLOC system is a grid system that can be used to pinpoint a 100-acre cell anywhere in the United States.

   b. Zones — the U.S. is divided into five zones.

   c. Each zone is divided into alphabetically designated blocks.

   d. Each block (two letters) contains 32 7-1/2 minute quadrangles. (7-1/2 minutes refer to 7-1/2 minutes of longitude and latitude.)

   e. Each quadrangle is numbered and divided into 8 lettered octagons.

   f. Each lettered octangle is divided into 50 numerically designated cells of 100 acres each.

   g. A seven-character alpha-numeric code is used to identify this cell.

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<table>
<thead>
<tr>
<th>KEY POINTS &amp; AIDS</th>
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<td>01-07-I244 VG</td>
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<td>01-08-I244 VG</td>
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<td>01-09-I244 VG</td>
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<td>01-10-I244 VG</td>
</tr>
<tr>
<td>OUTLINE</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>h. The Response Booklet uses this code to identify the various maps in the booklet.</td>
</tr>
<tr>
<td>SHOW SAMPLE FIRESCOPE RESPONSE BOOKLET</td>
</tr>
<tr>
<td>i. Typical response booklets contain 1:12,000 and/or 1:6,000 scale maps.</td>
</tr>
<tr>
<td>1) Covers urban and interface areas.</td>
</tr>
<tr>
<td>2) Information printed in red.</td>
</tr>
<tr>
<td>a) GEOLOC code</td>
</tr>
<tr>
<td>b) Block numbering</td>
</tr>
<tr>
<td>c) Hydrants</td>
</tr>
<tr>
<td>d) Water sources</td>
</tr>
</tbody>
</table>

HAND OUT GEOLOC HANDOUT. 01-05-1244 HO
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 1-Identify and Interpret Maps

LESSON: 3-Topographic Maps

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Explain what the five basic colors used on a topographic map represent.

2. Explain the purpose or meaning of 10 USGS Topographic Map Symbols.

3. List 6 items found in the margin of a topographic map.

4. Explain how to use the USGS Topographic Map Index Circular.

5. Explain contour lines and their use.

6. Identify peaks, saddles, canyons, ridges, and drainages on a topographic map.

TRAINING AIDS: Chalkboard, Topographic Map Index Circulars of the State, Topographic Map Symbols, handouts, and overhead projector.

-28-
I. Introduction

PRESENT LESSON OBJECTIVES

A topographic map depicts natural features such as hills, valleys, lakes and streams. It also depicts principal human-made features such as structures, roads, power lines, and wells.

Topographic maps are useful in emergency work because they show the shape of the land. Emergency service workers need to know which direction a wildland fire will spread or which way a hazardous liquid will flow in order to make tactical decisions. Topographic maps will aid them in making these decisions.

II. Presentation

HAND OUT TOPOGRAPHIC MAP INFORMATION AND SYMBOLS (USGS).

A. Symbols and Colors

1. Symbols are used on maps to indicate objects on the ground.

2. Topographic map symbols are usually printed in colors, each color identifying a class of features. The colors are as follows:

USE EXAMPLES ON TOPOGRAPHIC MAP

a. BLACK
Most cultural or human-made features, boundaries.
b. BLUE
   Water features such as lakes, rivers, or swamps.

c. GREEN
   Vegetation such as woods, orchards, or vineyards.

d. BROWN
   All relief features, contours, cuts, and hills

e. RED
   Main roads, built-up areas, sections, township and range boundaries, special features.

f. RED TINT
   Urban areas

g. PURPLE
   Aerial photo revisions, not field checked.

h. Other colors may be used for special purposes. Their key will be found in the margin information of the map.

3. The TOPOGRAPHIC MAP SYMBOLS sheet can be hard to read if you don't understand the system. If more than one name is given and there is more than one symbol, they read either top to bottom or left to right.

DRAW SYMBOLS ON BOARD AND HAVE STUDENTS EXPLAIN WHAT EACH SYMBOL REPRESENTS.
EXPLAIN THAT SYMBOLS USED ON MAPS ARE NOT ALWAYS THE SAME FOR EACH KIND OF MAP. THEY CHANGE FROM MAP TYPE TO MAP TYPE. THE SYMBOLS ON TWO THOMAS BROTHERS STREET ATLASES MAY BE THE SAME, OR TWO TOPOGRAPHIC MAPS MAY BE THE SAME, BUT TOPOGRAPHIC MAP SYMBOLS DIFFER FROM STREET ATLASES.

COMPARE TOPOGRAPHIC SYMBOLS TO ROAD MAP SYMBOLS.

B. Map Margins

1. The following information is found in topographic map margins:
   a. geographic area represented
   b. scale
   c. contour interval
   d. magnetic declination
   e. adjoining maps
   f. legal descriptions
   g. longitude and latitude
   h. revision date

2. The bottom margin contains the magnetic declinations of the areas represented by the map.

EXPLAIN DECLINATION, AND DEMONSTRATE ITS USEFULNESS AND DERIVATION.

HAVE STUDENTS DETERMINE MAGNETIC DECLINATION OF TOPOGRAPHIC MAP.
<table>
<thead>
<tr>
<th>OUTLINE</th>
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</thead>
<tbody>
<tr>
<td>3. Each margin of the map has the name of the adjacent quad.</td>
</tr>
<tr>
<td>HAVE STUDENTS IDENTIFY THE EIGHT ADJOINING QUADS.</td>
</tr>
<tr>
<td>4. The legal description of the areas are found in the margins. Townships are given in right and left margins and ranges are shown in the top and bottom margins. Legal descriptions will be covered in detail later.</td>
</tr>
<tr>
<td>5. Longitudes, expressed in degrees, minutes, and seconds are in the right and left margins. Latitudes, expressed in degrees, minutes, and seconds are in the bottom and top margins.</td>
</tr>
<tr>
<td>6. The latest revision date of the map is found in the lower right-hand corner of the bottom margin.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>KEY POINTS &amp; AIDS</th>
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<tbody>
<tr>
<td>EXPLAIN OTHER DATA FOUND IN MAP MARGINS.</td>
</tr>
<tr>
<td>DISPLAY THE TOPOGRAPHIC MAP INDEX CIRCULAR FOR THE STATE.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>C. Topographic Map Index Circular</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Topographic Map Index Circular contains a map of the state divided into quadrangles.</td>
</tr>
<tr>
<td>2. If you are working on a large moving incident, the Index Circular will help you to obtain maps of the area into which the incident is progressing.</td>
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</tbody>
</table>
### OUTLINE

<table>
<thead>
<tr>
<th>D. Contours</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Probably the most important feature on topographic maps are the contour lines which can give the trained Field Observer valuable information about the terrain.</td>
</tr>
</tbody>
</table>

DISCUSS THE GENERAL CONCEPTS OF CONTOUR LINES: AN IMAGINARY LINE ON THE GROUND ALONG WHICH ALL POINTS ARE THE SAME ELEVATION.

**Contours:**

- **a.** are the most practical method of showing relief on a map.
- **b.** are the most common method of showing relief on a map.
- **c.** are a line on a map indicating an imaginary line on the ground.
- **d.** show the shape of the terrain.
- **e.** represents the same elevation.
- **f.** never cross each other.

1) Steep terrain is indicated by closely spaced contour lines.

2) A uniform slope is indicated by equally spaced contour lines.
<table>
<thead>
<tr>
<th>OUTLINE</th>
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</tr>
</thead>
</table>
| 3) A cliff may appear to be a broad, solid line.  
  g. indicate depressions with closed lines with hachures. |
| 2. Features such as ridges, canyons, peaks, saddles, and drainages are easy to identify on a topographic map. |

INSTRUCTOR DRAW RIDGES, CANYONS, PEAKS, SADDLES, DRAINAGES ON BOARD.

ALLOW 10 MINUTES FOR WORKBOOK EXERCISE.

DRAW SOLUTION ON BOARD.

Wkbk pg. 1  
Solution  
Inst. Guide  
pgs. 35, 36
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 1-Identify and Interpret Maps

LESSON: 4-System of Land Description in the United States

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Define baseline.
2. Define principal meridian.
3. Define township lines.
4. Define range lines.
5. Define township.
6. Describe the Township Numbering System.
7. Define section.
8. Divide a section.

TRAINING AIDS: Overhead projector, screen, chalkboard.
<table>
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<tr>
<th>OUTLINE</th>
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<td>PRESENT LESSON OBJECTIVES</td>
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</tbody>
</table>

The United States System of Surveying the Public Lands, frequently referred to as the rectangular system, was planned in 1784 by the Continental Congress and has survived until today with only minor modifications.

The law requires that the public lands "shall be divided by North and South lines and by other lines running East and West so as to form townships 6 miles square." (Not 6 square miles but a square of 6 miles on each side, with an area of 36 square miles). The law also states that townships will be divided into 36 sections, each of which shall contain 640 acres, as nearly as possible. Human error and irregular shaped land areas causes some sections to be larger, smaller, or irregularly shaped.

In this section we will go through, step by step, the pertinent points of the land division system.

ADAPT THIS SECTION TO REFERENCE POINTS OF YOUR AREA.

II Presentation

A. Rectangular land division is based on an INITIAL POINT or a REFERENCE POINT.

Surveying in California is based on one of three points:

1. Humboldt Base and Meridian on Mount Pierce (HBM);

2. Mount Diablo Base and Meridian on Mount Diablo (MDBM); and

B. This viewgraph illustrates a Township-Range Grid. The center has a circle around it; this Township-Range is the initial or reference point. For this example, let's assume that it is the Mount Diablo Base and Meridian.

1. The heavy line running EAST-WEST through the initial point represents an imaginary line on the ground called the BASELINE.

2. The heavy line running NORTH-SOUTH through the initial point is called the PRINCIPAL MERIDIAN (also an imaginary line).

3. By imaginary line we mean that although certain points along the line have been surveyed and marked, the line itself is not marked on the ground. This is true for all the lines we talk about in this system.

C. Each Grid is named for its initial point and all references to any point in the grid refer to that name.

D. The Baseline, as previously stated, runs East and West through the initial point. A series of lines run parallel to the base line, at 6 mile intervals, both on the North and South sides. These
lines are called the Township lines. The area BETWEEN the first and second Township lines on the north is Township 2 North or T2N. The area BETWEEN the BASELINE and the FIRST TOWNSHIP LINE on the SOUTH SIDE is called TOWNSHIP 1 SOUTH or T1S.

E. The RANGE LINES are a series of lines 6 miles apart which run North and South parallel to the Principal Meridian. There is one every 6 miles on the East side of the Meridian, and one every 6 miles on the West side of the Meridian. The areas between these lines are numbered much the same as the Townships. The area BETWEEN the PRINCIPAL MERIDIAN and the FIRST line on the EAST SIDE is RANGE 1 EAST or R1E. The area BETWEEN the FIRST AND SECOND LINES on the WEST SIDE is RANGE 2 WEST or R2W.

F. Proper descriptions of locations have the Township written first followed by the Range and Base and Meridian.

In the area between the 4th and 5th Township lines North and the 3rd and 4th Range lines East is a 36 square mile area called a Township. This Township could be described from the Mount Diablo Base and Meridian as T5N, R4E, MDB&M. This is a properly written statement of location.

WRITE PROPER DESCRIPTION ON BOARD.
G. Township Numbering System

This is the numbering system of a township. As you can see, the numbers start in the upper right-hand corner, move across to the left, down and to the right, etc. If you remember that the UPPER RIGHT HAND CORNER is always Number 1 and that the numbers move BACK AND FORTH to the bottom you will be able to locate section numbers as necessary.

Each number identifies a square which is USUALLY one square mile and contains 640 acres. This area is called a SECTION and is identified by the section number.

REMEMBER: sections DO NOT ALWAYS contain 640 acres, nor are they always one square mile. A properly written section location description would read: Section (or Sec.) 22, T5N, R7W, MDB&M.

WRITE DESCRIPTION ON BOARD.

H. Division of Sections

1. A typical section of 640 acres may be broken down into smaller areas, each successive smaller piece having a unique location description of its own.

INSTRUCTOR WRITE DESCRIPTIONS ON BOARD

USE THE VIEWGRAPH FOR EXPLANATIONS.

THE AREA IDENTIFIED BY "A" WOULD BE
DESCRIBED AS: W1/2 SEC. 22, T5N, R7W, MDB&M
AREA "B" IS: E1/2 SEC. 22, T5N, R7W, MDB&M
<table>
<thead>
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</thead>
<tbody>
<tr>
<td>AREA &quot;C&quot; WOULD BE: N1/2 SEC. 22, T5N, R7W, MDB&amp;M</td>
<td>01-18-I244 VG</td>
</tr>
<tr>
<td>AREA &quot;D&quot; WOULD BE: S1/2 SEC. 22, T5N, R7W, MDB&amp;M</td>
<td></td>
</tr>
<tr>
<td>THESE WOULD BE 1/2 OF 640 ACRES OR 320 ACRES.</td>
<td></td>
</tr>
<tr>
<td>2. Sections can further be broken down into 1/4 sections.</td>
<td></td>
</tr>
<tr>
<td>INSTRUCTOR WRITE EXAMPLES ON BOARD.</td>
<td></td>
</tr>
<tr>
<td>USE THE VIEWGRAPH FOR EXPLANATIONS.</td>
<td></td>
</tr>
<tr>
<td>Section divided into quarters (1/4 Sec.).</td>
<td></td>
</tr>
<tr>
<td>Descriptions:</td>
<td></td>
</tr>
<tr>
<td>A = NW 1/4 Sec. 22; T5N, R7W, MDB&amp;M</td>
<td></td>
</tr>
<tr>
<td>B = NE 1/4 Sec. 22, T5N, R7W, MDB&amp;M</td>
<td></td>
</tr>
<tr>
<td>C = SW 1/4 Sec. 22, T5N, R7W, MDB&amp;M</td>
<td></td>
</tr>
<tr>
<td>D = SE 1/4 Sec. 22, T5N, R7W, MDB&amp;M</td>
<td></td>
</tr>
<tr>
<td>3. Quarter sections can further be divided into half or quarter-parcels containing 80 and 40 acres respectively.</td>
<td></td>
</tr>
<tr>
<td>INSTRUCTOR WRITE DESCRIPTIONS ON BOARD.</td>
<td></td>
</tr>
<tr>
<td>EXPLAIN HOW QUARTER SECTION AND QUARTER-QUARTER SECTIONS ARE DERIVED. WRITE DESCRIPTIONS ON BOARD.</td>
<td></td>
</tr>
<tr>
<td>4. Sections can reasonably be broken down to 10-acre parcels on one-half inch equals one mile maps, and to 2-1/2-acre parcels on one inch equals one mile or larger scales.</td>
<td></td>
</tr>
</tbody>
</table>
I. Other Systems of Land Description

Although the Rectangular System of Survey is the official method of land description in the U.S., other systems are also legal land divisions.

1. Longitude and latitude
   a. Common in Alaska due to large unsurveyed areas.
   b. Longitude is based on the prime meridian and divides the earth into vertical divisions (east and west).
   c. Latitude is based on the equator and divides the earth horizontally (north and south).
   d. A 7-1/2-minute topographic quad depicts 7-1/2 minutes of longitude and latitude.

2. Metes and bounds
   a. Metes and bounds is a system of establishing boundaries of tracts of land by reference to natural or artificial monuments along it, as distinguished from those established by beginning at a fixed starting point.
   b. In the Eastern United States, a common method of land division is metes and bounds.
### OUTLINE

<table>
<thead>
<tr>
<th>3. Spanish Land Grants</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. In the Western United States Spanish Land Grants have no sections, townships, or ranges.</td>
</tr>
<tr>
<td>b. These grants were exempted from survey by the rectangular system.</td>
</tr>
<tr>
<td>c. For field observations you can just continue known range and township lines into the grant and use the rectangular legal description.</td>
</tr>
</tbody>
</table>

H ave students complete pages 3, 4, 5, and 6 in the student workbook. Allow 15 minutes. Discuss answers to exercises.
DETAILLED LESSON PLAN OUTLINE

CURRICULUM:
Incident Command System

COURSE:
I-244 Field Observer/Display Processor

UNIT:
1-Identify and Interpret Maps

LESSON:
5-Other Common Maps and Symbols

SUGGESTED TIME:

OBJECTIVES:
Upon completion of this lesson, the trainee should be able to:

- Interpret common symbology used by:
  - a. NFPA,
  - b. Street Atlas,
  - c. ICS maps.

TRAINING AIDS:
Chalkboard, overhead projector, Street Atlas
I. Introduction

PRESENT LESSON OBJECTIVES

How many of us take maps for granted? How many of us have been lost and would have given plenty for one? Most maps are easy to use if you are familiar with them before you need them. However, they can be nearly useless unless you are able to identify the symbols used, and the distances between points or areas involved. Many situations have occurred where such data was misinterpreted causing unnecessary delays and problems, or escalation leading to increased damages, injury and death.

II. Presentation

A. We have discussed United States Geological Survey (USGS) Maps and symbols in past sessions.

INSTRUCTOR ASK CLASS "HOW MANY COMMON TYPES OF MAPS CAN YOU IDENTIFY OTHER THAN USGS?"

LIST ON BOARD SHOULD INCLUDE FOLLOWING:

- NFPA (NATIONAL FIRE PROTECTION ASSN.)
- STREET ATLAS
- ICS (INCIDENT COMMAND SYSTEM)
- MILITARY
- OIL AND GAS
- AVIATION MAP
- NAUTICAL CHART
- SOIL-VEGETATION MAP
### OUTLINE

<table>
<thead>
<tr>
<th>B. Aviation, nautical, and soil-vegetation maps or charts would generally be used by individuals specially trained in their use.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An Aviation map is a pilot's or F.A.A. &quot;air highway map.&quot;</td>
</tr>
<tr>
<td>2. Nautical chart is the seagoing equivalent of the aviation map.</td>
</tr>
<tr>
<td>3. Soil-vegetation maps classify soil for the support of vegetation. These can be used in predicting erosion factors after flooding or storm damage. They are used after the fact in major fires to determine the amount and type of reseeding necessary to rehabilitate the area.</td>
</tr>
</tbody>
</table>

EXPLAIN THEIR USE IN PRESCRIBED FIRE PLANNING.

DISPLAY STREET ATLAS.

<table>
<thead>
<tr>
<th>C. A Street Atlas is one of the most commonly used general purpose maps.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Thomas Bros. Guide is a popular street atlas.</td>
</tr>
<tr>
<td>The Key Map in the front of the book is an artery map of the entire area, designating the most direct route from one community to another. The Key Map also ties the individual map pages together, giving you an overall picture of the area.</td>
</tr>
</tbody>
</table>
The individual page numbers are given, making it possible to turn quickly to the detailed map of the city.

EXPLAIN THE USE OF THIS MAP BOOK. DEMONSTRATE FOLLOWING A STREET FROM PAGE TO PAGE, MAP TO MAP. EMPHASIZE THE IMPORTANCE OF READING THE INSTRUCTIONS. EXPLAIN THE LEGEND PAGE.

ASK: "HOW MANY OF YOU USE NFPA SYMBOLS OR SOMETHING LIKE THEM ON PRE-FIRE PLANS?"

D. NFPA Symbology

HAND OUT NFPA SYMBOLOGY.

1. Common Pre-fire plan symbols
2. Point out that Uniform Building Code and Uniform Fire Code do not have any standard symbols.
3. If any symbols could be UFC or UBC it would be those used by NFPA which are adopted from the Western Actuarial Bureau.

E. ICS Symbology

HAND OUT ICS OPERATIONAL SYMBOLOGY.

1. Operational symbols are found on Response Booklet Maps. This data is printed in red.

HAND OUT ICS DISPLAY SYMBOLOGY.

2. Display symbology is used on incident maps to indicate facilities and status.
ALLOW 10 MINUTES FOR WORKBOOK EXERCISE.

P. Military, Oil and Gas
These maps and symbols are used in a joint military operation, or on a military base, or when working in or around oil and gas fields.

GIVE EXAMPLE OF USING MILITARY MAPS ON AN INCIDENT SUPPORTED BY ACTIVE ARMY OR NATIONAL GUARD TROOPS.

III Summary

EMPHASIZE THE IMPORTANCE OF STUDYING THE MAP MARGIN INFORMATION BEFORE PROCEEDING INTO CALCULATIONS OR MAPPING. TELL THE STUDENTS TO "GET A FEEL" FOR THE MAP BEFORE GETTING BOGGED DOWN IN THE DETAILS.

Most maps and map symbols are approved and adopted by the U.S. Board of Surveys and Maps. Even with what we have covered here, you may have occasion to encounter completely foreign maps and symbols. If this occurs, inquire about information as to symbol identification. Usually they are readily available or can be obtained upon request. Remember, information on any map must be able to be deciphered to be of use. It is not a bad idea to have a chart of commonly used symbology on maps you work with available at all times.

DISTRIBUTE UNIT 1 QUIZ.

ALLOW 30 MINUTES FOR QUIZ
MAP INFORMATION

What is required on the maps:

I. Base Map - - - Cover with Mylar

1. ICP Location (sometimes) (New Mylar each Operational Period)
2. Base Location (sometimes) (If you know the ICP and Base will not be relocating, then put on base map)
3. Point of Origin
4. "Stand"
5. Burn Period
6. Safety Hazards
7. Completed Dozer Line
8. Completed Line Construction

II. Situation Unit Map

1. ICP Location
2. Base Location
3. Camp Location
4. Staging Area
5. Heliports
6. Helibase
7. Incident Origin
8. Uncontrolled Fire Edge
9. Spot Fires
10. Hot Spots
11. Water Sources
12. Local Area Environmental Data
13. Fire History
14. Post Map Symbology
15. "Stand"
16. Fire Spread Predictions
17. Branches and Division Bound
18. Planned Fire Line
19. Planned Secondary
20. Proposed Dozer Line
21. Size of Fire (Acreage)
22. Wind / Speed and Direction
23. Drop Points

III. Planning Meeting Map

1. Same as Situation Unit map

IV. Planning Meeting Sketch Map (Butcher Paper)

1. Point of Origin
2. Roads
3. Drainages
4. Ridges
5. Fire Area
6. Size of Fire (Acreage)
7. "Stand"
8. Division and Branch Boundaries
9. Shift - Day or Night

V. Incident Command Post Map - Mylar

Same as Situation Unit map but could be on a smaller scale map
VI  General Display Map - Mylar

Same as Situation Unit map but could be smaller scale map

VII  Operational Briefing Map - Mylar

Same as Situation Unit Map

VIII  Incident Action Plan Map

1. Try to Keep 8 1/2" X 11" Size
2. Size of fire (Acreage)
3. Branch and Division Boundaries
4. Roads
5. Drop Points
6. Staging Area
7. Base Heliport
8. Wind direction and speed
9. Safety Hazards
10. Spot Fires
11. Hot Spots
12. Completed hand line
13. Completed dozer line
14. Uncontrolled fire line
15. Water sources
16. "Stand"
17. Day or night shift
MAPS TO BE PROCESSED IN SITUATION UNIT

1) Situation Unit Map
   a. on mylar and topog.
   b. always remain in unit.
   c. Each shift adds new mylar over old for burning periods and only
      Display Processors on S.U.L. touch it.-Keep a clear mylar cover
      over map to prevent damage to map.
   d. update regularly-

2) ICP Display Map
   a. same as la.
   b. same as lc.
   c. same as ld.

3) General Display Map
   a. same as la.
   b. same as lc.
   c. same as ld.

4) Planning Meeting & OPS Display Map
   a. same as la.
   b. same as lc.
   c. same as ld.

** 5) Fire Information & Media Map
   a. same as la.
   b. same as ld.-*but clear info to be put on map with P.S.C.
** This map-map be optional

6) Planning Meeting Sketch Map
   a. drawn on butcher paper, 1 or more for each operational period as needed.
   b. include proposed predictions, secondaries and burns
   c. Keep simple - include major roads, drainages, ridges
   d. include acreage

7) Operational Meeting Sketch Map
   a. same as 6a.
   b. same as 6b.
   c. same as 6c.
   d. same as 6d.

8) General Display Sketch Map
   a. same as 6a.
   b. same as 6b. *clear with P.S.C.
   c. same as 6c.
   d. same as 6d.
9) Fire Information & Media Sketch Map - maybe optional, check with P.S.C.
   a. same as 6a.
   b. same as 6c.
   c. same as 6d.

10) Incident Action Plan Map
    a. draw on 8½" x 11" or 8½" x 14" type paper or in most cases
       reduced topog. map & incorporated into I.A.P.
    b. insure map & narrative instructions can be easily read
    c. map may be in sections depending on size of fire
    *** d. may have grid system set-up but insure all people on fire are
         using same grid system on all maps & approved by P.S.C. & I.C.

11) External Traffic Plan Map (map from Hwys to ICP or Base Camp)
    a. can use admin. map or Thomas Bros equivalent
    b. same as 10b.
    c. map may be in sections depending on distance
    d. include odometer readings

12) External Traffic Plan Map (map or maps from Base Camp or Spike camps, ICP
     or Staging to Incident)
    a. same as 11a.
    b. same as 10b.
    c. same as 11c.
    d. same as 11d.

13) Facilities or Internal Traffic Flow Map
    a. drawn in conjunction with Facility Unit, Ground Support & possibly
       Staging Managers.
    b. drawn on 8½" x 11" or 8½" x 14" bond paper
    c. same as 10b.
    d. incorporate all internal facilities and arrows showing traffic
       flow pattern and parking.

*These maps are generally all to be produced as needed and kept as a part
of Fire history each shift.

* Remember to use S.T.A.N.D. in all mapping
  Scale
  Title
  Author
  North arrow
  Date & time

*More maps than those mentioned here may be required but generally it is
incident specific.

* Always gain approval on any map before releasing for public purusal or
  use.
Suggested Input Items

1. Weather, time, wind speed / direction, RH, cloud cover.
2. Fuels; type, continuity.
3. Slope; maximum slope, location.
4. Water source, type, size, location.
5. Arc sites; location, type, arc representation.
6. Utilities; telephone, electric, microwave, gas/water lines.
7. X-Spots
8. Steep Terrain; (Slope Reading).
9. Nature problems; (bees, mine shafts, etc.)
10. Islands of Fuels.
11. Possible Re-Burn areas
12. Public; Shooting, hikers, residences, etc.
13. Medivac situation (build in situations)
14. Crew trapped (heliport location)
15. Hazard waste dump site.
16. Landmarks (bench marks)
17. Change in fire behavior
18. Resource input; equipment, personnel
19. Hazards; (With Safety) road, individuals
20. Distances
21. Division Freaks
22. Holding lines
23. Audiogram
24. Bearings and distances
25. ?? ?? ?? ?? ??
Unit 2

Map Calculations
STUDENT WORKBOOK

Unit 2

Comparison Scale

Use the Cajon Topographic Map for this exercise. What is the
distance in feet between spot elevation 4927 in the SW 1/4 of
Section 9, T2N, R5W and spot elevation 5461 in NW 1/4 of
Section 15, T2N, R5W? ___________________________ 6200 ft.

How far in miles? ___________________________ 1.2

The road that passes through spot elevation 4927 goes to spot
elevation 5461. How many feet are between these points?

HINT: Use a piece of paper and put one corner at 4927. Lay
the edge of the paper along the road. Where the road leaves
the edge of the paper, place your pencil point on the paper
then pivot the paper until the road is lined up again. Keep
repeating this process until you reach elevation 5461. Compare
the distance from your final mark to the starting corner of the
paper with the comparison scale.

How many feet between 4927 and 5461? ___________________________ 7920 ft.

How many miles? ___________________________ 1 1/2 miles
You have used a ruler and determined that the distance between two points on the Cajon quad is 4". Using the quad representative fraction, answer the following questions in the next 10 minutes.

How many on-ground inches are there between the two points? 96,000

How many feet? 8,000

The Cajon quad depicts an area 18-3/4" wide. How many miles does this represent? 7.1 miles

\[ \frac{18.75 \times 24000}{12} = 5280 \]
STUDENT WORKBOOK

Unit 2

Determining Elevation

Use the Cajon Quad for this exercise.

What is the contour interval of this map? 40 ft.

The distance between heavy contour lines is how many feet? 200 ft.

What is the elevation of Lost Lake? 2780 ft.

In the NW 1/4 of Section 17, T2N, R5W, what is the elevation of the X labeled "Prospect"? 3490 ft.

Is the Prospect on a ridge or in a draw? Ridge

If you are standing at the corner of Sections 8, 9, 16 and 17 of T3N, R5W and walked due South 80 chains, what would the elevation be? 4,120 ft.
STUDENT WORKBOOK

Unit 2

Determining Slope

Use the Cajon Quad for this exercise.

Remember back when you calculated the distance between elevations 4927 and 5461? Now determine the per cent of slope between these points. __________%

You get in your vehicle and drive north on I-15 from San Bernardino until you reach the section line between Sections 18 and 7 of T2N, R5W. You park your vehicle and follow the section line east on foot. What is the steepest percent of slope you will encounter within 2,000 meters of I-15?

_____________________

\[
\frac{2880 - 4180}{\frac{1400}{6564}} = \frac{480}{1400} = 34.28\%
\]
STUDENT WORKBOOK

Unit 2

Slope Calculator

Use the slope calculator to estimate slope between the Prospect in the NW 1/4 of Section 17, T2N, R5W and the miner's shack due south. What is the percent of slope? 35°

How many contour lines did you count inside the circle?
STUDENT WORKBOOK

Unit 2

Determining Area

1. On the Street Atlas map on the next page, determine the square blocks of the area bounded by:

U Street on the south (horizontal grid 6)
16th Street on the west (vertical grid C)
P Street on the north (horizontal grid 5)
21st Street on the east (vertical grid D)

Area is 25 square blocks.

2. How many square feet in this area? 4000000
Use the Cajon quad for the rest of these questions.

We determined that this topog was 7.1 miles wide. How many square miles are depicted on this map? \( \text{61} \text{ sq.miles} \times \frac{7.1}{2.6} = \text{61} \text{ sq.miles} \)

How many total acres? \( \text{39,040} \)

Look at the E 1/2 of Section 17, T3N, R5W. You should see a road that runs from the north section line to the south section line. Use the chain method to calculate the area east of this road bounded by the section lines.

What is the average width in chains of this area? \( \text{15 chains} \)

The area is ___120_______ acres.
Look at NW 1/4 of the SW 1/4 of Section 8 T2N, R5W. Locate spot elevation 4905. Now locate contour interval 4800. Calculate the area inside this contour interval. 12.5 acres

Locate Cajon Junction on I-15. Follow Highway 138 northeast 2-1/2 miles to BM 3515. Turn right on the private road and follow it southwest back to I-15. From here, drive back to Cajon Junction. Use a dot or acreage grid to determine the acreage inside the route you just traveled. 690 acres.
Use the Cajon Topographic Map for this exercise.

About halfway up your map on the righthand margin, you will see a black line (---) that designates the National Forest Boundary. Estimate the acreage of the area north of the Forest boundary. Use sections, half sections, and quarter sections for your estimate.

The area is roughly 8,780 acres.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 2-Make Map Calculations

LESSON: 1-Determining Distance, Elevation, and Slope

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Measure distance using a comparison scale.

2. Calculate distance using representative fractions.

3. Convert distances into other units of measure.

4. Determine elevations using bench mark and spot elevations.

5. Determine elevation from contour lines.

6. Determine percent of slope.

TRAINING AIDS: Student workbooks, rulers, scratch paper, overhead projector, screen, map wheel, dot grid/slope calculators.
I Introduction

PRESENT LESSON OBJECTIVES

One of the most common uses of maps is to determine the distance between points. In addition to determining distance, a topographic map can be used to determine the elevation of any point on the map. This lesson will cover various methods of calculating horizontal distance on a topographic map.

II Presentation

DRAW SCALE ON BOARD.

A. Comparison Scales

1. Most topographic maps have a comparison scale in the bottom margin.

2. Commonly used units of measurement such as miles, feet, and kilometers are graphically displayed.

3. The comparison scale is a direct representation of distance between a map and the ground.

POINT OUT COMPARISON SCALE ON MAP.

ALLOW 10 MINUTES FOR WORKBOOK EXERCISE.

B. Representative Fractions

1. A representative fraction (R.F.) is different from a comparison scale in that the distance is related in LIKE UNITS -- inches to inches, feet to feet.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. The scale on a 7-1/2 minute</td>
<td></td>
</tr>
<tr>
<td>topographic map is 1 to 24,000.</td>
<td></td>
</tr>
<tr>
<td>3. This means that one inch on the map is</td>
<td></td>
</tr>
<tr>
<td>equal to 24,000 inches on the ground.</td>
<td></td>
</tr>
<tr>
<td>4. You can convert ruler distance to map</td>
<td></td>
</tr>
<tr>
<td>distance by measuring the distance between</td>
<td></td>
</tr>
<tr>
<td>points on a map in inches and then</td>
<td></td>
</tr>
<tr>
<td>multiplying by the representative fraction</td>
<td></td>
</tr>
<tr>
<td>found in the map margin.</td>
<td></td>
</tr>
<tr>
<td>DEMONSTRATE CALCULATIONS ON CHALKBOARD.</td>
<td></td>
</tr>
<tr>
<td>5. This will give you the &quot;on ground&quot;</td>
<td></td>
</tr>
<tr>
<td>horizontal distance in inches.</td>
<td></td>
</tr>
<tr>
<td>6. Divide this &quot;on ground&quot; figure by 12 (the</td>
<td></td>
</tr>
<tr>
<td>number of inches per foot) to give you the</td>
<td></td>
</tr>
<tr>
<td>&quot;on ground&quot; horizontal distance in feet.</td>
<td></td>
</tr>
</tbody>
</table>

ALLOW 10 MINUTES FOR WORKBOOK EXERCISE

SHOW MAP WHEEL. INVITE STUDENTS TO TRY IT DURING BREAKS, ETC.

C. The map wheel is a mapping tool which allows you to measure distance by rolling this instrument along the map distance to be measured.

1. The map wheel may be obtained at any surveying equipment outlet.

2. Several types may be found.
D. Determining Elevations

ASK TRAINEES TO GIVE REASONS WHY ELEVATION MAY BE IMPORTANT TO A FIELD OBSERVER.

1. Elevation can be determined by using spot elevations and bench marks.

   a. Spot elevations are indicated on topographic maps in a number of ways. They can be shown as an "X" with the elevation designated next to it or simply as the elevation designated on the map.

   b. Bench marks are more exact elevations than spot elevations. Bench marks are permanent or semi-permanent markers that can be located on the ground.

   

OUTLINE

| a. Some types measure the distance in actual inches, and these measurements in turn must be computed using the representative fraction for that scale map. |
| b. Others can be adjusted to fit the commonly used topographic map scales, and these will give you actual distance on the ground. |

KEY POINTS & AIDS
<table>
<thead>
<tr>
<th>OUTLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Bench marks are also indicated in a number of ways on a topographic map.</td>
</tr>
<tr>
<td>2) They can be shown as a triangle with a dot in the center, or as an &quot;X&quot; followed by the elevation. The letters &quot;BM&quot; or &quot;VABM&quot; (vertical angle bench mark) usually proceed the symbol and elevation.</td>
</tr>
</tbody>
</table>

2. Elevation can be determined by using contour lines.
   a. In order to use contour lines the contour interval must be determined from the map margin.
   b. Count the contour lines between the point in question and a known elevation, such as a heavy contour line.
   c. Multiply the number of lines by the contour interval.
   d. By adding or subtracting this number from the known elevation, the elevation of the point in question can be determined.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>e. If the point in question lies between contour lines, estimate the elevation of that point.</td>
<td>Wkbk pg. 10 Solution: Inst. Guide, pg. 69</td>
</tr>
</tbody>
</table>

**ALLOW 10 MINUTES FOR WORKBOOK EXERCISE.**

**E. Determining Slope.** Slope can be very important to the control of an incident. The degree of slope will dictate the direction and speed of liquid flow as in a flood or gasoline spill. Slope will influence the direction and rate of spread of a fire. Slope will be important in determining whether access to an incident will be possible for engines, dozers, mobile cranes, large trucks, or even people!!

**DISCUSS IDEA OF SLOPE: RATE OF RISE OR FALL OF THE GROUND.**

1. Slope can be defined as the degree of steepness.

2. Slope is usually expressed in percent.

3. A one percent slope indicates a rise or drop of one vertical unit over a distance of 100 horizontal units. Usually the mapper will be working with feet; therefore, a one percent slope rise would indicate a one foot rise over a 100-foot horizontal distance.
4. To determine slope, first calculate the horizontal distance between given points. This horizontal line cannot cross ridges or drainages.

5. Then calculate the elevation difference between the given points.

6. Divide the horizontal distance into the elevation difference.

7. Multiply this figure by 100 to find percent of slope.

   ILLUSTRATE ON BOARD

   \[ H = \text{HORIZONTAL DISTANCE} = 1500' \]

   \[ V = \text{ELEVATION DIFFERENCE} = 300' \]

   \[ \% \text{ SLOPE} = \frac{V}{H} \times 100 \]

   \[ \frac{300'}{1500'} = .2 \]

   \[ .2 \times 100 = 20\% \text{ SLOPE} \]

8. This can also be expressed as a 20 foot rise in elevation for every 100 feet of horizontal distance.

9. Because contours are seldom uniform, it must be remembered that this slope is an AVERAGE only.

ALLOW 10 MINUTES TO DO WORKBOOK EXERCISE ON SLOPE.

HAND OUT SLOPE CALCULATORS
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Slope Calculator.</td>
<td></td>
</tr>
<tr>
<td>a. An acetate overlay for</td>
<td></td>
</tr>
<tr>
<td>calculating slope is helpful when</td>
<td></td>
</tr>
<tr>
<td>available.</td>
<td></td>
</tr>
<tr>
<td>b. These calculators are</td>
<td></td>
</tr>
<tr>
<td>commonly used for 7-1/2</td>
<td></td>
</tr>
<tr>
<td>minute and 15-minute</td>
<td></td>
</tr>
<tr>
<td>topographic maps.</td>
<td></td>
</tr>
<tr>
<td>c. Place circle over area.</td>
<td></td>
</tr>
<tr>
<td>d. Count contour lines within</td>
<td></td>
</tr>
<tr>
<td>circle (do not count across</td>
<td></td>
</tr>
<tr>
<td>ridges and creeks)</td>
<td></td>
</tr>
<tr>
<td>e. In table, find number of</td>
<td></td>
</tr>
<tr>
<td>contour lines counted (next to</td>
<td></td>
</tr>
<tr>
<td>proper contour interval for your</td>
<td></td>
</tr>
<tr>
<td>quad) and read percent slope at</td>
<td></td>
</tr>
<tr>
<td>bottom.</td>
<td></td>
</tr>
</tbody>
</table>

**DEMONSTRATE SLOPE CALCULATOR. ALLOW 5 MINUTES TO DO WORKBOOK EXERCISE.**

Wkbk. pg. 12
Solution: Instr. Guide, pg. 73
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 2-Make Map Calculations

LESSON: 2-Determining Area

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to determine area by:

1. Mathematical calculations
2. Dot and acreage grid overlays
3. Estimation

TRAINING AIDS: Overhead projector, screen, matte acetate overlay for each student, chalkboard.
### I Introduction

**PRESENT LESSON OBJECTIVES**

An important calculation in the analysis of data is the calculation of area. Area can be expressed in square miles, acres, blocks, feet, or any other unit of linear measurement, squared. In this lesson we will use a number of methods to calculate area.

### II Presentation

#### A. Mathematical calculations

Basic mathematical calculations involve determining the perimeter of a given area and then calculating the size of the area.

1. The most common calculation will be measuring length and width and then multiplying the two.

REFER TO HANDOUT ON AREAS CONVERSION.

2. Some units of measure you can use are:

   a. A mile is 5,280 feet long.
   
   b. An acre is 208 feet by 208 feet.
   
   c. A chain is 66 feet long.
   
   d. There are 80 chains in a mile.
   
   e. An acre is 10 chains square.
   
   f. An acre contains 43,560 square feet.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>g. A square mile is 640 acres.</td>
<td></td>
</tr>
<tr>
<td>h. A section is one mile square.</td>
<td></td>
</tr>
<tr>
<td>i. A quarter section contains 160 square acres.</td>
<td></td>
</tr>
<tr>
<td>3. These figures can be used for working calculations of area.</td>
<td></td>
</tr>
<tr>
<td>4. For more exact calculations, more sophisticated devices can be used for area determination.</td>
<td></td>
</tr>
</tbody>
</table>

B. One of the most common units of area measurement is the acre.  

1. When you first arrive at an incident and are asked for an estimated acreage, you do not have the time to follow the exact steps for computing acreage. You can, however, use this information as the basis for making a good guess. The more you know about the figuring of acreage, the easier it is to become an accurate estimator.  

2. The important thing to remember when figuring the acreage of an area is that it must be figured as a square. The term "square" does not mean to imply having equal sides, but merely straight lines with right angles. Both the length and the width must be figured.
a. Chain Method
66 ft. equals 1 chain:
10 square chains equal 1 acre. The important
factor in computing
acreage by the chain
method is the fact that
10 square chains equals
one acre. This is the
conversion factor from
chains to acres. It is
accomplished by
computing your total
square chains and
dividing by 10.

INSTRUCTOR SHOW EXAMPLES ON BOARD.

1. A RECTANGULAR AREA 5 CHAINS x 10 CHAINS
   = 5 ACRES

   \[ L(10) \times W(5) = 50 \text{ DIVIDED BY 10 (OR MULTIPLIED BY .1)} = 5 \text{ ACRES} \]

2. TO COMPUTE AN ODD SHAPED AREA, IT IS
   OFTEN NECESSARY TO TAKE TWO OR MORE
   MEASUREMENTS ACROSS THE AREA AND OBTAIN
   AN AVERAGE LENGTH AND WIDTH.

INSTRUCTOR PUT EXAMPLE OF IRREGULAR AREA ON
BOARD. USE THE FIGURES BELOW TO ILLUSTRATE
AREA COMPUTATION.

THE AREA IS 32 CHAINS WIDE AT ONE END AND
16 CHAINS WIDE AT THE OTHER. THE LENGTH IS
48 CHAINS.

   32 PLUS 16 EQUALS 48 CHAINS. 48
   DIVIDED BY 2 EQUALS 24 CHAINS.
   (AVERAGE WIDTH)

   48 (LENGTH) MULTIPLIED BY 24 (AVERAGE
   WIDTH) EQUALS 1152.

   1152 DIVIDED BY 10 EQUALS 115.2 ACRES.
b. The foot method is the same as the chain method except that it is figured in feet.

INSTRUCTOR PUT EXAMPLE ON BOARD. USE THE FIGURES BELOW TO ILLUSTRATE AREA COMPUTATION.

\[ L = (2640 \text{ ft.}) \times W(1320) = 3,484,800 \]
\[ \text{DIVIDED BY } 43,560 = 80 \text{ ACRES.} \]

HAVE STUDENTS USE CHAIN METHOD TO CALCULATE SAME PROBLEM. DISCUSS WHICH METHOD SEEMS EASIER. (L=40 CHAINS, W=20 CHAINS)

HAND OUT DOT AND ACREAGE GRIDS.

C. Dot and Acreage Grids

1. Transparent overlays can be used to determine acreage.

2. Used most frequently on topographic and orthophoto maps.

3. Determine representative fraction scale of map. The grid must be of the same scale or have a conversion chart with it.

When using dot grids with maps of a different scale,

a. Determine acres per dot - this is done by:

Counting the number of dots in one Section on your base map. The majority of maps used for resource purposes and which you will be
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>using as a base map have Range, Township, and Sections delineated.</td>
<td></td>
</tr>
<tr>
<td>One section equals 640 acres.</td>
<td></td>
</tr>
<tr>
<td>Divide 640 by the number of dots in one Section to determine acres per</td>
<td></td>
</tr>
<tr>
<td>dot.</td>
<td></td>
</tr>
<tr>
<td><strong>INSTRUCTOR ILLUSTRATE FORMULA ON BOARD:</strong></td>
<td></td>
</tr>
</tbody>
</table>
| \[
| \frac{640}{\text{# of dots}} = \text{acre per dot} \]
|                                                                         |                   |
| **b.** Count the number of dots in the area which you are computing.   |                   |
| Dots which fall on the boundary of the area should be counted          |                   |
| alternately.                                                           |                   |
| **c.** Multiply the total number of dots counted in Step 2 above times |                   |
| the acres per dot figure calculated in Step 1. This figure gives you  |                   |
| the acreage for the area which you are computing.                     |                   |

4. Dot Grid

**a.** Lay transparency over the area to be calculated.

**b.** Count the number of dots (acres) inside the area.

**c.** For dots that are on the perimeter lines, count every other dot.
5. Acreage Grid
   a. Lay transparency over the area to be calculated.
   b. Count the number of squares (acres) inside the perimeter.
   c. Estimate the acres in those squares that are on the perimeter lines.

HAND OUT MATTE ACETATE OVERLAYS

6. Use of Acetate Overlays
   a. Matte acetate can be very helpful when making map calculations. It can be written on with a lead pencil, erased and used again. The lead pencil will not smear on the acetate.
   b. Lay the acetate over the map with the shiny side down.
   c. Trace the perimeter onto the acetate.
   d. Place the acetate on the dot or acreage grid with the shiny side down.
   e. Now you can cross out the dots or squares as you count them.
   f. To make counting easier, remove the acetate with the perimeter drawn on it and place it on a blank sheet of paper.
ALLOW 20 MINUTES TO DO WORKBOOK EXERCISE.

D. Area Estimation

1. As a Display Processor, the estimation of acreage must be accurate. The Field Observer area estimates can be much rougher.

ASK STUDENTS TO EXPLAIN ABOVE STATEMENT.

2. When estimating, compare areas of known size such as:
   a. A football field - 1 acre.
   b. The lot that your house is on.
   c. Other known areas.

3. Use common sense when estimating area on a map.
   a. If the area is entirely within a single Section, it can't be more than 640 acres.
   b. Compare acreage estimates to Section divisions; half-Sections, quarter-Sections, etc.
   c. During the last workbook exercise (page 15), you calculated the area bordered by a road and Section lines.
   d. Your acreage was 110-120 acres.

Wkbk pgs. 13-15
Solution:
Instr. Guide,
pgs. 82-84
HAVE STUDENTS REFER TO CAJON TOPOGRAPHIC MAP.

LOOK AT THIS PIECE OF PROPERTY AGAIN. THE WIDE END (SOUTHERN END) IS ABOUT 1/3 OF A SECTION WIDE.

DIVIDE THE SECTION INTO THIRDS. YOU WILL SEE THAT THE AREA IN QUESTION IS ROUGHLY ONE-HALF OF ONE-THIRD OF A SECTION. THE ESTIMATE OF 110-120 ACRES IS PRETTY CLOSE TO HALF OF A THIRD.

THIS IS A LOGICAL WAY TO CHECK YOUR AREA ESTIMATES.

ALLOW 10 MINUTES TO DO WORKBOOK EXERCISE.

HAND OUT ACREAGE CHART.

4. An acreage chart can be used for estimating area.
   a. Determine area length and width.
   b. Lay a straight edge on the length in column A and on the width in column C.
   c. Read acreage where the straight edge crosses column B.

Distribute Unit 2 Quiz

Allow 15 minutes for Quiz.
Unit 3

Observation Aids
USE THE CAJON TOPOGRAPHIC MAP FOR THIS EXERCISE.

As a Display Processor, you may be required to write a Traffic Plan. As a Field Observer, you will be required to gather information for this Plan. Play both roles and write a narrative Traffic Plan explaining how to get from Summit Base to Sage Brush Staging Area. Use miles and tenths so that Strike Team Leaders can get their resources to the Staging Area by using their odometers. Use the Actual Cajon Topographic Map for your calculations, and the map on page 19 for a scratch copy.
Use the Cajon Topographic Map for this exercise.

Locate Cleghorn Mountain in Section 4 T2N, R5W. What true compass reading from Cleghorn Mountain to 4217 in Section 33, T3N, R5W?

Locate Cajon Mountain Lookout, about a mile and a half from Cleghorn Mountain. The lookout reports a smoke at 1660 feet 5 miles. Describe the area where you think the smoke will be.

A newly constructed lookout at spot elevation 12, T2N, R6W gives a cross reading of 1660 feet, 5 miles. Does this line cross with the line from your answer above within a 10th of a mile from your answer above? Set your readings.

-20-
1. From 1 (Church) to 2 (Lake) ........................................ 6. From 4 to 2 ........................................
2. From 2 (Lake) to 3 (Hill) ........................................ 7. From 1 to 6 ........................................
3. From 3 (Hill) to 4 (Quarry) .................................... 8. From 5 to 1 ........................................
4. From 4 (Quarry) to 5 (Bridge) .................................. 9. From 3 to 6 ........................................
5. From 5 (Bridge) to 6 (Cemetery) ............................... 10. From 2 to 4 ........................................

Read instructions for this practice on page 30. Using the practicing protractor from the envelope in the back of the book, determine the directions between the points listed. Parallel lines are north-south meridians.
Use of the Polar Planimeter

The polar planimeter is a simple instrument designed to give accurate measurements of plane areas of any shape. The planimeter consists of two units. The pole arm unit is simply a bar with the "pole" or weight with needle point in the bottom on one end and a ball which fits into a socket in the carriage on the other. The tracer arm and carriage unit contains a point which is guided around the area to be measured, and an arm connecting it to the carriage which rides on a measuring wheel.

To measure an area it is only necessary to set the pole, or weight, outside the area to be measured, then run the tracing point clockwise around the periphery of the figure. The measuring wheel records the distance which is read from a dial. Do not worry when, during use, the measuring wheel slides, or reverses itself. This is proper providing it has at all times been in contact with the map. The map should be flat and free of wrinkles.

At the beginning of a measurement the measuring wheel should be turned until the dial reads 0, or better, set the tracing point over a starting point, read the dial, wheel and vernier. The reading is said to be in vernier units, and a complete reading will have four digits, e.g., 0275, or 0275, etc.

The planimeters we will use have non-adjustable tracing arms. (Some planimeters are adjustable and can be set for different map scales as we use to read in convenient numbers.) They read directly in square inches as follows:

<table>
<thead>
<tr>
<th>Reading</th>
<th>Vernier units</th>
<th>Area in sq. in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 unit on vernier</td>
<td>1</td>
<td>.01</td>
</tr>
<tr>
<td>1 Division on wheel</td>
<td>10</td>
<td>.10</td>
</tr>
<tr>
<td>Major Division on wheel (between numbers)</td>
<td>100</td>
<td>1.00</td>
</tr>
<tr>
<td>1 revolution of wheel</td>
<td>1000</td>
<td>10.00</td>
</tr>
<tr>
<td>1 division on dial</td>
<td>1000</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Thus if the first reading (at start of measurement) is 13.76 and the second is 74.91, the difference is 61.15. The area then in 61.15 x .01 sq. in. = .6115 square inches.

To determine distance on the map the scale must be known. Assume this to be 1320 feet = 1 inch, or 4 inches per mile. One square inch of map surface will contain $1320 \times 1320 = 1,742,880$ sq. ft. This divided by 640 acres = 60,150 acres. Or a square inch of map area = .60 acres. Forty acres multiplied by .01 square inch equals = .50 acres in the area planimetered.
PYRAMID LAKE

EMIGRANT LANDING: Swim, picnic, toilet, marina, boat landing
NUGGET POINT: Picnic, toilet, hiking trails
CINNABAR
YELLOWBAR: Picnic, toilet
POWDER KEG
BEAR TRAP: Picnic, toilet, hiking trails
CHUMASH ISLAND: Picnic, toilet
SERRANO: Picnic, toilet, hiking trails
SPANISH POINT: Toilet
WILDHORSE
VAGUERO
BRAZOS
VISTA DEL LAGO
DAM OVERLOOK

TURN OFF at the HUNGRY VALLEY INTERCHANGE, and then go South on Old HWT. 99.

All locations are approximate. The information, rules and regulations are subject to change. Always consult local authorities on current recreation conditions, rules and regulations.

The magnetic north lines are not for navigational use. They are for use in location of your fishing hot spots.

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STREAMSIDE. In Bouquet Canyon. 12 units, trailers, 2500' elevation.
UPPER SHAE: 4 mi. N.W. of Lake Hughes. 18 units, trailers, 4400' elevation. Open May thru Oct.
ZUMI. In Bouquet Canyon. No drinking water, 11 units, no trailers. 2200' elevation.
WARM SPRINGS. 12 camping units, piped water, trailer space, dirt road access, $2.00/vehicle/day.

ROGERS TRAILER CAMP, 6 camping units, reservations required (805) 259-2790, no charge, stream water, access by trail only. Fire permits are required and you must pack out your own refuse.

GROUP COTTONWOOD, Reservations required (805) 259-2790, Camp one site for up to 25 people, piped water, fee/day.
CIENAGA, Reservations required (805) 259-2790, two sites available, Site #1 up to 75 people, Site #2 up to 25 people, piped water, equestrian facilities, $10/50 people/day.
Start at Point 5
Go 32 degrees for 107 feet
Then 158 degrees for 54 feet
Then 186 degrees for 50 feet
Destination reached: No. ....

Start at Point 6
Go 3 degrees for 100 feet
Then 134 degrees for 74 feet
Then 225 degrees for 69 feet
Destination reached: No. ....

Start at Point 7
Go 34 degrees for 119 feet
Then 186 degrees for 50 feet
Then 228 degrees for 74 feet
Destination reached: No. ....

Start at Point 8
Go 346 degrees for 102 feet
Then 139 degrees for 78 feet
Then 211 degrees for 58 feet
Destination reached: No. ....

Start at Point 9
Go 346 degrees for 102 feet
Then 139 degrees for 78 feet
Then 186 degrees for 50 feet
Destination reached: No. ....

Start at Point 10
Go 343 degrees for 104 feet
Then 141 degrees for 64 feet
Then 145 degrees for 61 feet
Destination reached: No. ....

Each participant goes to the marker which has the number that corresponds to the starting point on his card and proceeds according to instructions. When he has finished, he writes down the number of the marker nearest to the destination he has reached (all the routes lead back to markers on the course line) and turns his card over to the judge. The correct destinations for each of the starting points are found on page 104.

If the player reaches the correct destination he receives a score of 100 points. Otherwise, the judge deducts from his score of 100 points 1 point for each foot of error, or 5 points for each marker from the correct one.

Run the game three times with different starting points for a possible maximum score of 300 points.
COMPASS COMPETITION

PURPOSE—Training in following compass bearings and measuring distances by walking. This type of compass competition is particularly suited for school grounds and camp sites. The course can be set up quickly and can remain in location, and large numbers of pupils or campers can try their compass skills under the direct guidance of their teacher or leader. (Devised by Elston F. Larson.)

GROUP PROJECT—Before the start of this compass competition, each participant needs to know the length of his step. So mark off a distance of 100 feet on the ground over which the participants can walk to determine the length of their steps (as described on pages 53-54).

The compass course for the competition consists of twenty markers placed five feet apart on a straight magnetic east-west line. Number the markers consecutively from 1 to 20, with number 1 on the most westerly marker. An alternate, and simpler, method is to tie two loops in the ends of a piece of binder twine or other strong cord, 100 feet apart, and tie tags numbered from 1 to 20 to this cord, five feet apart. All you have to do, then, is to stretch out the cord between two pegs in an east-west direction, with number 1 on the west end.

When ready to start, each participant is provided with an Orienteering compass and with an instruction card telling him at what mark to start and how to proceed. You will find instructions below for the cards of ten players. If your group is larger, either run the participants in several sections or purchase printed instruction-score cards for twenty players from Orienteering Services (see addresses on page 210), or from your local council service center of the Boy Scouts of America.

**Start at Point 1**
- Go 36 degrees for 122 feet
- Then 149 degrees for 58 feet
- Then 235 degrees for 86 feet
- Destination reached: No ...

**Start at Point 2**
- Go 17 degrees for 104 feet
- Then 150 degrees for 52 feet
- Then 142 degrees for 64 feet
- Destination reached: No...

**Start at Point 3**
- Go 38 degrees for 125 feet
- Then 237 degrees for 90 feet
- Then 186 degrees for 50 feet
- Destination reached: No...

**Start at Point 4**
- Go 36 degrees for 122 feet
- Then 174 degrees for 50 feet
- Then 228 degrees for 74 feet
- Destination reached: No...
1. From road-T in Glenburnie to top of Record Hill
2. From Record Hill to crossroad south of BM 474
3. From crossroad south of BM 474 to Camp Adirondack
4. From Camp Adirondack to Log Chapel
5. From Log Chapel to Meadow Knoll Cemetery

1. From Log Chapel to Meadow Knoll Cemetery
2. From Meadow Knoll Cemetery to top of Hutton Hill
3. From top of Hutton Hill to Glenburnie
4. From Glenburnie to top of Record Hill
5. From top of Record Hill to Log Chapel

To make a paper-circle protractor, fold a three-inch square of paper in quarters, then into sixteen segments. Trim to circle shape.
Start at Point 1
Go 36 degrees for 122 feet
Then 149 degrees for 58 feet
Then 235 degrees for 86 feet
Destination reached: No. . . .

Start at Point 3
Go 38 degrees for 125 feet
Then 237 degrees for 90 feet
Then 186 degrees for 50 feet
Destination reached: No. . . .

Start at Point 5
Go 22 degrees for 107 feet
Then 158 degrees for 54 feet
Then 186 degrees for 50 feet
Destination reached: No. . . .

Start at Point 7
Go 34 degrees for 119 feet
Then 186 degrees for 50 feet
Then 228 degrees for 74 feet
Destination reached: No. . . .

Start at Point 9
Go 346 degrees for 102 feet
Then 129 degrees for 78 feet
Then 186 degrees for 50 feet
Destination reached: No. . . .
Figure 4-3  Using a protractor to determine a map bearing.
Figure 4-4  Orienteering compass on map — showing how to align it.
Figure 4-4  Orienteering compass on map — showing how to align it.
Example of use: Find the coordinates of the "X".

The TOPO-aid can be used to determine the longitude and latitude of a point on U.S.G.S. 7.5-Minute minutes on 7.5-Minute maps and 5 minutes on 15-Minute maps.

entire latitude and longitude is given. Between each corner are two additional grid lines at intervals of 2.5 U.S.G.S. Topographic maps indicate the longitude and latitude all 12 places. All four corners have

and 1-5-Minute topographic maps. Or, to find a point for which the coordinates are known.

DIRECTIONS FOR USE OF THE TOPO-AID
First, project the point normal to the nearest borders. Next, place the Topo-Aid™ as shown below between the grid tics that the point falls bet. en. The horizontal bars on the Topo-Aid™ should be parallel to the margin of the map and the outer lines of the Topo-Aid™ should correspond exactly to the width of the grid tics.

To read the Topo-Aid™ use the black scale for 7.5-minute topo maps and the red scale for 15-minute topo maps. Add the reading to the nearest grid tic value to the south for latitude and east for longitude for the example given.

**Longitude**
- 78°55'00" = nearest east grid tic
- 00'19" = Topo-Aid reading
- 78°55'19" (black scale)

**Latitude**
- 35°25'00" = nearest south grid tic
- 1'26" = Topo-Aid reading
- 35°26'26" (black scale)

---

Topo-Aid™ distributed by
Stonetree, Inc.
P.O. Box 335
Waxhaw, N.C. 28173
PRACTICE EXERCISE FOR I-244 FIELD OBSERVER/DISPLAY PROCESSOR COURSE

ACING PRACTICE (3 times)

Flat Ground (66' & 100')
1st 27' 2nd 27' 3rd 40' 2.5' Pace Lgt

Medium Slope (1 ch/66')
1st 25' 2nd 33' 3rd 53' Pace Lgt

Steep Slope (1 ch/66')
1st 51' 2nd 49' 3rd 53' Pace Lgt

THREE LEGGED COMPASS EXERCISE

1. Distance Selected 15'(pc) 2. Magnetic Bearing 0° +120° +120° 34°

How Far Off: 1'st try 3' 2'nd try 1' 3'rd try 1'

ABNEY LEVEL/CLINOMETER PRACTICE

Abney Reading (percent slope) 45° %
Clinometer Reading (percent slope) 40° %

COMPASS AND PACE (closed course) EXERCISE

Sta. 1. 15'(p) 397.5'(ft.) Magnetic Bearing 21° True North 36°
Sta. 2. 15'(p) 287.5'(ft.) Magnetic Bearing 54° True North 68°
Sta. 3. 10'(p) 260'(ft.) Magnetic Bearing 65° True North 79°
Sta. 4. 42'(p) 105'(ft.) Magnetic Bearing 23° True North 41°
Sta. 5. 46'(p) 115'(ft.) Magnetic Bearing 19° True North 205°
Sta. 6. 22'(p) 207.5'(ft.) Magnetic Bearing 170° True North 184°
Sta. 7. 28'(p) 70'(ft.) Magnetic Bearing 25° True North 229°
Sta. 8. 21'(p) 535'(ft.) Magnetic Bearing 213° True North 257°
Sta. 9. 30'(p) 217.5'(ft.) Magnetic Bearing 230° True North 244°
INTERSECTION (Where is it?)

Station 1. Magnetic Bearing \[355^\circ + 13.5^\circ (\text{dec}) = 368.5^\circ (\text{true})\]
Station 2. Magnetic Bearing \[332^\circ + 13.5^\circ (\text{dec}) = 345.5^\circ (\text{true})\]

Remember that it is good to use a third and even forth reading for better accuracy, we will use two for this exercise.

RESECTION (Where am I?)

Station 1. Magnetic Bearing \[355^\circ + 13.5^\circ (\text{dec}) = 368.5^\circ (\text{true})\] (back azimuth)

Station 2. Magnetic Bearing \[302^\circ + 13.5^\circ (\text{dec}) = 315.5^\circ (\text{true})\] (back azimuth)

Remember to plot your bearing on the map "from the location you are shooting on".

EMINDERS: "LARS" 
When converting a MAP BEARING to the field, we SUBTRACT (Right Subtract) the declination.

EXAMPLE: 270 Deg. True (off of the map) is 255 deg. Magnetic (if the Declination is 15 Degrees East).

When we plot a MAGNETIC BEARING on a map we must first ADD the declination to correct for the error.

EXAMPLE: A 90 Deg. Magnetic reading from the compass would read 105 Degrees True (with 15 Degree East). Happy Plotting!!!

**This will always be true when West of the Mississippi!**

"RESECTION" (Where AM I?): You must be able to locate at least 2 locations on the map(s) you are using. They will cross at your location.

"INTERSECTION" (Where Is It?): You take Bearings from at least two known locations. Locating a lightning strike or spot fire are examples of this technique.

"BACK AZIMUTH" (180 Degrees from a bearing) If the bearing is between 0-180 Degrees we Add 180 degrees to get our reading, if its between 181/360 degrees we Subtract to get our reading. EXAMPLES:17+180+197(ba) 280-180=100(ba)
For simple practice in using Orienteering compass, try Three-Legged Compass Walk.
Place marker, add 120 degrees to each setting from original.
True north is the map direction toward the geographical North Pole; magnetic north is the compass direction toward the Magnetic North Pole.

*magnetic north* of your compass and the geology of our continent didn't affect the magnetized needle. But unfortunately, they aren't, and it does.

The result is that...
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 3-Use Observation Aids

LESSON: 1-Aneroid Barometer, Abney Level, and Odometer

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, trainee should be able to:

1. Adjust an aneroid barometer.

2. Determine elevation with an aneroid barometer.

3. Adjust an abney level.

4. Measure percent of slope to within 2% with an abney level.

5. Determine distance with an odometer.

TRAINING AIDS: Overhead projector, aneroid barometers, abney levels or other devices such as clinometer, student workbook.
I. Introduction

II. Aneroid Barometer

The aneroid barometer (altimeter) is a convenient instrument for determining differences in elevation where a low order of accuracy will suffice. It is adapted to use for mapping where distances are paced and 50 feet or greater contour intervals are used. Because barometer readings are affected by constantly changing atmospheric pressures the best results are obtained when it is possible to tie into points of known elevation every 2 hours or less. Avoid using the barometer on days of changing weather conditions.

SHOW ANEROID BAROMETER.

A. Adjustment of Aneroid Barometer

1. Tap the glass lightly with the forefinger.

2. The needle should move slightly each time returning to its original position.

3. Read the instrument at points having a known difference of 50 to 100 feet in elevation such as the top and bottom of a lookout tower or of a building.

4. Several repetitions of this process should establish whether the instrument is reasonably sensitive or how consistently it is in error.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Use</td>
<td></td>
</tr>
<tr>
<td>1. On the movable foot-scale set the known or assumed elevation of the starting point opposite the needle, then read and record successive elevations at subsequent stations together with time of each reading.</td>
<td></td>
</tr>
<tr>
<td>2. Constantly observe the following precautions:</td>
<td></td>
</tr>
<tr>
<td>a. Handle barometer carefully at the time the movable scale is set. Note and record scale reading on it opposite a graduation on the immovable scale (inches of pressure) as a means of detecting accidental movement of the foot-scale.</td>
<td></td>
</tr>
<tr>
<td>b. Tap the instrument gently on the glass before reading.</td>
<td></td>
</tr>
<tr>
<td>c. Wait a few minutes to allow needle to &quot;catch up&quot; after arrival at a point where a reading is to be taken.</td>
<td></td>
</tr>
<tr>
<td>d. Always hold the instrument in the same position to read.</td>
<td></td>
</tr>
<tr>
<td>e. Take advantage of every opportunity to check with points of known elevation.</td>
<td></td>
</tr>
</tbody>
</table>
ASK STUDENTS HOW THE ANEROID BAROMETER CAN BE USED BY A FIELD OBSERVER.

1. AID IN ORIENTING MAPS
2. ESPECIALLY USEFUL AT NIGHT

PRACTICAL APPLICATION WILL BE DONE DURING FIELD EXERCISE.

III Abney level (or other device commonly used)

An abney level measures the angle between the horizontal plane and the line of sight along a slope. A percent abney measures the number of feet rise per 100 feet of horizontal distance.

SHOW ABNEY LEVEL.

A. Adjustment

1. To make the horizontal cross hairs (wire) correspond with the etched line on the prism when the instrument reads zero:
   a. Set index arm at zero.
   b. Loosen small screw on top of telescope tube at end farthest from the eye to the right of center.
   c. Move slide containing prism and cross hairs slide, held in place by this screw, until the cross hairs and etched line coincide.
   d. Tighten screw.
2. Adjust height of the level vial above the telescope tube so that the cross hairs and etched line coincide at steep angles (At such angles, the bubble appears crescent-shaped in which case the etched line should appear near the concave side of the bubble).

   a. Loosen the four tiny anchor screws on the side of the vial.

   b. Turn the two capstan screws, locked by the anchor screws, until the vial is at the proper height.

   c. Tighten the anchor screws.

3. To make the level vial parallel to the line of sight by the "two-peg" method

   a. Set and keep index arm at zero.

   b. Sight from point A at a convenient height on a pole or tree, and have an assistant mark point B on another tree about 100 feet distant.

   c. From B sight back to the original tree at C, directly above or below A.

   d. Establish D halfway between A and C (BD is then a horizontal line.)
e. Sighting from B to D, adjust the capstan screws holding the level vial until the level bubble is exactly centered in its tube.

B. Use

In this discussion we will only explain how to use the abney to measure percent of slope.

1. Loosen knobs holding index arm.

2. Sight through the eyepiece with the level vial up.

3. Sight up the slope at an object which is about the same height as your eye (height of instrument).

4. Move the index arm until the bubble is split by the cross hairs.

5. Read the percent slope indicated on the scale.

DURING FIELD EXERCISE, HAVE TRAINEES MEASURE A SLOPE USING THE ABNEY. MEASUREMENT SHOULD BE WITHIN 2% OF ACTUAL SLOPE.

IV Odometer

One of the most useful tools for mapping an incident is the odometer. This instrument measures miles traveled by vehicle and is usually broken into 1/10-mile intervals. As a quick and easy method of gaining an idea of distance, the odometer is easily used.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Locate the odometer in your vehicle.</td>
<td></td>
</tr>
<tr>
<td>B. Record the odometer reading from the point which you want to begin your measurement.</td>
<td></td>
</tr>
<tr>
<td>C. The mileage indicated on the odometer will give you a close estimate of the distance from the origin to the destination by subtracting the ending mileage reading from the initial reading.</td>
<td></td>
</tr>
<tr>
<td>D. This information is important in developing traffic plans and access routes and can be used in determining acreage.</td>
<td></td>
</tr>
</tbody>
</table>

ALLOW 15 MINUTES TO DO WORKBOOK EXERCISE.

Wkbk. pgs. 18, 19
Solution:
Instr. Guide,
pgs. 96, 97

Almost a must for camp support.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 3-Use Observation Aids

LESSON: 2-Pacing

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Establish a pace distance.

2. Calculate the distance between two points by pacing. The calculation must be within 5% of the measured distance.

TRAINING AIDS: Pre-measured course between two points for students to pace off, overhead projector, screen.
I Introduction

PRESENT LESSON OBJECTIVES

One of the easiest methods to estimate distance is pacing. This method requires only that you know what your average pace distance is.

II Presentation

A. A pace is actually two steps at normal stride.

EXPLAIN THAT PACE IS AN INDIVIDUAL THING THAT REQUIRES PRACTICE.

B. To determine distance of pace:

1. Lay out pre-measured course on level ground.

2. Step off the course counting paces.

3. Divide number of paces into measured distance to arrive at average pace.

4. Repeat the process a number of times to get a more accurate pace distance.

5. The longer the pre-measured course, the more accurate the pace distance.

C. Pacing on slopes

1. Moderate slopes - count each 10th pace twice.

2. Steep slopes - count each 5th and 10th pace twice.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. On slopes, both uphill and downhill, the paces will be shorter; consequently there will be more paces than on level ground. By counting some paces twice, the number of paces will be fewer and a more accurate distance will be obtained.</td>
<td></td>
</tr>
</tbody>
</table>

D. Inaccessible areas

1. The pacer should be able to estimate the number of paces to given points.

2. If the pacer cannot pace through brush, water or other obstacles, the number of paces should be estimated.

E. Pacing must be checked frequently for accuracy.

F. To determine distance multiply number of paces by length of pace.

HAVE STUDENTS ESTABLISH PACE DISTANCE OVER MEASURED COURSE. HAVE STUDENTS PACE BETWEEN POINTS AND CALCULATE DISTANCE DURING FIELD EXERCISE AT THE END OF THIS UNIT.

Inst. Guide pg. 118, 119
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 3-Use Observation Aids

LESSON: 3-Compass and Protractor

SUGGESTED TIME: 

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. List the essential parts of the compass.

2. Take a field azimuth on an object within 20°.

3. Walk a compass course.

4. Use a protractor to locate an object by intersection.

5. Calculate back azimuths.

6. Describe declination.

7. Locate True North using a compass.

8. Orient a map with a compass.

9. Locate self on a map by the process of resection.

10. Locate an object by the process of intersection.

TRAINING AIDS: Ruler, student workbook, protractor, compass from belt weather kit or other orienting compass, topographic map of class area, overhead projector, screen, chalkboard.
INTRODUCTION

Many years ago, around 2500 B.C., the Chinese invented the compass. They found that a sliver of metal ore placed on a piece of wood and floated in water will line up in a north-south direction.

From that discovery the compass needle developed. The needle consists of a strip of magnetized steel balanced on a pin point that is free to swing in any direction. A metal case was developed to protect the magnetized needle.

The force that attracts this magnetized needle is the magnetism of the earth itself. The earth is like a tremendous magnet with one end in the north and the other in the south. The north end is the magnetic North Pole toward which the north end of the compass needle points when at rest. Unfortunately, the magnetic North and the true geographic North Pole do not coincide. The magnetic North is located about 1,400 miles south of True North. The significance of this will be explained later.

The Mariner's Compass, our first usable one, carries the "compass rose" with the old compass direction designations (N, NNE, NE, ENE, E, etc). Modern compasses use the 360 degrees of a circle.

PRESENTATION

A. The Compass
   1. The compass is an instrument which enables you to determine a general direction and to travel that direction with accuracy whether day or night.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Your compass is a delicate</td>
<td></td>
</tr>
<tr>
<td>instrument; avoid careless</td>
<td></td>
</tr>
<tr>
<td>and rough handling.</td>
<td></td>
</tr>
<tr>
<td>ENSURE THAT STUDENTS HAVE A COMPASS.</td>
<td></td>
</tr>
<tr>
<td>HAVE THEM EXAMINE THEIR COMPASS</td>
<td></td>
</tr>
<tr>
<td>DURING THIS LECTURE.</td>
<td></td>
</tr>
<tr>
<td>B. Essential Parts of a Compass</td>
<td></td>
</tr>
<tr>
<td>1. A magnetic needle that always</td>
<td></td>
</tr>
<tr>
<td>points to magnetic North and</td>
<td></td>
</tr>
<tr>
<td>from which <strong>True North</strong> is</td>
<td></td>
</tr>
<tr>
<td>determined.</td>
<td></td>
</tr>
<tr>
<td>2. The north end of the needle</td>
<td></td>
</tr>
<tr>
<td>is usually marked by an arrow</td>
<td></td>
</tr>
<tr>
<td>or painted red with a luminous dot.</td>
<td></td>
</tr>
<tr>
<td>3. A graduated circle for laying</td>
<td></td>
</tr>
<tr>
<td>off angles from True North</td>
<td></td>
</tr>
<tr>
<td>marked off in degrees.</td>
<td></td>
</tr>
<tr>
<td>4. A sighted line for extending</td>
<td></td>
</tr>
<tr>
<td>the line of sight while</td>
<td></td>
</tr>
<tr>
<td>following a course of</td>
<td></td>
</tr>
<tr>
<td>direction.</td>
<td></td>
</tr>
<tr>
<td>5. A base plate.</td>
<td></td>
</tr>
<tr>
<td>C. Using Your Compass</td>
<td></td>
</tr>
<tr>
<td>1. You will see that the</td>
<td></td>
</tr>
<tr>
<td>graduated circle or azimuth</td>
<td></td>
</tr>
<tr>
<td>circle is marked off into 360</td>
<td></td>
</tr>
<tr>
<td>degrees.</td>
<td></td>
</tr>
<tr>
<td>a. Zero degrees or 360 degrees is</td>
<td></td>
</tr>
<tr>
<td>North on your compass.</td>
<td></td>
</tr>
<tr>
<td>b. 90 degrees is East, 180 degrees</td>
<td></td>
</tr>
<tr>
<td>is South, 270 degrees is West.</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>c. The north end of the needle always points to magnetic North.</td>
<td></td>
</tr>
<tr>
<td>2. Always hold the compass level so that the needle swings freely. Hold your elbows at your side so the compass is steady. The compass should be at a height that allows you to take a line of sight reading on the azimuth circle and also allows you to turn the azimuth circle without unnecessary movement of the needle.</td>
<td></td>
</tr>
<tr>
<td>3. To determine North.</td>
<td></td>
</tr>
<tr>
<td>a. Set 360 degrees on the azimuth circle in line with the line of sight mark.</td>
<td></td>
</tr>
<tr>
<td>b. Hold the compass and turn your body until the needle lines up with the line of sight mark. The direction you are facing is magnetic North.</td>
<td></td>
</tr>
</tbody>
</table>

HAVE STUDENTS USE COMPASS TO DETERMINE MAGNETIC NORTH. ASK STUDENTS WHICH DIRECTION THEIR RIGHT ARM WOULD POINT IF HELD STRAIGHT OUT FROM THEIR SIDE.

ASK STUDENT WHAT AZIMUTH WOULD BE INDICATED IF THEIR LEFT ARM WERE HELD STRAIGHT OUT FROM THEIR SIDE.

EXPLAIN THAT AZIMUTHS GO FROM 0° TO 360°, BUT BEARINGS GO ONLY FROM 0° TO 90°. DIFFERENTIATE BETWEEN THE TWO.

4. To determine the direction of an object,
<table>
<thead>
<tr>
<th>OUTLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Hold the compass and line the object up with the line of sight marker.</td>
</tr>
<tr>
<td>b. Turn the azimuth circle until the needle is aligned with the north marker. Hold the base plate steady.</td>
</tr>
<tr>
<td>c. Read the magnetic azimuth where the line of sight mark meets the azimuth circle.</td>
</tr>
</tbody>
</table>

**DRAW Bearings AND AzIMUTHS ON BLACKBOARD.**
SEE SAMPLE. DEMONSTRATE CONVERSIONS BETWEEN THE TWO. EMPHASIZE DRAWING PICTURES RATHER THAN MEMORIZING RULES-OF-THUMB.

**HAVE STUDENTS DETERMINE DIRECTION OF AN OBJECT.**

5. To follow or walk a direction, bearing or azimuth:

<table>
<thead>
<tr>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
</table>

| a. Determine the direction to be walked. Write the direction on a piece of paper. |
| b. Select an object along the line of sight. Walk to the object without looking at the compass. |
| c. Repeat steps "a" and "b" when you reach the object. |

**HAVE STUDENTS SET A DIRECTION, WITH BOTH BEARINGS AND AZIMUTHS.**
D. Protractor

ENSURE THAT STUDENTS HAVE A PROTRACTOR

1. Used to determine compass degrees to a point
2. Circle or semi-circle marked with degrees
3. Using the protractor
   a. Draw a line from an initial point to the object.
   b. Set the protractor on an East-West axis.
   c. Place the center mark of the protractor on the initial point with the 0 on the outer ring at North.
   d. The compass degree is read where the line intersects the outer ring.
   e. This is a true compass reading from the initial point to the object.
   f. With a true compass reading and a distance from a given point, a line can be drawn on a map and a location on this line found. This is the principle used by Fire Lookouts.

ALLOW 10 MINUTES FOR WORKBOOK EXERCISE.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Magnetic Declination</td>
<td>03-07-I244 VG</td>
</tr>
<tr>
<td>1. Declination is the angle in degrees between magnetic North and True North.</td>
<td>03-08-I244 VG</td>
</tr>
<tr>
<td>2. The compass needle always points to MAGNETIC NORTH.</td>
<td>03-09-I244 VG</td>
</tr>
<tr>
<td>3. Remember the needle of the compass is magnetized and can easily be influenced by nearby metallic objects.</td>
<td></td>
</tr>
</tbody>
</table>

**H ave students pass metallic objects such as keys, lighter, etc. over compass and note the effect.**

| 4. Topographic maps have a declination diagram in the bottom margin showing the degrees of magnetic declination for the area. | |

<p>| F. Adjusting Azimuths for Declination | |
| 1. If you take a map azimuth of 230 degrees to an object one mile away then walk that compass bearing the proper distance, you will NOT arrive at the object. | |
| For the Cajon area you will be a quarter mile away from your destination after traveling one mile. | |
| 2. Declination requires adjustments in readings when mixing true and magnetic azimuths. | |</p>
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAW A DECLINATION DIAGRAM ON CHALKBOARD, SEE SAMPLE. DISCUSS DIAGRAM EXPLANATION IN MAP MARGIN. CALCULATION COMPENSATION IS USUALLY EXPLAINED IN THE MARGIN. DO A FEW CONVERSIONS BETWEEN TRUE, MAGNETIC AND GRID NORTH. EXPLAIN THAT SOME COMPASSES CAN BE PRE-SET TO LOCAL DECLINATION.</td>
<td></td>
</tr>
<tr>
<td>Instr. Guide pg. 111</td>
<td></td>
</tr>
</tbody>
</table>

3. Map azimuths are true azimuths and compass azimuths are magnetic.

4. Maps are drawn based on True North; there is nothing you can do about this fact.

5. The compass needle is being pulled toward Magnetic North. There is nothing you can do about this fact.

6. The only variable is the azimuth reading.

7. When adjusting a compass for magnetic declination, use the following steps:
   a. From Magnetic North to True North, add the declination.
   b. From True North to Magnetic North, subtract the declination.

   THIS FORMULA APPLIES WEST OF THE MISSISSIPPI RIVER.

8. In the example where we missed our destination by a quarter of a mile, we can compensate for declination by determining that our declination for the Cajon area is 15 degrees.
ASK STUDENTS HOW THIS WAS DETERMINED.

9. To compensate, we must subtract 15 degrees from 230 degrees. We arrive at a corrected azimuth of 215 degrees. Now if we line up 215 degrees with our line of sight and walk that bearing we will end up right on target.

10. We have converted true readings to magnetic readings by subtracting declination.

11. Now we are on a hillside and we observe what appears to be the wreckage of the light plane we have been searching for. We shoot an azimuth of 154 degrees, one mile and radio this direction to Base. The Display Processor plots this on the Cajon quad and radios back saying try again. That reading ends up in the middle of Lost Lake.

ASK CLASS WHY THIS COULD HAPPEN AND HOW TO CORRECT IT.

12. The Display Processor has taken a magnetic azimuth and plotted it on a map that is drawn to True North. The Display Processor must adjust the variable for declination. The variable is the azimuth because the needle won't move nor will the wreckage.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. To find the azimuth you are looking at in relation to True North, the Display Processor must <strong>ADD</strong> 15 degrees to your reading and then plot the distance and bearing.</td>
<td></td>
</tr>
<tr>
<td>14. The Display Processor has converted magnetic azimuths to true azimuths by adding declination.</td>
<td></td>
</tr>
</tbody>
</table>

**G. Orienting the Map**

1. **Topographic Orientation**
   a. Find your approximate location on the map.
   b. Select two prominent landmarks visible to you and shown on the map.
   c. Turn the map until the map landmarks are in proper relation to the actual landmarks.
   d. The map is now oriented generally to True North. This is referred to as terrain association: associating the map to fit the terrain.

2. **Compass Orientation**

   *ASK OF CLASS "IF WE LINE UP THE LINE OF SIGHT 360 DEGREES ON THE AZIMUTH CIRCLE, AND THE COMPASS NEEDLE WITH A NORTH-SOUTH LINE ON THE CAJON QUAD, IS THE MAP ORIENTED TO THE TERRAIN?"

   **ANSWER:** NO, THIS IS MAGNETIC NORTH.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. True North is 15 degrees West of magnetic north.</td>
<td></td>
</tr>
<tr>
<td>b. We can't move magnetic north nor can we move the terrain, so we must move the map.</td>
<td></td>
</tr>
<tr>
<td>c. If we rotate the map 15 degrees West, the map is now oriented to the terrain or True North.</td>
<td></td>
</tr>
<tr>
<td>d. Another way of doing this is to set the compass for the declination. The Cajon area declination is to the East so we add declination.</td>
<td></td>
</tr>
<tr>
<td>e. After setting the declination, lay the compass on the map with the line of sight on a North-South line (the left or right margin is a good N-S line). Rotate the map with the compass on it until the arrow is centered in the North marker. The map is now oriented to True North (the terrain).</td>
<td></td>
</tr>
</tbody>
</table>

**EMPHASIZE DRAWING A SKETCH FOR THIS PROCESS.**

**H. Back Azimuth or Backsighting**

1. A back azimuth is calculated by adding 180 degrees to the azimuth when it is less than 180 degrees, or by subtracting 180 degrees if the azimuth is more than 180 degrees. For example: If the azimuth is 53 degrees,
add 180 degrees to find the back azimuth. Our back azimuth would be 233 degrees. If the azimuth is 195 degrees, subtract 180 degrees. The back azimuth would be 15 degrees.

2. Backsighting or back azimuths are used to check the line of sight back to the starting point. A mistake of a few feet will result in a significant distance over a long run.

3. Checking your line of sight by using a back azimuth is called backsighting.

4. After you have continued on your line of sight for some time and you are able to see your starting point, calculate your back azimuth. Look along the line of sight to determine if it bisects your starting point. If your line of sight points to the left of your starting point, this means you will have to move to your right in order to get back on your original line of sight.

I. Resection — Or, where am I?

1. Resection is used to find your location on a map.

2. Orient the map to True North.

3. Select two landmarks visible to you and shown on the map.

4. Take a compass reading on each of the landmarks and write them down.
5. Calculate the back azimuths.

6. Now we must transfer these magnetic readings to the map. We must adjust for declination.

USE 282° AND 38° AND CALCULATE BACK AZIMUTH AND DECLINATION (15°) ON BOARD.

7. Set the line of sight to the first reading. Place the compass on the map with the line of sight on the landmark.

8. Pivot the compass until the needle is aligned with the north marker.

9. Draw a line from the landmark to a point well past your approximate location. You are somewhere along this line.

BY USING THE EDGE OF THE COMPASS, YOU CAN DRAW THIS LINE MORE EASILY.

10. Repeat the process of drawing a line with the second landmark.

11. Your location is the intersection of these lines.

J. Intersection - Where is it?

1. Intersection is used to locate the exact spot of an object on the map.

2. From a known point, take a compass reading on the object.

3. Adjust for declination.

4. Orient the map to True North.

5. Lay the compass on the map.
6. Pivot the compass until the needle is aligned with the north marker.

7. Draw a line from your location to a point well past the object.

8. Move to a second known point and repeat the process.

9. The object's location is the intersection of these lines.

**EXPLAIN THE USEFULNESS OF INTERSECTION AND RESECTION. RELATE THESE TO MAPPING FIRES.**

**UNIT 3 FIELD EXERCISE:**

Inst. Guide
pgs. 118-120
03-02-1244 HO
Unit 4

Aircraft Mapping
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 4 - Mapping from Aircraft

SUGGESTED TIME: 2 hours

OBJECTIVES: Upon completion of this unit, the trainee will be able to:

1. List the types of maps needed for mapping from aircraft.

2. List the advantages and disadvantages of various map types for aircraft mapping.

3. List the materials needed to draw a fire map while airborne.

4. Describe how to deliver a map to the Incident Commander.

TRAINING AIDS:

1. Slide projector, slides and screen.
2. U.S.G.S. Topographic Maps
3. Acre grid overlays
4. Pencils, black, red, blue
5. Overlay material
6. Overhead projector
7. Chalkboard
8. Mapping kit, including:
   a. map case
   b. index maps
   c. drawing surface
   d. colored pencils
   e. acreage and slope overlap
   f. topography map symbols
   g. agency specific map symbols
   h. engineering scales
   i. masking tape
   j. overlay material
   k. drop pouches
First, let's look at some of the problems presented to mappers while working from aircraft.

A. The aircraft itself creates problems because it is, in effect, a constantly moving platform.

1. The mapper may have difficulty staying oriented with directions and locations on the ground.
2. The aspect from which you are viewing the area is constantly changing as the aircraft moves.
3. Aircraft noise and attitude may cause discomfort to those people who are not used to flying.
4. The view from high mapping altitudes tends to cause terrain features to "flatten out".
5. A lot of time spent in "head-down" concentration on a map can cause loss of equilibrium and/or airsickness.

B. Aircraft also provides a very limited working space for mapping.

1. Handling large map sheets is difficult in the cockpit and can restrict the vision of the pilot in seeing flight instruments or even other air traffic.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Limited space for turning in the seat can cause you to develop a &quot;crick&quot; in the neck after awhile.</td>
<td></td>
</tr>
<tr>
<td>3. Space and weight limits of an aircraft limit the amount and size of materials and equipment that can be carried.</td>
<td>04-06-I244 SL</td>
</tr>
</tbody>
</table>

II What can we do to overcome, or at least minimize, these problems? Experience in flying or riding in aircraft helps to some extent, especially in becoming more comfortable working in the air, but there are some things the novices can do to make the job easier. First:

A. Organize the maps and materials you need ahead of time into compact storage in such a way that you can get what you need with minimum effort and confusion.

B. Obtain or make up a writing surface that can be used in the aircraft without interfering with the pilot or controls such as:

1. A clipboard/kneeboard
2. A binder

C. Fold maps so that they can be easily used in the cockpit within the space available (Demonstrate)

D. After becoming airborne use your master map to keep oriented while enroute to the fire. This is very important, especially if you are not familiar with the area. 04-08-I244 SL
E. Stay as relaxed as possible in the aircraft.

Scan inside and outside. Check for other air traffic and keep from becoming disoriented. Do NOT make quick head movements because it tends to cause loss of equilibrium. This is especially true when changing from looking down inside the aircraft to looking up and outside.

III Now let's go into more detail about the material needed in a mapping kit. Agency specific requirements may dictate the type of maps to be used.

A. First let's look at the types of maps that will be useful.

1. Index maps - this is any map covering a relatively large area that can be used for:
   a. Area orientation enroute to and in a fire area.
   b. Indexing topog maps for quick location in a map case.
   c. Examples: AAA road maps, CDF admin. maps, USFS maps. May be agency specific.

2. USGS topographic quadrangles (agency specific)
   a. 15 minute maps for larger areas, easier orientation
   b. 7.5 minute maps for more detail in smaller area.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Sometimes it helps to locate the fire on the 15' maps first then select the 7-1/2' map for detail.</td>
<td></td>
</tr>
<tr>
<td>3. Flight maps – for long range navigation, identifying VOR radials and needed frequencies, terminal control area (TCA) limits, etc.</td>
<td></td>
</tr>
<tr>
<td>a. We will only mention flight maps briefly as they are not very useful for fire mapping.</td>
<td></td>
</tr>
<tr>
<td>b. One type of map that is very handy and compact for navigational use is the Calif. Aeronautical Chart published by CalTrans.</td>
<td></td>
</tr>
<tr>
<td>4. The maps needed for a particular mapping assignment will depend on what the assignment is and the requirements of the specific agency.</td>
<td></td>
</tr>
</tbody>
</table>

B. Now let's look at other materials and equipment needed for mapping. Please note this equipment can be carried in a very compact case.

1. Clipboard type writing/drawing surface.

   a. Large enough to work on with maps and small enough to fit into the aircraft cabin without interfering with the flight controls.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. These are available at office supply stores with built-in storage adequate for most material needed.</td>
<td></td>
</tr>
<tr>
<td>2. Inside the clipboard we have:</td>
<td></td>
</tr>
<tr>
<td>a. Black, red and blue pencils (two of each), or you may use combination multi-colored pencils.</td>
<td></td>
</tr>
<tr>
<td>b. Matte acetate overlay material.</td>
<td></td>
</tr>
<tr>
<td>c. ICS and agency specific map symbol sheets.</td>
<td></td>
</tr>
<tr>
<td>d. A small roll of masking or clear plastic tape for holding down the maps and/or overlay material while drawing. This is very useful if you have to join two or three maps together and when making overlays.</td>
<td></td>
</tr>
<tr>
<td>e. Acreage, slope and distance measuring tools.</td>
<td></td>
</tr>
</tbody>
</table>

HAND OUT VARIOUS TYPES OF ACREAGE AND SLOPE OVERLAYS. DISCUSS ADVANTAGES AND DISADVANTAGES OF EACH.

3. There are a few other items you will need that will not fit into the clipboard. These items can probably be stored inside the map case.

a. USFS "message droppers", or mailing tubes with flags.
b. A navigation plotter for use on flight maps.

c. Airsick bags.

4. A planimeter is easy to use for measuring fire acreage by setting the correct scale and then tracing the fire perimeter with the wheel and reading the acreage. Do it two or three times for accuracy. Expensive tool.

IV. In-Flight Mapping Procedures

A. What are you going to be doing with your maps while enroute to the fire area? STAY ORIENTED with your master map, of course.

1. Follow your flight progress as you go along on the map starting as soon as you leave the airport traffic area.

2. Use rivers, lakes, roads, and terrain as visual reference points to stay oriented.

3. Locate the project site as close as possible on the master map and identify to index number of indicated reference map or topog map.

4. Pull the topog map that is indicated by the master map. Example:

   a. A 15' map may be useful if exact location of the fire needs to be narrowed down to locate the correct 7-1/2' map.

   1) Especially if fire is close to edge of two or more 7-1/2' quads.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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</thead>
<tbody>
<tr>
<td>2) It is sometimes easier to find the &quot;legal&quot; (section, township, and range) on the 15' map.</td>
<td></td>
</tr>
<tr>
<td>b. Use the 7-1/2' map for better detail in mapping.</td>
<td></td>
</tr>
<tr>
<td>1) Easier to locate quarter sections.</td>
<td></td>
</tr>
<tr>
<td>2) 7-1/2' map will take up more room in cockpit.</td>
<td></td>
</tr>
<tr>
<td>B. Instruct your pilot as to the aircraft positioning needed to do the job and fit in with other air traffic.</td>
<td></td>
</tr>
<tr>
<td>1. When air attack aircraft are working the fire:</td>
<td>04-14-I244 SL</td>
</tr>
<tr>
<td>a. Maintain-radio contact with other aircraft.</td>
<td></td>
</tr>
<tr>
<td>b. Advise air attack when approaching the fire area. Give your altitude, direction of approach, ask Air Attack for their altitude.</td>
<td></td>
</tr>
<tr>
<td>c. Approach at least 500 feet above the highest air attack aircraft (unless instructed otherwise). Make right hand orbit well above fire area.</td>
<td></td>
</tr>
</tbody>
</table>
d. Advise air attack of your intentions at the fire and request clearance to perform your assignment.

e. Clear with air attack or other aircraft before making changes in:

1) Altitude

2) Flight pattern (left turns, etc.)

2. Begin mapping from a wide right turn at a high altitude (2000 to 5000 above ground level (AGL)).

a. This allows for easier area orientation by being able to see more area at once.

b. A wider flight pattern is possible while keeping the fire perimeter in sight.

c. The aspect change is slower for mapping.

3. Fly lower if necessary for better detail but no lower than necessary to do the job.

a. Keep agency specific requirements in mind.

b. Remember to clear with air attack or other control aircraft first.

c. Watch for flight hazards before and during descent.

-129-
### OUTLINE

<table>
<thead>
<tr>
<th>d. Lower flight will require steeper banked turns for viewing the ground as well as a tighter orbit.</th>
</tr>
</thead>
<tbody>
<tr>
<td>e. Clear with control aircraft prior to climbing out after completing assignment.</td>
</tr>
</tbody>
</table>

### C. Keep safety in mind at all times when flying.

1. Look around for other traffic frequently. Make sure the pilot sees the other aircraft too.

2. Scan the aircraft instruments occasionally to double check the pilot. It doesn’t hurt and may help to prevent an embarrassing situation such as running out of fuel or overheating an engine. Ask the pilot about anything that doesn’t look right to you.

### V Mapping Exercise

**OK! NOW YOU ARE APPROACHING THE FIRE AREA. AS YOU APPROACH THE FIRE AREA NOTE THAT THE PERSPECTIVE, ATTITUDE, ALTITUDE, AND VISUAL REFERENCES ARE CONSTANTLY CHANGING. ALSO, THE FIRE IS CONSTANTLY CHANGING. THESE SLIDES ARE A VISUAL DOCUMENTATION OF THE LIFE CYCLE OF A LARGE FIRE THAT BEGAN AS A SERIES OF INDIVIDUAL IGNITION SOURCES THAT BURNED TOGETHER. NOW YOU ARE AT THE MAIN FIRE.**

**A.** Narrow down the general location of the fire to a specific area by marking down the easiest points to recognize first. Some features that generally show up well from the air are:
<table>
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<tr>
<th>OUTLINE</th>
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<tbody>
<tr>
<td>1. Water - especially rivers, lakes, ponds and canals. Sometimes creeks may be difficult to see in steep canyons if under trees.</td>
</tr>
<tr>
<td>2. Man made features such as roads, railroads, buildings, powerlines, quarries, mine excavations, etc. New roads may be missing from old quad maps but often parts of old roads shown on a map will still be visible on the ground.</td>
</tr>
<tr>
<td>3. Vegetation changes such as grass to brush, orchard plots and timber patches are often accurately shown on topog maps. Even old overgrown vineyards are usually visible as a grid type pattern on the ground.</td>
</tr>
<tr>
<td>4. In remote areas terrain features may be the only good references available close to the fireline. Generally the easiest terrain features to recognize include:</td>
</tr>
<tr>
<td>a. Major peaks and long ridges.</td>
</tr>
<tr>
<td>b. Saddles and ridge intersections.</td>
</tr>
<tr>
<td>c. Major drainages and meander lines.</td>
</tr>
<tr>
<td>d. Unusual topographic features such as cliffs, sharp ridges with distinctive shapes, knobs and domes.</td>
</tr>
<tr>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>04-29-I244 SL</td>
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<tr>
<td>04-30-I244 SL</td>
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<tr>
<td>04-31-I244 SL</td>
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</tbody>
</table>
B. Now let's draw a map of the fire. Where do we start? Use of a "connect the dots" method of mapping tends to be accurate and quick.

1. Start with the easiest points to locate such as where the fireline intersects a road, crosses a ridge or a drainage, etc.

2. Mark each point as they are recognized with a dot or an "X" on the map.

3. Then locate all "corners" along the fireline. (Points where the fireline changes directions). Location of minor changes in fireline depends upon the accuracy needed in the map and the amount of time you have to make the map.

4. When you think you have enough points for the accuracy needed, connect the dots to complete the fireline.

5. Check the general shape of your map outline against the burned area on the ground to see that you have included all of the burn. Adjust if necessary by locating points along the line where needed.

C. Now that we have the fire outline on the map, we can go ahead and measure the acreage burned. While we are at it, let's look at a few methods for estimating acreage with and without maps.
### OUTLINE

1. Quick acreage estimation is usually made by comparison to something of known size.
   
   a. A football field between end zones is about one acre. The area inside the track around the field, including end zones, etc., is about 1-1/2 acres.

   b. Much of area estimation is based on experience. You can expand this experience base by consciously looking for comparisons, i.e., what does the five acre fire look like compared to a fire engine or dozer?

   c. How much of the aircraft window is taken up by burns of various acreage? You may want to put a few marks on the side window to use as "gauges", but remember for the marks to be useful:

<p>| | |</p>
<table>
<thead>
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<tbody>
<tr>
<td>1)</td>
<td>The aircraft must be near the same altitude above the ground each time.</td>
</tr>
<tr>
<td>2)</td>
<td>You must be positioned the same distance from the window each time when viewing the fire.</td>
</tr>
<tr>
<td>3)</td>
<td>Otherwise the &quot;picture&quot; will not be comparable in the window.</td>
</tr>
<tr>
<td></td>
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<table>
<thead>
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<th>KEY POINTS &amp; AIDS</th>
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<tr>
<td>04-34-I244 SL</td>
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<tr>
<td>04-35-I244 SL</td>
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</tbody>
</table>
2. A semi-quick area estimation method that should result in a "ball park" figure for fire acreage is to mark the general burn limits on a topog map using a few quickly recognized points on opposite sides of the fire.

   a. Make a rough outline of the fire area and compare it with a section (or more) that is marked on the map.

   b. The average section is 640 acres, so if the burn is about 1/2 section, it would be about 320 acres. If it is about 1/4 section it would be about 160 acres, or if it is 2-1/2 sections it would be about 1600 acres, etc.

   c. Acreage grids may be used similarly with a base of 100 or 1000 acres, or any convenient size.

VI Now we'll have a reasonable reproduction of the fire perimeter on our map when the Incident Commander calls to request a map of the fire.

What are you going to do? Are you going to give the Incident Commander your map? No! Not unless you have more than one copy. You may need the map again later. So what are you going to do? Make an Overlay.

A. Do not give your map away!

1. The Incident Commander should have a set of maps on the ground.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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</thead>
<tbody>
<tr>
<td>2. You will normally have room in the aircraft for only one set of maps and you are likely to need this map again.</td>
<td></td>
</tr>
<tr>
<td>3. Always carry matte acetate overlay material with you in your map kit.</td>
<td></td>
</tr>
<tr>
<td>B. We need to keep in mind that someone else is going to have to be able to use the overlay to construct another map. Use ICS map symbols only to construct map overlay.</td>
<td>04-01-I244 HO</td>
</tr>
<tr>
<td>1. Information is needed to identify the map, the fire and location, and the mapper. In other words make a &quot;title&quot;.</td>
<td></td>
</tr>
<tr>
<td>2. In addition, we need to include enough map features to allow easy orientation to an unmarked map.</td>
<td></td>
</tr>
<tr>
<td>a. Mark at least three control points on the overlay.</td>
<td></td>
</tr>
<tr>
<td>1) The most commonly used control points are section corners.</td>
<td></td>
</tr>
<tr>
<td>2) Include section numbers in centers.</td>
<td></td>
</tr>
<tr>
<td>3) There may not be a section shown on some reference maps or topog maps. This is usually in areas of old Spanish land grants.</td>
<td></td>
</tr>
</tbody>
</table>
4) In this case use road intersections or intersections of boundaries, trails, and any other identifiable points shown on the map for control points.

b. Even if section corners are used for control points other map features should be traced on the overlay for easy orientation. Use ICS map symbols and colors.

1) Roads, trails, powerlines and other man-made features - marked in BLACK.

2) Boundary lines (land grant, county, national forest, etc.) - also marked in BLACK.

3) Label the boundaries and main roads.

4) Water features, including intermittent creeks, marked in BLUE.

c. Put roads on the overlay in BLACK only, even if they are shown in red on the topog map.

1) RED is used for fire perimeter features only.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) The fire edge.</td>
<td></td>
</tr>
<tr>
<td>b) Control lines along the fire edge.</td>
<td></td>
</tr>
<tr>
<td>c) Spot fires and backfires.</td>
<td></td>
</tr>
<tr>
<td>d) Safety zones.</td>
<td></td>
</tr>
</tbody>
</table>

2) Planned control lines away from the fire edge and secondary lines are marked in BLACK.

3) Use control line symbols on a "going" fire. As these symbols are for control planning purposes they are often not needed when mapping a controlled fire.

C. Let's go ahead and make an overlay of the fire we have just drawn on our map. Use ICS map symbology.

1. First of all we need to use a piece of overlay material large enough to include all the information needed. (Recommend 8"x10").

   a. Position the overlay to allow room for the "title" information beside, above or below the fire outline.

   b. Secure the overlay in position with masking tape to keep it from slipping as you draw.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Trace the fire outline and control lines using the ICS symbols.</td>
<td></td>
</tr>
<tr>
<td>If there is a section of fire edge that has been contained with a</td>
<td></td>
</tr>
<tr>
<td>&quot;wet&quot; line. How do we show this on our overlay?</td>
<td></td>
</tr>
<tr>
<td>a. There is no symbol for wet line. Show it as uncontained fire edge.</td>
<td></td>
</tr>
<tr>
<td>b. If you have room on the overlay you may want to label this as &quot;wet&quot;</td>
<td></td>
</tr>
<tr>
<td>or &quot;hose lay&quot;, etc.</td>
<td></td>
</tr>
<tr>
<td>3. Trace in section corners, roads, etc--for map orientation.</td>
<td></td>
</tr>
<tr>
<td>a. Be sure to include at least three control points.</td>
<td>04-39-I244 SL</td>
</tr>
<tr>
<td>b. Be sure, also, to leave room for the &quot;title&quot;. What do we include</td>
<td></td>
</tr>
<tr>
<td>in the title?</td>
<td></td>
</tr>
<tr>
<td>1) Date and time the map was drawn.</td>
<td></td>
</tr>
<tr>
<td>2) The name of topographic map and scale.</td>
<td></td>
</tr>
<tr>
<td>3) Fire name and number if needed.</td>
<td></td>
</tr>
<tr>
<td>4) Section, township, and range of the origin.</td>
<td></td>
</tr>
<tr>
<td>5) Your name (i.e., Field Observer Jones).</td>
<td></td>
</tr>
<tr>
<td>6) Estimated acreage of the burned area.</td>
<td>-138-</td>
</tr>
</tbody>
</table>
VII Before we go into the procedures to be used for delivering the map, let's practice mapping a more difficult fire. You will be working at a slight disadvantage here as you are limited to using what you can see in the slides, but at least you will have a bit more room and a more stable platform compared to in an aircraft.

INSTRUCTOR PREPARE FIRE OVERLAY IN ADVANCE.

A. You have followed your progress on the index map while enroute to the fire, so you have a good idea where you are.

B. As quickly as you can, locate the fire, the fire origin on the map and mark down the section, township, and range on your log.

04-40 through 04-46-1244 SL

GIVE TWO MINUTES.

Are you ready? What is the "legal" of this fire?

C. Now mark the points you recognize along the fire edge as we progress around the fire. Try to locate as many "corners" as you can in three laps around the fire.

CONTINUE WITH SLIDES AT THIRTY SECOND INTERVALS AND REPEAT THREE TIMES.

D. Do you have all the points marked that you need to finish the map? If not, we'll go around once more.

SEQUENCE SLIDES ONE MORE TIME.

Now, complete the lines and compare the fire shape against what you see in this slide.

04-47-1244 SL

GIVE A MINUTE TO COMPLETE LINES.
E. Now that you have the fire plotted on the map go ahead and measure the acreage burned.

F. Now draw your fire on an overlay and label the overlay correctly. The fire name is ________. Put in control lines that you recognize on the slide and use the ICS symbols appropriately. When you are done bring your overlay to me and we will go over them together.

AFTER OVERLAYS ARE IN.

G. Let's take a look at some of the overlays on the transparency projector and see how close they are to each other, and to the overlay I made ahead of time.

AFTER COMPARING A FEW OVERLAYS.

H. Now let's compare the map overlay with the points that we can recognize on the slide of the fire.

COVER 6-10 POINTS ON THE SLIDE THAT CAN BE EASILY RECOGNIZED ON THE MAP AND RELATE TO FEATURES.

I. So after we are all done we find the fire acreage to be 25 acres.

J. Let's have a quick review now. What are some features that are helpful in mapping? What are some things that can cause problems while mapping from an aircraft?

VIII Mapping Summary.

A. Check your map kit ahead of time -- prior to departure.
B. Talk to your pilot before the flight and tell him what you will be doing, where you are going and what you want him to do to help you.

C. Have the index map handy and keep track of your location while enroute to the fire.
   1. If you get lost have the pilot circle or change course until you can orient yourself.
   2. Identify check points on the map along the course to your destination and note them as they pass by.

D. Have the pilot fly the altitude and flight pattern you want while completing your assignment in the fire area. Remember! The pilot is working for you!

E. If you become disoriented, relax and have the pilot identify your position using VOR's.

IX Once you have your map completed and copied correctly onto the overlay, you are ready to deliver the overlay to the Incident Commander. There are a few things you need to determine before making a map drop.

A. Where do they want the map dropped? Is it safe?
   1. NEVER make a low flight over a populated area to drop a map. It is unsafe, illegal, and you could be embarrassed if someone reports your aircraft number to the FAA.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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<tbody>
<tr>
<td>2. Check the drop area for approach and</td>
<td>04-51-I244 SL</td>
</tr>
<tr>
<td>departure hazards such as wires, trees,</td>
<td></td>
</tr>
<tr>
<td>hills, and other aircraft. Do NOT make a</td>
<td></td>
</tr>
<tr>
<td>drop that requires a steep climb out to</td>
<td></td>
</tr>
<tr>
<td>exit. Have the receiver move to a better</td>
<td></td>
</tr>
<tr>
<td>location.</td>
<td></td>
</tr>
<tr>
<td>3. Avoid low flight on the leeward side of</td>
<td>04-52-I244 SL</td>
</tr>
<tr>
<td>ridges. It is likely to be turbulent and</td>
<td></td>
</tr>
<tr>
<td>will cause the aircraft to sink.</td>
<td></td>
</tr>
<tr>
<td>4. The best locations for map dropping are:</td>
<td>04-53-I244 SL</td>
</tr>
<tr>
<td>a. Long, flat ridges without snags or wires.</td>
<td></td>
</tr>
<tr>
<td>b. Wide valleys or other open areas that</td>
<td>04-54-I244 SL</td>
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<tr>
<td>allow an exit over a flat or gently sloping</td>
<td></td>
</tr>
<tr>
<td>terrain.</td>
<td></td>
</tr>
<tr>
<td>c. An opening where the receiver will not</td>
<td></td>
</tr>
<tr>
<td>have to climb a tree or rummage through the</td>
<td></td>
</tr>
<tr>
<td>brush to find the map (large grassy opening)</td>
<td></td>
</tr>
</tbody>
</table>

B. When making the drop these procedures should be followed: 04-02-I244 HO

1. Secure the overlay in the message packet and seal it. FOLD streamer, seal & fold in accordion type fold in compact package.

2. Secure all loose items in the aircraft cabin to keep them from blowing around.

3. Take off your glasses, wrist watch, and button your shirt pockets.
4. Clear the area for other aircraft before descending. When clear, make a slow circling descent. Make sure you and the pilot agree on the target, approach and departure path, and airspeed for opening the window.

5. Check the wind in the drop area to allow for drift on the approach and release.
   a. Look for smoke drift if close to the fire.
   b. Make a high flight above the anticipated flight path to check wind and hazards.

C. When ready and assured the flight is safe, advise the recipient you are beginning the map drop run.

1. Double check the cockpit and pockets for loose items.

2. Make a pre-landing check of the aircraft. This is very important to ensure that the aircraft controls are set for a maximum performance "go around" type climb out if necessary.
   a. Fuel selectors on main setting.
   b. Prop controls at high rpm.
   c. Flaps as needed.
   d. Fuel mixture "full rich" or set for max. power for altitude of run.
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<thead>
<tr>
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<tbody>
<tr>
<td>3. Call off pre-landing check to pilot as they are made and ask for the okay to open the window. When pilot has reduced the airspeed and okayed the window open, tell him you are going off the air and remove your headset. Secure the headset, check the airspeed and open the window, SLOWLY.</td>
<td></td>
</tr>
</tbody>
</table>

D. Watch the approach and line up before releasing the map.

1. If the run doesn't look good, (too low, off line, etc.) close the window, put on the headset and--tell the pilot to go around.

   a. Never descend below 500 feet AGL in an intermittent use fixed wing aircraft, except to land. –

   b. Maintain 600 feet AGL in contract aircraft under normal conditions. If unusual conditions exist that require a lower elevation flight in contract aircraft, maintain at least 100 feet above the highest obstacle and at least 150 feet AGL in contract air attack aircraft during the map run.

2. If you drop the map off line there is a good chance you will have to make another overlay and another drop run. So, make it right the first time even if it takes two runs to assure it will be in the target area.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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</thead>
<tbody>
<tr>
<td>E. Where and how do you release the map to hit the target?</td>
<td></td>
</tr>
<tr>
<td>1. The release point will vary with wind conditions.</td>
<td></td>
</tr>
<tr>
<td>2. If you are flaring into the wind (headwind) wait for the target to pass under the nose of the aircraft before releasing the packet.</td>
<td></td>
</tr>
<tr>
<td>3. With a tailwind release it before the target passes below the nose of the aircraft.</td>
<td></td>
</tr>
<tr>
<td>4. Adjust the flight path to allow for crosswinds. A strong sideward will be indicated by the aircraft flying in a &quot;crab&quot; condition. If there is a strong crosswind request a large open drop zone to keep from losing the overlay.</td>
<td></td>
</tr>
<tr>
<td>5. As to the &quot;how&quot; of releasing the packet, get in the habit of throwing it downward as hard as you can. This is especially important if you are riding in a Cessna 337; so, the packet will miss the rear prop. It helps in other aircraft too in keeping the streamer from hanging up on the horizontal stabilizer.</td>
<td>04-58-I244 SL</td>
</tr>
<tr>
<td>6. Again, practice helps. Ask the person on the ground to indicate where the streamer landed. After making the drop, close the window, climb out and come around for a high pass through the target area to see where your map landed.</td>
<td>04-59-I244 SL</td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
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<td>---------------------------------------------</td>
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</tr>
<tr>
<td>7. Clear with other air traffic before climbing back up to normal pattern altitude.</td>
<td></td>
</tr>
<tr>
<td>X  Remember—Safety first for all air operations</td>
<td></td>
</tr>
<tr>
<td>A. Clear all maneuvers involving changes in altitude or orbit.</td>
<td></td>
</tr>
<tr>
<td>B. Check fuel consumption, time and flight instruments regularly.</td>
<td></td>
</tr>
<tr>
<td>C. Look up, around and down for other traffic frequently.</td>
<td></td>
</tr>
<tr>
<td>D. Use low altitude flight only when necessary and then clear the highest obstacles by at least 500 feet.</td>
<td></td>
</tr>
<tr>
<td>E. Check the planned low altitude flight path for hazards and ease of exit before descending.</td>
<td></td>
</tr>
<tr>
<td>F. Set the airplane up according to the pre-landing check list (with the exception of gear-down) before descending.</td>
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</table>
Unit 5

Field Observations
List 7 kinds of information which a Field Observer may collect on a recon mission.

- Perimeter of the incident
- Threatened areas
- Direction & spread rate
- Access routes
- Possible control locations
- Possible facility locations
- Weather conditions

Earthquake
fault line
area affected/destroyed
access routes

Flooding
water line
access routes
weather victims
List some safety gear and equipment which would be taken on a wildland fire recon mission. You have 10 minutes.

- Hard hat
- Gears
- Goggles
- Fire shelter
- Radios
- Water
- Money
List some considerations you should evaluate regarding access routes.

- escape routes
- road conditions (surface, maintenance)
- bridges (weights and limitations)
- turnouts
- culverts
- traffic
- percent of grade
- power lines
- safety zones
The following is a narrative description of a fire perimeter as relayed by two Division Supervisors:

DIV A REPORT - I'm looking at the Cajon quad and the line goes from the origin due north about an inch into the SW 1/4 of Section 6 until it crosses the 3000' contour. Then it goes NE til it crosses the pipeline at the 3200' level. This line is holding pretty well. From the pipeline, it goes NE til it hits the 3400' level and it follows it North to the drainage with the dry creek in it. From there it goes due East into Section 5. Strike Team 6601 reports that it is almost to the big curve in the truck trail right in the center of the NW 1/4 of Section 5.

DIV B REPORT - From the origin, it goes due East to the pipeline. From there it goes to just above the point where the 3200' contour crosses the section line between 6 and 7. From there, it goes up to the section line between 6 and 5 at about the 4100' level and continues pretty much in a straight line NE until it hits the sharp jag in the 4200' level where it goes directly North almost to the truck trail according to Air Attack.

On the next page is a map, using their description, plot the perimeter on the map. Take 10 minutes for this exercise.
STUDENT WORKBOOK

Unit 5

Audiogram

Use the map on the next page, the Cajon quad, and the audiogram to describe the perimeter of one of the fires on page 27 to another student. Compare perimeter. Have the student describe the other fire to you. You have 10 minutes.
Unit 5

Mile Coordinate System

Use the Cajon quad for this exercise.

Establish a reference point at the corner of Sections 5, 6, 7, 8, in T2N, R5W.

Is there a cluster of buildings at 2.2 east? Is the south margin at 2.1 south? If not, recheck the reference point.

What landmark is at .6 east, .7 south? ____________________________

What are the coordinates of Hill 5461? (Follow the road from Cajon Lookout southeast to Section 15, T2N, R5W)

________________________

Select a point on the map and describe to another student using mile coordinates. Establish a new reference point for this exercise.
CONVERSIONS

LINEAR
12" = 1 foot
3' = 1 yard
5280' = 1 mile
66' = 1 chain
80 ch. = 1 mile

AREA
1 acre = 208' x 208'
1 acre = 43,560 square feet
1 acre = 10 square chains

640 acres = 1 square mile
1 section = 1 square mile
1/2 section = 320 acres
1/4 section = 160 acres

LENGTH X WIDTH = AREA
<table>
<thead>
<tr>
<th>FUEL MODELS</th>
<th>DESCRIPTION</th>
<th>COMMON TYPES/SPECIES</th>
<th>FIRE BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 SHORT GRASS (1 ft.)</td>
<td>Fire spread governed by the fine herbaceous fuels that have cured or are nearly cured. Very little, if any, shrubs or timber is present, generally less than one-third of the area.</td>
<td>Best fits grasslands that are not grazed. Also consider savanna types, stubble, grass with scattered shrubs, and grass-tundra or low tussock with grasses, lichens, and mosses.</td>
<td>Surface fires that can burn very rapidly.</td>
</tr>
<tr>
<td>02 TIMBER (GRASS AND UNDERSTORY)</td>
<td>Fire spread is primarily through fine herbaceous fuels, either curing or dead. In addition litter and dead-down stemwood from open shrub or timber overstory contributes to fire intensity. Shrub or tree cover is approximately one-third to two-thirds of the area.</td>
<td>Best fits open pine/grassy understory, wiregrass/scrub oak associations, but can be used for timber/sagebrush/grass associations, some pinyon-juniper stands, and southern pine clearcut slash.</td>
<td>Surface fires can spread easily. Clumps of fuels that generate higher intensities may produce firebrands.</td>
</tr>
<tr>
<td>03 TALL GRASS (2 1/2 ft.)</td>
<td>Fire spread is in tall stands of grass averaging about 3 feet where one-third or more of stand is considered dead or cured. Fire may be carried by wind through the upper heights of grasses standing in water.</td>
<td>Best fits tall sawgrasses, fountain grass (Hawaii), eastern marsh vegetation, and other grasses such as bluebunch wheatgrass, blue-stem, broomsedge, and panic-grass. Also consider wild or cultivated grains that haven't been harvested, and tall tussock/tundra/grass situations.</td>
<td>Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind.</td>
</tr>
<tr>
<td>FULL MODELS</td>
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<tr>
<td>04 CHAPARRAL (6 ft.)</td>
<td>Fire intensity and fast spreading fire involve the foliage and live and dead fine woody material in the crowns of the nearly continuous secondary overstory. Dead woody material in the stand significantly contributes to fire intensity. There may also be a deep litter layer that confounds suppression efforts.</td>
<td>Stands of mature shrubs, 6 or more feet tall, such as California mixed chaparral, the high pocosins along the east coast, the pine barrens of New Jersey or the closed jack pine stands of the north-central states are typical candidates. Red slash sites with 40 tons per acre or more of less than 3-inch material can also be considered.</td>
<td>Very high to extreme rates of spread can be experienced in this model. Very high intensities make control efforts difficult.</td>
</tr>
<tr>
<td>05 BRUSH (2 ft.)</td>
<td>Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. Shrubs are generally not tall but have nearly total coverage of the area.</td>
<td>Best fits the generally non-flammable shrubs such as laurel, salal, vine maple, alder, or mountain mahogany. Young, green stands of chaparral, manzanita, and chamise qualify until deadwood is generated.</td>
<td>Fires are generally of lower intensity as surface fuel loads are light, shrubs are young with little dead, and the foliage contains little volatile materials.</td>
</tr>
<tr>
<td>06 INTERMEDIATE BRUSH--HARDWOOD SLASH</td>
<td>Brush is taller than in 05, but less height and fuel than 04. Foliage is generally flammable although moderate to strong winds may be required to carry fire in the crowns.</td>
<td>A broad range of shrub conditions are covered, such as intermediate stands of chamise, chaparral, oak brush, low pocosin, and palmetto-gallberry. Pinon-juniper shrublands may be represented with winds of 20 mph or greater. Fresh but cured hardwood slash can be represented.</td>
<td>Fire carries through the shrub layer with moderate winds, but drops to the ground at low winds speeds or openings in the stand.</td>
</tr>
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<tr>
<td>07 SOUTHERN ROUGH</td>
<td>Fires burn through the surface and shrub strata with equal ease, and can occur at higher dead fuel moisture contents because of flammable nature of live foliage and other live materials. Stands are generally between 2 and 6 feet high.</td>
<td>Best fits the southern rough communities of the palmetto gallberry understory/pine overstory association of the southeast coastal plains. Can be used for low pocosins when moisture content is high in the foliage.</td>
<td>Rate of spread and fire intensity are both moderately high.</td>
</tr>
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<tr>
<td>08 CLOSED TIMBER LITTER</td>
<td>Closed canopy stands of healthy, short-needled conifers or hardwoods that have leaved out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present.</td>
<td>Representative conifer types are white pine, lodgepole pine, spruces, firs, and larch.</td>
<td>Slow burning surface fires with low flame heights are typical, although an occasional &quot;jackpot&quot; or heavy fuel concentration can cause flareups.</td>
</tr>
<tr>
<td>09 HARDWOOD LITTER</td>
<td>Fire spread is primarily in surface litter such as concentrations of dead, dry leaves in fall or spring. Stands can be hardwoods, mixed hardwood/conifers, or long needle conifers.</td>
<td>The oak/hickory types are best represented, but also covers other hardwoods and loosely compacted litter under long-needled conifers, such as ponderosa, Jeffrey and red pines or southern pine plantations. Also includes mixed hardwoods/white spruce type in Alaska when conditions are very dry.</td>
<td>Fires run through the surface litter and possibly torch out trees, spot, and crown where concentrations of dead-down woody materials are encountered.</td>
</tr>
<tr>
<td>010 TIMBER (LITTER AND UNDERSTORY)</td>
<td>Fire spreads through high loadings of dead, down woody fuels beneath over-mature timber stands. Shrub understory or tree reproduction may be present. Much of the woody material is over 3 inches in diameter.</td>
<td>Any forest type may be considered if heavy down materials are present; examples are insect or disease-ridden stands, wind thrown stands, over-mature situations with deadfall, and aged light thinning or partial cut slash. Also used for settled thinning or partial cut conifer slash with needles fallen.</td>
<td>Torching of individual trees and spotting is more frequent, and fire intensity is higher in this model than model 8 or 9, thereby leading to potential fire control difficulties.</td>
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<td>011 LIGHT LOGGING SLASH</td>
<td>Slash and herbaceous material intermixed carry an active fire. The spacing of the rather light fuel loading, shading from overstory, or aging of fine fuels can contribute to lowering fire potential. The less than 3-inch material load is less than 12 tons/acre. The greater than 3-inch material is represented by not more than 10 pieces, 4 inches in diameter along a 50-foot transect.</td>
<td>Light partial cuts or thinning operations in mixed conifer stands, hardwood stands and southern pine harvests are considered. Clearcut operations generally produce more slash than represented here.</td>
<td>Surface fires of moderate rates of spread and moderate to high intensities can be expected where fuels are continuous.</td>
</tr>
<tr>
<td>012 MEDIUM LOGGING SLASH</td>
<td>Slash loadings where the less than 3-inch material is less than 35 tons per acre. Most needles have fallen and the slash is somewhat compact. The greater than 3-inch material is represented by 11 pieces, 6 inches in diameter along a 50-foot transect.</td>
<td>Heavily thinned conifer stands, clear-cuts and medium or heavy partial cuts are represented. Typical of logging operations in northwestern forests.</td>
<td>Rapidly spreading fire with high intensities capable of generating firebrands. When fire starts, it generally sustains itself until a fuel break or change in fuels occurs.</td>
</tr>
<tr>
<td>013 HEAVY LOGGING SLASH</td>
<td>Fire generally carries across an area by a continuous lay of slash. Loading is dominated by greater than 3-inch diameter material. The total load may exceed 200 tons/acre but less than 3-inch fuel is generally only 10 percent of total load.</td>
<td>Best fits conifer clearcuts and partial cuts in old growth stands west of the Cascade and Sierra Nevada mountains. Areas where &quot;red&quot; needles are attached, but loadings are lighter can also be considered.</td>
<td>Fire spreads quickly through the fine fuels, but intensity builds up more slowly as the larger fuels start. Active flaming is sustained for longer periods. Spotting can occur.</td>
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# Fine Dead Fuel Moisture Calculations

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<tr>
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<th>D/N</th>
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<tr>
<td>a.</td>
<td>Projection point</td>
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<tr>
<td>b.</td>
<td>Day or night (D/N)</td>
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<td>c.</td>
<td>Dry bulb temperature, °F</td>
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<tr>
<td>d.</td>
<td>Relative humidity, %</td>
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<tr>
<td>e.</td>
<td>Reference fuel moisture, % (from Table A)</td>
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<td>f.</td>
<td>Month</td>
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<td>g.</td>
<td>Exposed or shaded (E/S)</td>
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<td>h.</td>
<td>Time</td>
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</tbody>
</table>
| i. | Elevation change  
B = 1000' - 2000' below site  
L = ±1000' of site location  
A = 1000' - 2000' above site | B/L/A | B/L/A | B/L/A | B/L/A |
| j. | Aspect | | | |
| k. | Slope | | | |
| l. | Fuel moisture correction, % (from Table B, C, or D) | | | |
| m. | Fine dead fuel moisture, % (line e - line 1) | | | |

## Night Time Calculations

<table>
<thead>
<tr>
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<td>p.</td>
<td>Reference fuel moisture, % (from Table E)</td>
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<td>Use Table F only if a strong inversion exists and a correction must be made for elevation or aspect change.</td>
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<tr>
<td>q.</td>
<td>Aspect of projection point</td>
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<tr>
<td>r.</td>
<td>Aspect of site location</td>
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| t. | Elevation change  
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L = ±1000' of site location  
A = 1000' - 2000' above site | B/L/A | B/L/A | B/L/A | B/L/A |
| u. | Correction for projection point location (from Table A) | | | |
| v. | Correction for site location (L) (from Table A) | | | |
| w. | Fuel moisture correction, % (line u - line v) | | | |
| x. | Fine dead fuel moisture, % (line p - line w) | | | |
## FINE DEAD FUEL MOISTURE CALCULATIONS

### DAY TIME CALCULATIONS

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#### Elevation change
- B = 1000' - 2000' below site
- L = ±1000' of site location
- A = 1000' - 2000' above site

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<td>i. Aspect</td>
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<td>k. Slope</td>
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<td>l. Fuel moisture correction, % (from Table B, C, or D)</td>
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<tr>
<td>m. Fine dead fuel moisture, % (line e - line i)</td>
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### NIGHT TIME CALCULATIONS

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Use Table F only if a strong inversion exists and a correction must be made for elevation or aspect change.

|   |   |   |   |   |
| q. Aspect of projection point |   |   |   |   |
| r. Aspect of site location |   |   |   |   |
| s. Time |   |   |   |   |
| t. Elevation change
  - B = 1000' - 2000' below site
  - L = ±1000' of site location
  - A = 1000' - 2000' above site | B/L/A | B/L/A | B/L/A | B/L/A |
| u. Correction for projection point location (from Table F) |   |   |   |   |
| v. Correction for site location (L) (from Table F) |   |   |   |   |
| w. Fuel moisture correction, % (line u - line v) |   |   |   |   |
| x. Fine dead fuel moisture, % (line p - line w) |   |   |   |   |
FUEL MODEL QUIZ - SITUATION UNIT

1. Model ___  Explanation ________________________________

.................................................................

2. Model ___  Explanation ________________________________

.................................................................

3. Model ___  Explanation ________________________________

.................................................................

4. Model ___  Explanation ________________________________

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5. Model ___  Explanation ________________________________

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6. Model ___  Explanation ________________________________

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7. Model ___  Explanation ________________________________

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8. Model ___  Explanation ________________________________

.................................................................
FIRE BEHAVIOR

Fire Characteristics Chart

RATE OF SPREAD, CH/H

HEAT PER UNIT AREA, BTU/FT²

Fireline Intensity, BTU/ft's

Flame Length, ft
FIRE BEHAVIOR
Fire Characteristics Chart
(Logarithmic Scale)

RANGE OF SPREAD, CM/H

HEAT PER UNIT AREA, BTU/FT²
CALCULATING FIRE BEHAVIOR WITH NOMOGRAMS

A nomogram is a group of interconnecting graphs that can be used to solve a mathematical equation or series of equations. In this case the fire model equations developed by Rothermel (1972) can be solved by constructing a set of lines on one sheet of paper.

Nomograms for predicting fire behavior were originally developed by Albini (1976). The nomograms presented here have been modified somewhat from Albini's original version. The primary change has been the adoption of the midflame windspeed as an input rather than 20-foot windspeed. Albini used 20-foot windspeed with a wind reduction factor of 1/2, which was the prevailing assumption at that time, to predict fire behavior in all conditions. To correct the over-prediction of firespread in cases where the fuels were sheltered by an overstory of trees, the method of calculating windspeed in sheltered fuel presented by Albini and Baughman (1979) was adopted.

There are two nomograms for each of the 13 fuel models; a low windspeed version and a high windspeed version. They will both give the same answers, but better resolution can be obtained from the low windspeed version so it should be used whenever possible. Nomograms for all fuel models are given in the appendix.

Solution of a fire spread problem on a nomogram will provide an estimate of rate of spread, fireline intensity, heat per unit area, and flame length. The Fire Behavior Worksheet provides the input data and is used to record the outputs. It has been designed for use with either the nomograms or the TI-59. Not all values are used with both systems; consequently, some lines on the FB worksheet will not be used. Whenever the worksheet is needed, the line number on the left hand margin will be referred to.
For the nomograms, data on the following lines is necessary:

3 Fuel model
7 Fine dead fuel moisture
10 Live fuel moisture for some fuels
13 Midflame windspeed
14 Maximum slope

Fuel models 2, 4, 5, 7, and 10 contain living fuel. The procedures for fuels with live fuel moisture are somewhat different than for the fuel models that have only dead fuel. Methods for calculating fire behavior with fuel models containing only dead fuels will be covered first.

It is assumed that a worksheet has been prepared with the required information (see fig. 1). Select the nomogram for the fuel model designated on the Fire Behavior Worksheet, line 3. Note that there are four parts to the nomogram. These are called quadrants and are referred to as upper and lower (meaning the top and bottom of the page) and by left and right.

Solving a fire spread problem on a nomogram requires initial preparation and then a trip through all four quadrants with a continuous line starting and finishing in the upper right quadrant. All of the answers are read in that quadrant. A diagramatic depiction of the written instructions is given in figure 2.

Before starting, a note on techniques is worthwhile. Lay the nomogram on a flat surface. Have a narrow 10- or 12-inch straight edge available. Note that there is an underlying 1/4" grid; use this to keep your lines true with the nomogram, i.e., parallel with the edges and forming right angles at intersections.
**Step 1:** --Determine effective value of the midflame windspeed. (This step combines wind and slope.) Note the slope—given on line 14 of the FB worksheet. In the lower left quadrant find the percent slope and draw a vertical line to the top of the quadrant. On the right hand side of the lower left quadrant find the midflame windspeed given on line 13 of the FB worksheet. Follow the curved windspeed line down until it intercepts the vertical line just drawn. At the intersection of the vertical line from the slope and the midflame windspeed draw a horizontal line to the left hand margin. The effective windspeed is read off the margin (example shown on figure 2). Record the effective midflame windspeed on line 18 of the FB worksheet.

The construction lines drawn in the lower left quadrant are not used again.

**Step 2:** --Prepare the lower right quadrant by locating a ray (line from the origin) that represents the effective windspeed. Such lines are already in the quadrant to guide you. Interpolate if necessary to establish a ray for the effective windspeed determined in Step 1. This line will be used later as a turning line when taking the trip through the nomogram.

**Step 3:** --For nomograms with no live fuel. This step prepares the upper left quadrant. Find the dead fuel moisture value given on line 7 of the FB worksheet on the edge of the quadrant. If necessary to interpolate, construct a new ray for the fuel moisture value.

All preparations have been made and you can begin your trip around the nomogram.
Step 4: Draw a horizontal line across the G-shaped curve. At the interception of the upper right quadrant, draw a vertical line through the intersection just found and into the lower right quadrant until it hits the ray designating the effective windspeed (Figure 2).

Step 5: Insert the diagonal line in the lower left quadrant. This is the next turning line. From the interception of the effective windspeed line into the lower right quadrant, draw a horizontal line into the lower left quadrant. (Pay attention to the previously constructed lines from Step 4 in the lower left quadrant.)

Step 6: The lower left quadrant draw a vertical line into the upper right quadrant. At the interception, draw a line to the appropriate ray for the fuel moisture marked from Step 3 (see Figure 2).

Step 7: At the intercept in the upper right quadrant draw a horizontal line from the beginning of your trip in Step 4. Draw a small circle at this intercept. See Figure 2.

The ratio of spread is taken from the left hand margin of the upper right quadrant where the horizontal line constructed at Step 7 enters the quadrant. See Figure 2. Record line of spread on line 19 of the PB worksheet.
Fireline intensity is found at the small circle drawn in Step 7 in the upper right quadrant. The fireline intensity numbers are indicated on each curved line running through the quadrant. Interpolate between lines. See figure 2. Record fireline intensity on line 21 of the FB worksheet.

Flame length. The small circle drawn in Step 7 lies on, near, or between the family of curved lines; follow the nearest line to the top of the upper right quadrant and see the flame lengths marked in feet. Use the location of the circle between these lines to estimate flame length. Do not be exact. The nearest foot is sufficient in most cases. See figure 2. Record flame length on line 22 of the FB worksheet. This completes the calculation.

Heat per unit area is found on the horizontal axis of the upper right quadrant where it is crossed by the vertical line drawn in step 4.

When you have had some practice you will find that it is not necessary to draw lines all around the nomogram when you make the trip; tic marks at each intersection are sufficient. The starting point in the upper right quadrant usually requires a line so you will not miss it at the completion of the trip.

Fuel Models With Living Fuels

Fuel models 2, 4, 5, 7, and 10 have living fuels requiring a different procedure in Step 3. Do not be discouraged; the genius of Albini's nomograms is that they can handle this extra variable without requiring two pages for the solution.
Intersect the vertical line with the S-shaped curve that is quadrant that corresponds to the live date moisture. You can follow the S-shaped curve line that is quadrant that corresponds to the live date moisture. You can follow the S-shaped curve line that is quadrant that corresponds to the live date moisture.

At the intersection, we can follow the S-shaped curve line that is quadrant that corresponds to the live date moisture.

To find the live date moisture, lay your straight edge between the live date moisture given on line 10 of the form and the S-shaped curve line that is quadrant that corresponds to the live date moisture. See Figure 4. In the upper right quadrant, draw a line across both quadrants at the desired date and on the left side of the upper right quadrant. Draw a line across both quadrants at the desired date and on the left side of the upper right quadrant and on the right side of the live date.

Progressive little correction.

If the curved lines are so straight that this step

The intersecting line is the nerve to the heart of the disease, and some conditions like the following can be made:

Figure 4. Note the major line in the upper right quadrant (see Figure 4). This line will be the intersection point of the horizontal and the vertical line. Lay your straight edge between the point where the two lines intersect and the intersection point. This line will be the intersection point.

Figure 4. Note the major line in the upper right quadrant (see Figure 4). This line will be the intersection point of the horizontal and the vertical line. Lay your straight edge between the point where the two lines intersect and the intersection point. This line will be the intersection point.
The correct procedure to follow if the vertical line from the upper right quadrant intersects the curved dashed line is to stop at the intersection with the dashed line and construct the next line into the lower left quadrant from that intersection. This will produce a lower rate of spread and fire intensity than would result if you continued and used the effective windspeed line.

Interpretation and use of the answers obtained from the nomograms are discussed in other lessons.
**Figure 1**

**FIRE BEHAVIOR WORKSHEET**

<table>
<thead>
<tr>
<th>NAME OF FIRE</th>
<th>FIRE BEHAVIOR OFFICER</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE</td>
<td>Time</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PROJ. PERIOD DATE</th>
<th>PROJ. TIME FROM to</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LOAD PROGRAM</th>
<th>2</th>
<th>PGM</th>
<th>7</th>
<th>SBR</th>
<th>R/S = -4 display</th>
</tr>
</thead>
</table>

**INPUT DATA** (Enter in any order)

1. Projection Point
2. Fuel Model Proportion, %
3. Fuel Model
4. Shade Values
5. Dry Bulb Temperature, °F
6. Relative Humidity, %
7. 1 H TL FM, %
8. 10 H TL FM, %
9. 100 H TL FM, %
10. Live Fuel Moisture, %
11. 20-foot Wind Speed, mph
12. Wind Adjustment Factor
13. Maximum Wind Speed, mph
14. Maximum Slope, %
15. Projection Time, hr
16. Map Scale, in/in
17. Map Conversion Factor, in/chain
18. Effective Wind Speed, mph

**OUTPUT DATA** (Must be run in sequence below)

19. Rate of Spread, ch/hr
20. Heat per Unit Area, BTU/hr²
21. Flame Intensity, BTU/ft²
22. Flame Height, ft
23. Spread Distance, ch
24. Map Distance, in
25. Perimeter, ch
26. Area, Acres
27. Ignition Component
28. Reaction Intensity, BTU/ft²/min

---

**Aug. 19**
Figure 2

11. LIGHT LOGGING SLASH - LOW WINDSPEEDS

Figure 2
FIRE BEHAVIOR WORKSHEET

NAME OF FIRE ____________________________ FIRE BEHAVIOR OFFICER ____________________________

DATE ____________________________ TIME ____________________________

PROJ. PERIOD DATE ____________________________ PROJ. TIME FROM ______ to ______

LOAD PROGRAM

1. Projections Point
2. Fuel Model Proportion, % (value)
3. Fuel Model
4. Shade Value 0-10% = 0; 10-50% = 1. (value)
5. Dry Bulb Temperature, °F (value)
6. Relative Humidity, % (value)
7. 1 H TL FHM, % (value)
8. 10 H TL FHM, % (value)
9. 100 H TL FHM, % (value)
10. Live Fuel Moisture, % (value)
11. 20-foot Windspeed, mph (value)
12. Wind Adjustment Factor
13. Midflame Windspeed, mph (value)
14. Maximum Slope, % (value)
15. Projection Time, hr (value)
16. Map Scale, in/mi (value)
17. Map Conversion Factor, in/chain (value)
18. Effective Windspeed, mph (value)

OUTPUT DATA (Must be run in sequence below)

19. Rate of Spread, ch/hr (value)
20. Heat per Unit Area, BTU/hr² (value)
21. Flame Intensity, BTU/ft² (value)
22. Flame Length, ft (value)
23. Spread Distance, ch (value)
24. Map Distance, in (value)
25. Perimeter, ch (value)
26. Area, Acres (value)
27. Ignition Company (value)
28. Reaction Intensity, BTU/ft²/min (value)

*Check inputs or outputs [ ] Reg. Ac. = means
To change fuel value [ ] New fuel value [ ]
To change wind value [ ] New wind value [ ]
Then run program.
10. TIMBER (LITTER & UNDERSTORY) - LOW WINDSPEEDS

FIGURE 4

Fuel model 10 - low windspeeds
# MAP CONVERSION CHART

## MAP SCALES

<table>
<thead>
<tr>
<th>SCALE</th>
<th>REPRESENTATIVE FRACTION 1</th>
<th>MAP IN./MILE²</th>
<th>FT./MAP INCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:253,440</td>
<td>253.44</td>
<td>.25</td>
<td>21120</td>
</tr>
<tr>
<td>1:126,720</td>
<td>126.72</td>
<td>.50</td>
<td>10560</td>
</tr>
<tr>
<td>1:63,360</td>
<td>63.36</td>
<td>1.00</td>
<td>5280</td>
</tr>
<tr>
<td>1:62,500</td>
<td>62.5</td>
<td>1.01</td>
<td>5280</td>
</tr>
<tr>
<td>1:31,680</td>
<td>31.68</td>
<td>2.00</td>
<td>2640</td>
</tr>
<tr>
<td>1:24,000</td>
<td>24</td>
<td>2.64</td>
<td>2000</td>
</tr>
<tr>
<td>1:21,120</td>
<td>21.12</td>
<td>3.00</td>
<td>1760</td>
</tr>
<tr>
<td>1:15,840</td>
<td>15.84</td>
<td>4.00</td>
<td>1320</td>
</tr>
<tr>
<td>1:14,080</td>
<td>14.08</td>
<td>4.50</td>
<td>1173</td>
</tr>
<tr>
<td>1:7,920</td>
<td>7.92</td>
<td>8.00</td>
<td>660</td>
</tr>
</tbody>
</table>

1. CONVERSION FACTOR USED ON SLOPE/MAP WORKSHEET INPUT LINE 2.
2. CONVERSION FACTOR USED ON SLOPE/MAP WORKSHEET INPUT LINE 3.

VG 5-II-J
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 5-Make Field Observations

LESSON: 1-General Observations

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, trainee should be able to:

1. List seven types of information to be gathered while making observations.

2. Explain how to report a hazardous situation.

3. List four methods of transportation used for recon.

4. Explain one advantage and one disadvantage of each method of transportation.

TRAINING AIDS: Overhead projector, screen, chalkboard.
# OUTLINE

## I. Introduction

**PRESENT LESSON OBJECTIVES**

As a Field Observer, you are the eyes of the Planning Section. Without information from you, the Command and General Staff could not formulate a plan of action for the handling of an incident. Inaccurate or erroneous information could cause the formulation of an Incident Action Plan which would be totally useless and could even jeopardize the lives of emergency service workers and the public.

## II. Presentation

A. The Field Observer is responsible for collecting situation information by personal observations. This information is then given to the Display Processor to be processed.

ALLOW 10 MINUTES TO DO WORKBOOK EXERCISE ON CHALKBOARD.

**COMPILE LIST ON BOARD.**

B. Information to be gathered.

1. Perimeter of the incident;
2. Threatened areas;
3. Direction and spread rate;
4. Access routes;
5. Possible control locations;
6. Possible facility locations;
   a. Staging areas
   b. Helispots

---

**KEY POINTS & AIDS**

05-01-I244-VG

Wkbk pg. 21
Solution: Instr. Guide pg. 149
c. Aid stations

7. Operational resource progress;

8. Isolated problem areas;

9. Weather conditions;

10. Other observations which may influence incident operations.

ALLOW 10 MINUTES TO DO WORKBOOK EXERCISE.

C. Safety Hazards

1. Personal Safety

   a. Before beginning any mission you must have the necessary safety clothing and equipment.

   b. You should have a means of communication.

   c. You may find yourself in a life-threatening situation, so be prepared to act quickly and logically.

2. Safety of Others

   a. While making observations, you may see a life-threatening situation developing.

   b. This situation should be reported directly to the supervisor of the threatened people. If this is impossible, report the situation to the Communications Unit so it may be relayed.
### OUTLINE

| c. When reporting a life-threatening situation by telecommunications, state that this is "EMERGENCY TRAFFIC!!" to get priority service. |
|---|---|
| 3. Often you can remedy a safety hazard and prevent a serious injury, i.e., downed power lines |
| a. Stay a safe distance away. |
| b. Mark the area. |
| c. Report the location of the lines. |
| d. Advise others nearby of the hazard. |
| e. If necessary, remain at the scene to prevent others from getting electrocuted. |

ASK CLASS TO LIST OTHER HAZARDS AND REMEDIES. DON'T FORGET INCIDENTS SUCH AS FLOODS, EARTHQUAKES, ETC.

### D. Foot recon

1. Recon on foot is the most accurate type of recon mission.

2. It is also the slowest method.

### E. Vehicle recon

1. Faster than on foot.

2. May not be able to drive to all points that need to be checked.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>F. Rotary-wing (helicopter)</td>
<td></td>
</tr>
<tr>
<td>1. Most accurate aerial recon.</td>
<td></td>
</tr>
<tr>
<td>2. Can fly low and slow.</td>
<td></td>
</tr>
<tr>
<td>3. Can hover.</td>
<td></td>
</tr>
<tr>
<td>4. Can set down to allow some</td>
<td></td>
</tr>
<tr>
<td>foot recon.</td>
<td></td>
</tr>
<tr>
<td>5. Sometimes unavailable due</td>
<td></td>
</tr>
<tr>
<td>to Command or Operational</td>
<td></td>
</tr>
<tr>
<td>use.</td>
<td></td>
</tr>
<tr>
<td>6. Limited night use.</td>
<td></td>
</tr>
<tr>
<td>G. Fixed wing recon (airplane)</td>
<td></td>
</tr>
<tr>
<td>1. Excellent for very general</td>
<td></td>
</tr>
<tr>
<td>recon.</td>
<td></td>
</tr>
<tr>
<td>2. Must drive to and from</td>
<td></td>
</tr>
<tr>
<td>landing field.</td>
<td></td>
</tr>
<tr>
<td>3. Flies too high and too fast</td>
<td></td>
</tr>
<tr>
<td>for specific recon.</td>
<td></td>
</tr>
<tr>
<td>a. Can't determine condition</td>
<td></td>
</tr>
<tr>
<td>of access routes.</td>
<td></td>
</tr>
<tr>
<td>b. Topographic features</td>
<td></td>
</tr>
<tr>
<td>appear to be flatter (e.g.</td>
<td></td>
</tr>
<tr>
<td>hills, roads, etc.).</td>
<td></td>
</tr>
<tr>
<td>4. Limited night use.</td>
<td></td>
</tr>
<tr>
<td>H. Getting your ACT together</td>
<td>05-02-1244-VG</td>
</tr>
<tr>
<td>Observations must be accurate,</td>
<td></td>
</tr>
<tr>
<td>complete, and timely.</td>
<td></td>
</tr>
</tbody>
</table>
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 5-Make Field Observations

LESSON: 2-Wildland Fire Observations

SUGGESTED TIME: Upon completion of this lesson, trainee should be able to:

1. List 7 of the 10 Standard Firefighting Orders.

2. List 9 of the 13 Situations That Shout "Watch Out!"

3. List 4 factors to consider in access routes.

4. List 3 factors to consider in possible helispot locations.

5. List 5 factors to consider when looking for possible control line locations.

6. List 6 factors that influence resistance to control.

7. List 2 situations where specialized equipment, procedures, or personnel may be required.

TRAINING AIDS: Overhead projector, screen, chalkboard wallet-size Fire Order cards.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I  Introduction</td>
<td>05-03-I244-VG</td>
</tr>
<tr>
<td>One of the most frequent large-scale emergencies which will require Field Observers or Display Processors will be wildland fires.</td>
<td></td>
</tr>
<tr>
<td>Because of the size of these incidents, the Field Observer's job will be very complex and time consuming.</td>
<td></td>
</tr>
<tr>
<td>The job of making observations can also be very dangerous. You will be given assignments where you will be very close to an uncontrolled fire without much protection except your experience and knowledge of fire behavior and fireline safety.</td>
<td></td>
</tr>
<tr>
<td>II Presentation</td>
<td></td>
</tr>
<tr>
<td>A. Fireline Safety</td>
<td></td>
</tr>
<tr>
<td>1. You must know, understand, and observe the 10 Standard Firefighting Orders and the 13 Situations that Shout &quot;Watch Out!&quot;</td>
<td></td>
</tr>
<tr>
<td>2. These orders also apply to operational personnel you may encounter during your recom missions. If you observe violations of these rules, you should notify the supervisor of the personnel so that the situation can be remedied.</td>
<td></td>
</tr>
<tr>
<td>B. 10 Standard Firefighting Orders</td>
<td></td>
</tr>
<tr>
<td>INSTRUCTOR EXPLAIN EACH ORDER. ADVISE CLASS THAT THESE ORDERS WILL BE TEST QUESTIONS.</td>
<td></td>
</tr>
<tr>
<td>HAND OUT WALLET CARD.</td>
<td>05-01-I244-HO</td>
</tr>
</tbody>
</table>
OUTLINE

1. Keep informed of weather conditions and forecasts.
2. Know what your fire is doing at all times - observe personally, use scouts.
3. Base all action on current and expected behavior of fire.
4. Have escape routes for everyone and make them known.
5. Post a lookout when there is possible danger.
7. Maintain prompt communications with your crew members, your supervisor and adjoining forces.
8. Give clear instructions and be sure they are understood.
9. Maintain control of firefighters at all times.
10. Fight fire aggressively but provide for safety first.

C. Fire Situations that Shout "Watch Out!"

1. You are building a line downhill toward a fire.
2. You are on a hillside where rolling fire can ignite fuel below you.
3. You notice wind change.
4. You feel the weather getting hotter and drier.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. You are in heavy cover with unburned fuel between you and the fire.</td>
<td></td>
</tr>
<tr>
<td>6. You are in an area where terrain and/or cover make travel slow and difficult.</td>
<td></td>
</tr>
<tr>
<td>7. You are in country you have not seen in daylight.</td>
<td></td>
</tr>
<tr>
<td>8. You are in an area where you are unfamiliar with local factors influencing fire behavior.</td>
<td></td>
</tr>
<tr>
<td>9. You are attempting an attack on the head of a fire with engines.</td>
<td></td>
</tr>
<tr>
<td>10. You are getting frequent spot fires over your line.</td>
<td></td>
</tr>
<tr>
<td>11. You cannot see the main fire and you are not in communication with anyone who can.</td>
<td></td>
</tr>
<tr>
<td>12. You have been given an assignment and/or instructions not clear to you.</td>
<td></td>
</tr>
<tr>
<td>13. You feel like taking a nap near the fireline.</td>
<td></td>
</tr>
</tbody>
</table>

HAVE STUDENTS INDIVIDUALLY DO WORKBOOK EXERCISE. ALLOW 10 MINUTES THEN DISCUSS ANSWERS.

COMPILE LIST ON BOARD.

D. Access Routes

Access routes are vitally important to the handling of an incident. If they cannot gain access or move about the incident,
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>resources may not be used to their maximum capabilities. Access routes shall be located, identified, and marked, if necessary, both at the scene and on incident maps. The Ground Support Unit Leader is also responsible for much of the same information. Work closely with that person to avoid unnecessary duplication of effort.</td>
<td></td>
</tr>
<tr>
<td>1. Road conditions</td>
<td></td>
</tr>
<tr>
<td>a. Surface</td>
<td></td>
</tr>
<tr>
<td>b. Maintenance</td>
<td></td>
</tr>
<tr>
<td>c. Where does it go?</td>
<td></td>
</tr>
<tr>
<td>d. Fuel conditions along road</td>
<td></td>
</tr>
<tr>
<td>e. Can resources turn around?</td>
<td></td>
</tr>
<tr>
<td>2. Bridges</td>
<td></td>
</tr>
<tr>
<td>a. Width</td>
<td></td>
</tr>
<tr>
<td>b. Weight limitations</td>
<td></td>
</tr>
<tr>
<td>3. Turnouts - avoid chimneys</td>
<td></td>
</tr>
<tr>
<td>4. Culverts - weight limitations</td>
<td></td>
</tr>
<tr>
<td>5. Traffic</td>
<td></td>
</tr>
<tr>
<td>a. Time of season</td>
<td></td>
</tr>
<tr>
<td>b. Time of week</td>
<td></td>
</tr>
<tr>
<td>c. Time of day</td>
<td></td>
</tr>
<tr>
<td>6. Percent of grade</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>7. Power lines</td>
<td></td>
</tr>
<tr>
<td>a. Helicopters</td>
<td></td>
</tr>
<tr>
<td>b. Fixed-wing aircraft</td>
<td></td>
</tr>
<tr>
<td>8. Safety zones</td>
<td></td>
</tr>
<tr>
<td>E. Water Sources</td>
<td></td>
</tr>
<tr>
<td>1. Water is of primary interest to the fire control activities on an incident. As a Field Observer it is your responsibility to locate water sources, determine their capabilities and accessibility.</td>
<td></td>
</tr>
<tr>
<td>a. hydrants</td>
<td></td>
</tr>
<tr>
<td>b. swimming pools</td>
<td></td>
</tr>
<tr>
<td>c. cisterns</td>
<td></td>
</tr>
<tr>
<td>d. lakes, ponds, streams, rivers</td>
<td></td>
</tr>
<tr>
<td>e. ocean</td>
<td></td>
</tr>
<tr>
<td>f. sewage treatment plants</td>
<td></td>
</tr>
<tr>
<td>g. wells</td>
<td></td>
</tr>
<tr>
<td>2. Accessibility</td>
<td></td>
</tr>
<tr>
<td>a. Can resources reach the water?</td>
<td></td>
</tr>
<tr>
<td>b. Is the ground near natural water sources stable enough to support incident resources?</td>
<td></td>
</tr>
</tbody>
</table>

ASK IF ANYONE HAS EXPERIENCED UNSTABLE DRAFTING CONDITIONS.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>c. Can helicopters get into the water source?</td>
<td></td>
</tr>
<tr>
<td>d. Can resources turn around at the source?</td>
<td></td>
</tr>
<tr>
<td>F. Improvements</td>
<td></td>
</tr>
<tr>
<td>Being able to identify improvements which are involved in an incident or lie in the path of it are important items for the Field Observer to note.</td>
<td></td>
</tr>
<tr>
<td>1. fences</td>
<td></td>
</tr>
<tr>
<td>2. barns</td>
<td></td>
</tr>
<tr>
<td>3. homes</td>
<td></td>
</tr>
<tr>
<td>4. any human-made features</td>
<td></td>
</tr>
<tr>
<td>G. Possible Incident Facility Locations</td>
<td></td>
</tr>
<tr>
<td>As a Field Observer, you will be required to identify possible incident facility locations that may be established during the course of an incident.</td>
<td></td>
</tr>
<tr>
<td>1. camps</td>
<td></td>
</tr>
<tr>
<td>a. accessibility</td>
<td></td>
</tr>
<tr>
<td>b. area (size)</td>
<td></td>
</tr>
<tr>
<td>c. water - domestic and incident needs</td>
<td></td>
</tr>
<tr>
<td>d. traffic routing</td>
<td></td>
</tr>
<tr>
<td>e. availability of communications</td>
<td></td>
</tr>
<tr>
<td>f. personnel needs</td>
<td></td>
</tr>
</tbody>
</table>
2. staging areas
   a. accessibility
   b. area (size)
   c. water - domestic and incident needs
   d. availability of communications
   e. personnel needs

3. helispots and helibase
   a. accessibility
      1) trees, power lines, etc.
      2) wind
      3) terrain
   b. area (size)
   c. water - domestic and incident needs
   d. availability of communications
   e. personnel needs

H. Possible Control Line Locations

1. It is the responsibility of the Incident Commander to determine where control lines are to be located. As a Field Observer, it may be your job to identify possible control line locations. This information will be used at the planning meeting to determine the best strategy to be used on an incident.
<table>
<thead>
<tr>
<th>OUTLINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>You may also be sent out to determine if proposed control line locations can be constructed. Sometimes a ridge on a map looks like an ideal place for a dozer line, but in reality is too rocky or the fuel is too heavy to accomplish the job.</td>
</tr>
<tr>
<td>You should be able to evaluate the conditions and limitations, and determine whether control lines can be established.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2. Resource limitations</strong></td>
</tr>
<tr>
<td><strong>a. Engines</strong></td>
</tr>
<tr>
<td>1) <strong>ICS types 3 and 4</strong> are best suited for wildland fires.</td>
</tr>
<tr>
<td>2) <strong>Used most effectively for hoselays, firing out, mobile pumping, protection of remote improvements or exposures, and mop-up.</strong></td>
</tr>
<tr>
<td>3) <strong>On a hard dirt surface</strong> conventional drive engines can climb a 20-25% slope. Four-wheel drive can climb a 30-35% slope.</td>
</tr>
<tr>
<td>4) <strong>As the surface gets loose or rough the climbing ability is greatly reduced.</strong></td>
</tr>
<tr>
<td>OUTLINE</td>
</tr>
<tr>
<td>---------</td>
</tr>
<tr>
<td>5) Water flow, pump pressures, and hose complements must be considered on hoselays.</td>
</tr>
<tr>
<td>b. Dozers</td>
</tr>
<tr>
<td>1) Used most effectively in grass and brush on slopes of up to 30%.</td>
</tr>
<tr>
<td>2) Efficiency is greatly reduced at slopes over 30% (both upgrade and downgrade).</td>
</tr>
<tr>
<td>3) Soil conditions</td>
</tr>
<tr>
<td>a) Rocks reduce capability.</td>
</tr>
<tr>
<td>b) Wet or moist spots can cause dozer to get stuck.</td>
</tr>
<tr>
<td>4) Fuel type</td>
</tr>
<tr>
<td>Trees and heavy brush reduce capability.</td>
</tr>
<tr>
<td>5) Avoid use around structures and improvements.</td>
</tr>
<tr>
<td>c. Crews</td>
</tr>
<tr>
<td>1) Heavy fuels limit travel, escape routes, and work.</td>
</tr>
</tbody>
</table>
2)  Canopy of high fuels will require much additional work to clear.
3)  Steep terrain slows crew progress.

d.  Aircraft
   1)  Ridge-top winds limit effectiveness.
   2)  Heavy, dense fuels limit effectiveness.
   3)  Power lines and other aerial obstructions limit use.
   4)  High lead or cable logging operations may interfere.

3.  Topography
   a.  Ridges are better than drainages for control lines.
   b.  Midslope line construction and firing out should be carefully evaluated.
   c.  Steepness reduces capability of all resources.

4.  Fuel
   a.  Topography is shown on a topo map but fuel type and density are not.
OUTLINE

b. Look for:
   1) natural breaks in fuel continuity
   2) height of canopy
   3) areas where fuels become lighter

c. Barriers
   1) rivers
   2) rock outcroppings
   3) highways, roads, etc.

5. Weather

   Detailed weather observations will be covered in a later lesson, but there are some general observations that can be made in regard to control line locations.

   a. Local wind conditions such as eddies, or winds that swirl at the junction of canyons or draws, should be taken into account.

   b. Winds that are moving contrary to forecasts or general movement of air may cause problems.

   c. Some indicators of weather instability may include dust devils.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>6. General behavior of the fire</td>
<td></td>
</tr>
<tr>
<td>a. Will the fire reach the proposed line before it is controlled?</td>
<td></td>
</tr>
<tr>
<td>b. Can the proposed resources effectively deal with the heat output and flame lengths?</td>
<td></td>
</tr>
<tr>
<td>c. Is the fire spotting? If so, which direction are the spots spreading, and how fast?</td>
<td></td>
</tr>
<tr>
<td>d. How will changes in fuel, topography, and weather affect behavior?</td>
<td></td>
</tr>
<tr>
<td>I. Resistance to Control Factors</td>
<td></td>
</tr>
<tr>
<td>1. Resistance to control is based upon the limitations of the resources, fuel, weather, and topography.</td>
<td></td>
</tr>
<tr>
<td>2. For the most part, the resistance to control factors are the same factors used to evaluate possible control lines.</td>
<td></td>
</tr>
<tr>
<td>J. Specialized Equipment, Procedures, or Personnel</td>
<td></td>
</tr>
<tr>
<td><strong>ASK FOR STUDENT INPUT.</strong></td>
<td></td>
</tr>
<tr>
<td>1. Sometimes conditions will dictate the need for special resources or procedures. Conditions requiring mechanized equipment could include:</td>
<td></td>
</tr>
<tr>
<td>a. wilderness areas</td>
<td></td>
</tr>
<tr>
<td>b. archeological sites</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>c. ecologically sensitive areas</td>
<td></td>
</tr>
<tr>
<td>1) deserts</td>
<td></td>
</tr>
<tr>
<td>2) endangered wildlife habitats</td>
<td></td>
</tr>
<tr>
<td>d. critical watershed areas</td>
<td></td>
</tr>
<tr>
<td>2. Some special equipment which may be needed</td>
<td></td>
</tr>
<tr>
<td>a. falling crews</td>
<td></td>
</tr>
<tr>
<td>b. special firing equipment such as helitorch</td>
<td></td>
</tr>
<tr>
<td>c. relay pumping equipment</td>
<td></td>
</tr>
<tr>
<td>d. four-wheel drive vehicles</td>
<td></td>
</tr>
<tr>
<td>3. Technical Specialists can be requested as needed for advice and recommendations.</td>
<td></td>
</tr>
</tbody>
</table>

HAND OUT OBSERVATION CHECKLIST CARD.

05-02-I244-HO Observation Checklist Card
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Management

COURSE: I-244 Field Observer/Display Processor

UNIT: 5-Make Field Observations

LESSON: 3-Wildland Fire Behavior Observations

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Use a sling psychrometer to measure dry bulb and wet bulb temperature.

2. Calculate relative humidity within 2% using relative humidity chart.

3. Calculate relative humidity within 2% using a slide rule.

4. Measure average wind speed and direction within 2 mph.

5. Complete weather Observation Record form.

6. List the four Fire Behavior Fuel Model groups.


8. Define flame length.

9. Explain how to estimate rate of spread for verification of fire behavior predictions.

TRAINING AIDS: Chalkboard, belt weather kit, overhead projector, 35mm slide projector, screen.
Present Lesson Objectives

In order for SITSTAT or the Fire Behavior Prediction (FBP) Specialist to make accurate projections of the fire spread and behavior they must receive accurate data from the fire line. One of the Field Observer's jobs is to provide this data.

The belt weather kit is the primary means of collecting field weather data.

In addition to weather data, information on fuel types may be required. There are a number of fuel type classification systems, but we will concentrate on the National Forest Fire Laboratory fuel types.

II Presentation

Ensure students have belt weather kits. If there are not enough kits, have students share.

A. Belt Weather Kit Contents
   1. Writing board
   2. Observation record
   3. Pencil (preferably mechanical)
   4. Sling psychrometer
   5. Bottle of water (filled before use)
   6. Charts or slide rule for humidity and dew point
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. Wind gauge</td>
<td></td>
</tr>
<tr>
<td>8. Compass</td>
<td></td>
</tr>
<tr>
<td><strong>B. Observation Record</strong></td>
<td></td>
</tr>
<tr>
<td>1. Write observations down; don't rely on memory.</td>
<td>05-20-I244 VG</td>
</tr>
<tr>
<td>HAVE STUDENTS GET RECORD FROM WEATHER KIT.</td>
<td></td>
</tr>
<tr>
<td>2. Recording information</td>
<td></td>
</tr>
<tr>
<td>a. date</td>
<td></td>
</tr>
<tr>
<td>b. location</td>
<td></td>
</tr>
<tr>
<td>1) landmark</td>
<td></td>
</tr>
<tr>
<td>2) legal description</td>
<td></td>
</tr>
<tr>
<td>3) Make a note on your map, such as &quot;Weather Observation (WO) #1, 1350 hours&quot;</td>
<td></td>
</tr>
<tr>
<td>c. elevation from topog map necessary to calculate condition of fine fuels by FBG Specialist</td>
<td></td>
</tr>
<tr>
<td>d. aspect, the direction the slope is facing (does not apply to ridge tops)</td>
<td></td>
</tr>
<tr>
<td>e. exposure</td>
<td></td>
</tr>
<tr>
<td>f. cover type</td>
<td></td>
</tr>
<tr>
<td>1) grass and brush are fully exposed to the wind.</td>
<td>05-21-I244 VG</td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>2) timber</td>
<td></td>
</tr>
<tr>
<td>g. stand density</td>
<td>1) If available, use charts.</td>
</tr>
<tr>
<td>1) open</td>
<td>2) Make sure proper elevation chart is used.</td>
</tr>
<tr>
<td>2) sparse foliage</td>
<td>3) Use slide rule only if charts are not available.</td>
</tr>
<tr>
<td>3) dense foliage</td>
<td></td>
</tr>
<tr>
<td>h. time</td>
<td></td>
</tr>
<tr>
<td>i. temperature</td>
<td></td>
</tr>
<tr>
<td>j. relative humidity</td>
<td></td>
</tr>
<tr>
<td>1) If available, use charts.</td>
<td></td>
</tr>
<tr>
<td>2) Make sure proper elevation chart is used.</td>
<td></td>
</tr>
<tr>
<td>3) Use slide rule only if charts are not available.</td>
<td></td>
</tr>
<tr>
<td>k. wind speed</td>
<td></td>
</tr>
<tr>
<td>l. direction wind is blowing FHOM</td>
<td></td>
</tr>
<tr>
<td>m. comments</td>
<td></td>
</tr>
<tr>
<td>1) gustiness (not recorded)</td>
<td></td>
</tr>
<tr>
<td>2) dust devils</td>
<td></td>
</tr>
<tr>
<td>3) wind shears indicated by smoke</td>
<td></td>
</tr>
<tr>
<td>4) can also include fuel type</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>---------</td>
<td>------------------</td>
</tr>
<tr>
<td>5) If the data is transmitted to Base, enter the time the data was transmitted.</td>
<td></td>
</tr>
</tbody>
</table>

C. Sling Psychrometer

1. The sling psychrometer measures wet bulb and dry bulb temperature from which relative humidity and dew point are computed.

DEMONSTRATE.

2. Use
   a. Stand in shade if possible. Stand with back to wind.
   b. Make sure thermometers are securely fastened to the psychrometer.
   c. Wet wick on wet bulb thermometer.
   d. Note wet bulb temperature.
   e. Hold at arm's length.
   f. Whirl at moderate speed.
   g. Check wet bulb temperature frequently.
   h. Record lowest temperature reached.
   i. Record dry bulb temperature.
D. Relative Humidity Charts

HAVE STUDENTS USE HUMIDITY CHARTS TO CALCULATE ROOM HUMIDITY.

1. Select proper chart for elevation.
2. Locate dry bulb reading on vertical scale.
3. Locate wet bulb reading on horizontal scale.
4. Read chart where values intersect.
5. Relative humidity percent printed in black.
6. Dew point temperature is printed in red.
7. Record relative humidity in notebook.

E. Relative Humidity Slide Rule

1. Align wet bulb and dry bulb readings.
2. Read relative humidity at scale.
3. Not as accurate as charts.

F. Wind gauge

1. Record direction wind is blowing from.
2. Face into wind.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Hold gauge vertically in front of you with the scale toward you.</td>
<td>EYE LEVEL</td>
</tr>
<tr>
<td>4. Do not obstruct holes in the back.</td>
<td></td>
</tr>
<tr>
<td>5. Read wind mph from height of ball on scale.</td>
<td></td>
</tr>
<tr>
<td>7. If low range scale is too low, place finger over hole on top and read high range scale.</td>
<td></td>
</tr>
<tr>
<td>8. Record average wind speed and gusts.</td>
<td></td>
</tr>
<tr>
<td>G. Each time location is changed, use a new observation record.</td>
<td></td>
</tr>
<tr>
<td>Turn in observation records to SITSTAT upon return.</td>
<td></td>
</tr>
</tbody>
</table>

HAVE STUDENTS TAKE BELT WEATHER KITS OUTSIDE AND MAKE OBSERVATIONS. RECORD OBSERVATIONS ON WEATHER OBSERVATION RECORD FORM.

III National Forest Fire Lab (NFPL) Fuel Types

A. The Field Observer will often have to classify the type of fuel that is carrying the fire so that the Fire Behavior Prediction Specialist can predict fire behavior.

B. NFPL fuels cover 13 models in four Groups.
### OUTLINE

| 1.  | grasses |
| 2.  | brush/shrubs |
| 3.  | timber |
| 4.  | slash |

**REFERENCE** INT-122 AIDS TO DETERMINING FUEL MODELS FOR ESTIMATING FIRE BEHAVIOR. H.E. ANDERSON.

**INSTRUCTOR Distribute Key to Classifying Fuels.**

**Present Slides of Fuel Types and Compare to Descriptions.**

**Grasses**
- Fire Behavior Model #1
- Fire Behavior Model #2
- Fire Behavior Model #3

**Brush/Shrubs**
- Fire Behavior Fuel Model #4
- Fire Behavior Fuel Model #5
- Fire Behavior Fuel Model #6
- Fire Behavior Fuel Model #7

**Timber**
- Fire Behavior Fuel Model #8
- Fire Behavior Fuel Model #9
- Fire Behavior Fuel Model #10

**Slash**
- Fire Behavior Fuel Model #11
- Fire Behavior Fuel Model #12
- Fire Behavior Fuel Model #13

**EXERCISE**: Show slides of various fuels. Have students classify fuels. Discuss exercise. Slides:

- 05-14-I244 SL FIRE BEHAVIOR FUEL MODEL #1
- 05-15-I244 SL FIRE BEHAVIOR FUEL MODEL #4
- 05-16-I244 SL FIRE BEHAVIOR FUEL MODEL #13
- 05-17-I244 SL FIRE BEHAVIOR FUEL MODEL #10
- 05-18-I244 SL FIRE BEHAVIOR FUEL MODEL #4

**05-04-I244 HO** Fuel class key card
IV Estimate Flame Length and Rate of Spread

A. After the Fire Behavior Prediction Specialist has made predictions, you may be required to verify their accuracy. The Fire Behavior Prediction Specialist will be concerned with flame length and rate of spread.

B. Flame length is the average length of the flames from the base to the tips. This is not flame height.

C. Rate of Spread is usually expressed in feet per minute or chains per hour.

ASK CLASS HOW MANY FEET IN A CHAIN. POINT OUT THAT CHAINS PER HOUR AND FEET PER MINUTE ARE ALMOST THE SAME.

D. Rate of Spread can be estimated by estimating the distance between two objects, such as a large rock and a tree, and timing the spread of the fire between the objects. The rate of spread can be calculated by dividing the distance by the time. The accuracy of the distance estimation will determine the accuracy of the rate of spread estimation.

DEMONSTRATE EXAMPLE CALCULATIONS ON CHALKBOARD.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 5-Make Field Observations

LESSON: 4-Transmit Field Data

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Transmit field data by
   a. narrative description
   b. legal description
   c. audiogram
   d. mile coordinates

2. Identify telecommunication methods for transmitting field data.

TRAINING AIDS: Overhead projector, screen, audiogram overlay.
I. Introduction

PRESENT LESSON OBJECTIVES

The method or methods of transmitting field data will be discussed with the Situation Unit Leader during your briefing. There are various ways in which a map of an incident or specific area may be transmitted via telecommunications.

II. Presentation

A. Narrative Description

1. Narrative descriptions can be used to transmit location of large parcels or objects.

2. Narrative descriptions are time consuming and easily misunderstood.

ASK IF STUDENTS HAVE EVER HEARD NARRATIVE DESCRIPTIONS OF PERIMETER?

ASK FOR A RATING OF BETWEEN 1 AND 10 FOR THIS METHOD.

3. Narrative descriptions usually incorporate distance, landmarks, and legal descriptions.

ALLOW STUDENTS 10 MINUTES TO COMPLETE WORKBOOK EXERCISE.

TERMINATE THIS EXERCISE EVEN THOUGH STUDENTS MAY STILL BE WORKING.

HAVE STUDENTS COMPARE PERIMETERS IN GROUPS (5 MINUTES).

B. Legal Descriptions

Wkbk pg. 24, 25
Solution:
Instr. Guide
pgs. 180, 181
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Legal descriptions can be used to locate points on a map. As long as the transmitter and receiver have maps with Sections, Townships and Ranges, it doesn't matter if the maps are identical.</td>
<td></td>
</tr>
<tr>
<td>2. Legal descriptions can be very cumbersome to use when trying to transmit incident perimeter location.</td>
<td></td>
</tr>
<tr>
<td>3. When describing a point on a map, if the area can be reduced to a 1/4 of a 1/4 Section (40 acres) then the receiver should be able to locate the point.</td>
<td></td>
</tr>
<tr>
<td>4. 40-acre accuracy usually is not adequate for plotting perimeters.</td>
<td></td>
</tr>
</tbody>
</table>

C. Audiogram

**DISTRIBUTE AUDIOGRAM OVERLAY.**

| 1. The audiogram is an excellent way to describe perimeters and locations. |
| 2. An audiogram can be used with any map providing that the person transmitting and the person receiving the data have the identical maps and audiograms. |
| 3. The audiogram has numbered points that are used to describe locations. |

-182-
4. Using the audiogram
   a. Select a reference point which will allow the area you are going to describe to be covered by the numbered points.
   b. Describe the reference point to the receiver.
   c. Confirm the overlay placement by describing a major feature with the number from the audiogram.
   d. Simply read off the numbers corresponding to the perimeter or location.

THE PERIMETER CAN BE PLOTTED AND THE NUMBERS RECORDED AND THEN READ TO RECEIVER.

   e. Perimeter plotting can be done by placing matte acetate over the audiogram and outlining the perimeter on the acetate.

5. Some audiograms have quadrants. When using these audiograms, use the center axis to establish the reference point.
   a. Whenever possible, use a single quadrant to cover the area to be described.

DEMONSTRATE AUDIOGRAM BY DESCRIBING A FIRE ON THE CAJON QUAD TO THE CLASS.
OUTLINE

DIVIDE STUDENTS INTO PAIRS.

ALLOW 15 MINUTES FOR WORKBOOK EXERCISE

b. When the area to be described covers more than one quadrant, ensure that the receiver is aware of the quadrant being used.

c. Mile coordinates; map adjusted scale for measuring mileages.

III Communications

A. Radios are the primary means of communicating field data.

1. Radio time is very valuable so transmissions should be brief.

2. On an escalating incident, operational radio traffic will usually tie up most of the frequencies.

3. Before starting a recon mission, it is advisable to have SITSTAT and the Communications Unit Leader determine a clear frequency to use for data transmissions.

B. Telephone

1. Telephones can be used if the radio is too busy.

2. Telephones should be considered if the data will be time consuming.
3. Of course on a wildland fire, it may be difficult to find a phone booth out in the "boonies".

4. If the time frame for submission of the data allows, it may be a good idea to plan the mission so that you can call the information into the Situation Unit.

5. If you are going to use a phone booth, make sure you have proper coin to pay for the call.

DISTRIBUTE UNIT 5 QUIZ.

ALLOW 50 MINUTES FOR QUIZ.

Unit 5 Quiz
05-06-1244 HO

Solution:
Instr. Guide
pgs. 189-195
Unit 6

Process & Display Data
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 6-Process and Display Data

LESSON: 1-Collect and Analyze Data

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, trainee should be able to:

1. Determine what sources of data are available for the incident.

2. Establish a centralized location for receiving incoming data and notify data sources to route information to this location.

3. Identify critical time frames so that data can be processed to meet incident needs and notify data sources of established time frames.

4. Date/time stamp data.

5. Sort data into safety, operational, logistical and environmental categories.

6. Assist the Situation Unit Leader in the analysis and evaluation of incident status information.

7. Respond to specific requests for information.

TRAINING AIDS: Overhead projector, screen
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Introduction</td>
<td>06-01-I244 VG</td>
</tr>
<tr>
<td>PRESENT LESSON OBJECTIVES.</td>
<td></td>
</tr>
<tr>
<td>As a Field Observer/Display Processor your</td>
<td></td>
</tr>
<tr>
<td>job is only half completed after the field</td>
<td></td>
</tr>
<tr>
<td>data has been collected. In order to</td>
<td></td>
</tr>
<tr>
<td>complete the process, systems must be</td>
<td></td>
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<tr>
<td>developed to bring all of this information</td>
<td></td>
</tr>
<tr>
<td>together into a usable form.</td>
<td></td>
</tr>
<tr>
<td>II Presentation</td>
<td></td>
</tr>
<tr>
<td>A. To effectively analyze incident events</td>
<td></td>
</tr>
<tr>
<td>determine the various data sources available</td>
<td></td>
</tr>
<tr>
<td>to provide input.</td>
<td></td>
</tr>
<tr>
<td>1. Maps</td>
<td></td>
</tr>
<tr>
<td>Explore local sources for maps which show</td>
<td></td>
</tr>
<tr>
<td>pertinent information and may be of use on</td>
<td></td>
</tr>
<tr>
<td>the incident.</td>
<td></td>
</tr>
<tr>
<td>a. Planimetric maps</td>
<td></td>
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<tr>
<td>1) fire department maps</td>
<td></td>
</tr>
<tr>
<td>2) road maps</td>
<td></td>
</tr>
<tr>
<td>3) floor plans</td>
<td></td>
</tr>
<tr>
<td>4) blue prints and system schematics</td>
<td></td>
</tr>
<tr>
<td>5) street atlas</td>
<td></td>
</tr>
<tr>
<td>6) aviation maps</td>
<td></td>
</tr>
<tr>
<td>7) Agency maps (e.g., U.S.F.S, B.L.M.)</td>
<td></td>
</tr>
<tr>
<td>b. Topographic maps</td>
<td></td>
</tr>
<tr>
<td>c. Orthophoto maps</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
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<tr>
<td>---------</td>
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</tbody>
</table>

2. Operations Personnel

Perhaps the greatest sources of current information can be gathered from Operations personnel. Refer to the Initial Attack Commander's Incident Briefing (ICS Form 201) for initial information about the perimeter, current organization, and location and type of incident facilities.

Develop a system for gathering Operations information.

| a. Have Field Observers recon the incident operations and gather this information in face-to-face discussions. |
| b. Request that the Operations Section Chief bring you the most current incident status information at a designated place and time. |
| c. Debrief personnel at the completion of each operational period. This information will be of value for the following shift. |

3. Incident Generated Forms

<p>| a. Incident Action Plan for information about control plans. |</p>
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>b. Organization Assignment List (ICS Form 203) for activated Units and Unit Leaders.</td>
<td></td>
</tr>
<tr>
<td>c. Incident Communications Plan (ICS Form 205) for information on what communications are available and in use.</td>
<td></td>
</tr>
<tr>
<td>4. Resources Unit</td>
<td>Information about the type and number of resources assigned to the incident.</td>
</tr>
<tr>
<td>5. Facilities and Ground Support Units</td>
<td>Information about incident facilities.</td>
</tr>
<tr>
<td>6. Local Residents</td>
<td>During field observations, have the Field Observers stop and talk to locals. Their knowledge of the area or understanding of situations which may be peculiar to that area can be valuable.</td>
</tr>
<tr>
<td>7. Technical Specialists</td>
<td>If Technical Specialists are assigned to the Planning Section, they should be used to the fullest. Representatives of the National Weather Service can be vital Technical Specialists for your incident.</td>
</tr>
</tbody>
</table>
8. News Media

If possible, follow local media coverage of your incident. There may be a chance that an area of concern may have been overlooked by incident personnel and that the news media may be "beating their drum" to bring it to someone's attention.

9. Tactical Radio Frequencies

Monitor tactical radio frequencies to obtain additional information concerning incident situations, control operations and other potentially important information that the Unit needs.

B. When you receive your initial briefing from the Situation Unit Leader, you should decide on a centralized location for receiving incoming data.

1. This is a key point in your operation since it is necessary for data collectors and sources (Field Observer, Operations personnel, locals, etc.) to give their information to someone. Once the information is collected, it should be analyzed and handled in a way that no data is lost.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Once a centralized location has been designated, you must ensure that the sources are notified to report to this one location.</td>
<td></td>
</tr>
<tr>
<td>3. It is very important that Planning and Operations personnel know this location, and it is also important that key Logistics personnel are notified.</td>
<td></td>
</tr>
<tr>
<td>a. One of the most important units to notify is the Communications Unit.</td>
<td></td>
</tr>
<tr>
<td>b. Communications personnel may be receiving information by telephone from concerned citizens which is vitally important to the data collection and analysis system.</td>
<td></td>
</tr>
<tr>
<td>C. Deadlines for submitting data must also be set.</td>
<td></td>
</tr>
<tr>
<td>1. Because the planning process is an around the clock operation and because an effective incident operation relies on teamwork by all sections, it is important that the most up to the moment information is available when the Command and General Staff meet for their planning meeting.</td>
<td></td>
</tr>
<tr>
<td>2. All available sources of information should have their information into the Display Processor so that it can be analyzed prior to the planning meeting. This is</td>
<td></td>
</tr>
<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>why it is critical that all data sources are notified of the established time frame and deadlines.</td>
<td></td>
</tr>
<tr>
<td>D. In order to ensure that items of information are not lost, or so that a question will not arise as to how current your information is, set up a system to date/time stamp data as it is received. This simple system will help prevent questions from arising as to relevancy and timeliness of information.</td>
<td></td>
</tr>
<tr>
<td>E. Once information has been gathered, it should be sorted into categories so that it is easily retrievable. When handling a large amount of data from the various sources already discussed, it may be necessary to break this data into separate categories. Some examples are:</td>
<td></td>
</tr>
<tr>
<td>1. Safety</td>
<td></td>
</tr>
<tr>
<td>Data pertaining to items of safety which should be included in the Incident Action Plan.</td>
<td></td>
</tr>
<tr>
<td>2. Operations</td>
<td></td>
</tr>
<tr>
<td>Data pertaining to perimeter locations, values and risks, rate of spread, weather predictions, and resources assigned to the incident are items which are needed for the incident operations.</td>
<td></td>
</tr>
</tbody>
</table>
3. Logistics

Information on Incident Base, Camps, Staging Areas, Helibases and Helispots should be filed together to provide data concerning the Logistics Section and operational plans.

4. Environmental Concerns

Data on such items as erosion potential, siltation, and historically significant sites are items which must be considered in the Incident Action Plan so that environmental concerns and special needs may be addressed. Contingency plans may be necessary to prevent harm to the environment or culturally significant resources.

F. After the collected data has been assembled, the Display Processor will assist the Situation Unit Leader in the analysis and evaluation of incident status information. This data is necessary for the completion of maps for the Command Post and the Incident Action Plan, the Traffic Plan, and for the preparation of the Incident Status Summary (ICS Form 209).

G. Often the Incident Commander requests the Planning Section Chief or the Situation Unit Leader to provide information for a specific purpose. The Incident Commander may be receiving these requests from the local agency or
possibly a local, state or federal elected office in whose jurisdiction the incident is located.

1. In this situation, the Field Observer/Display Processor is often asked to collect the requested data.

2. Photographic services may also be included in these specific requests for information.
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System

COURSE: I-244 Field Observer/Display Processor

UNIT: 6-Process and Display Data

LESSON: 2-Maps and Displays

SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Identify ICS symbology

2. Prepare maps for:
   a. Operational support
   b. Planning activities
   c. Logistical support
   d. Incident Command Post (ICP) Displays
   e. Specialized purposes

TRAINING AIDS: Overhead projector, screen
I Introduction

PRESENT LESSON OBJECTIVES.

The Display Processor is responsible for preparing the Incident Action Plan maps, ICP displays, specialized maps such as highway maps for route planning, and other maps as requested.

II Presentation

A. Symbology

It is important that the agreed upon ICS symbology be used. Commonality of application among incident and interagency personnel will greatly enhance communication and understanding.

REFER TO FIELD OPERATIONS GUIDE (ICS 420-1) FOR SYMBOLOGY.

1. Branches and Divisions/Groups

Initially, Branches are numbered (using Roman numerals) clockwise from the point of origin (i.e., the number depends on initial assignment). As more Branches are formed and assigned, they are given the next unused number. For example, if the spread required a new Branch be placed between existing Branches II and III, it would be designated as Branch IV.
2. Similarly, Divisions or Groups are initially designated alphabetically (using capital letters) clockwise from the point of origin, starting with Division A. As additional Divisions are formed, they are given the next unused letter of the alphabet, regardless of assignment location.

There are no duplicate designations (i.e., Divisions are designated independently of Branches). Thus, there is only one Division D for an incident. On map displays, boundaries for Branches are shown by brackets; Division or Group boundaries within a Branch are shown by parentheses. Generally, Divisions are geographic, while Groups are functional.

BRANCHES AND DIVISIONS SHOULD NEVER BE RENUMBERED. RENUMBERING CREATES CONFUSION FOR OPERATIONAL PERSONNEL.

B. Maps

1. Base maps

Base maps are maps upon which other maps and overlays are based. They are the source for other maps which are either detail or sketch in nature.

a. Base maps should be selected according to the Situation Unit Leader's prediction of incident progression.
OUTLINE

1) When two or more adjacent maps are being used, they should have the margins trimmed and then be joined using "invisible mending tape."

ASK STUDENTS WHY THEY SHOULD AVOID CUTTING OFF THE BOTTOM MARGIN OF MAPS. EXPLAIN THAT INTERPRETATION INFORMATION IS LOST.

2) "Invisible mending tape" doesn't obscure detail and can be written on.

b. Base maps should display the same information as the Incident Action Plan map except:

ASK CLASS WHAT INFORMATION IS DISPLAYED ON THE INCIDENT ACTION PLAN MAP.

1) Uncontrolled perimeter
2) Spot fires
3) Branch/Division boundaries (unless these are static)
4) Wind speed and direction

ASK CLASS WHY THIS INFORMATION IS NOT PLACED ON BASE MAP.

2. Maps requiring detail
   a. Unit Map

   This is the most accurate, current map of
the incident. This map never leaves the Situation Unit.

The Unit Map overlay displays information which is subject to change.

b. Planning Meeting Map

Exact copy of Situation Unit Map

1) A base map with an overlay showing information should be available at the Planning meeting for detailed analysis if necessary. (Make sure there is an overlay for the base map. People love to draw on maps and a map that took an hour or more to prepare can be ruined with one stroke of a felt tip marker).

2) This map should be a separate map from the Situation Unit's map.

3) Clear mylar overlays should be used to cover specific maps.

   a) Mylar can be written on with "vis-a-vis" type marking pens.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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</thead>
<tbody>
<tr>
<td>b) These pens are permanent markers and will not smear.</td>
<td></td>
</tr>
<tr>
<td>c) Regular felt tip markings will &quot;bead-up&quot; and smear on mylar.</td>
<td></td>
</tr>
<tr>
<td>4) Information which will change should be displayed on overlays.</td>
<td></td>
</tr>
<tr>
<td>5) Overlays should always show the date and time.</td>
<td></td>
</tr>
<tr>
<td>This will prevent accidentally using an outdated overlay and producing bad information.</td>
<td></td>
</tr>
<tr>
<td>6) Overlays must always have two or more registration marks to align the overlay on the base map.</td>
<td></td>
</tr>
<tr>
<td>a) Section corners</td>
<td></td>
</tr>
<tr>
<td>b) Road intersections</td>
<td></td>
</tr>
<tr>
<td>c) Landmarks</td>
<td></td>
</tr>
<tr>
<td>c. Incident Action Plan Map</td>
<td></td>
</tr>
<tr>
<td>1) These maps are prepared by the Display Processor. They must show enough detail for</td>
<td></td>
</tr>
</tbody>
</table>
Division and/or Branch personnel to identify assigned work area.

2) Examples of features to be included on the Incident Action Plan Maps are:

   a) Outstanding terrain features
   
   b) Branch and/or Division locations and lines/areas of responsibility
   
   c) Staging areas, drop points, and other incident facilities
   
   d) Hazardous areas; cliffs, powerlines, etc.
   
   e) Aid stations
   
   f) Helispots
   
   g) Uncontrolled perimeter
   
   h) Spot fires
   
   i) Hot spots
   
   j) Proposed line (work assignments)
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
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</thead>
<tbody>
<tr>
<td>k) Controlled perimeter</td>
<td></td>
</tr>
<tr>
<td>l) Projections of spread</td>
<td></td>
</tr>
<tr>
<td>m) Legend</td>
<td></td>
</tr>
<tr>
<td>3) The Incident Action Plan maps should contain the same basic map symbology that is used for the Command Post Displays. However, they cannot rely on color coding, because reproduction is in black and white.</td>
<td></td>
</tr>
<tr>
<td>4) Originals of Incident Action Plan maps are prepared by the Display Processor and given to the Documentation Unit for reproduction.</td>
<td></td>
</tr>
<tr>
<td>5) The preferred size is 8-1/2&quot;x11&quot;.</td>
<td></td>
</tr>
<tr>
<td>d. Incident Command Post Map</td>
<td></td>
</tr>
</tbody>
</table>

The recommended Situation Status Display in the Incident Command Post consists of up to nine (9) topographic maps, a resource summary board, and the Organization Chart (ICS Form 207). These are set up and initial data is posted during Unit activation.
**OUTLINE**

**DISCUSS NEED FOR POSTING AND UPDATING.**

1) Make sure overlays are used on the Displays.

2) Posting of data is primarily the responsibility of the Display Processor.

   a) As data is acquired and confirmed, it must be neatly and accurately posted on the display.

      Grease pencils or vis-a-vis markers are recommended for this purpose.

   b) Note that color coding allows for drawing over previously displayed information with later data (e.g., orange projections may be covered with red as the incident progresses and a red uncontrolled line can be overlaid with black as control is established).

   -213-
e. General Display Maps

1) The ICP display is required but other displays can be provided for incident personnel so that they can see the status of the incident.

2) Always post the ICS symbology on status displays.

ASK WHERE OTHER MAPS SHOULD BE POSTED.

3) General display maps should have overlays.

f. Specialized maps

1) Many agencies may require specialized maps.

ASK STUDENTS FOR EXAMPLES OF SPECIALIZED MAPS.

2) If you are not familiar with the requirements of a specific map, ask the requester for details.

3) Agency Representatives can also give you advice on agency requirements.

3. Sketch maps

a. Planning meeting sketch map
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) These maps should be large and basically display the perimeter of the incident and prominent permanent features.</td>
<td></td>
</tr>
<tr>
<td>ASK STUDENTS WHY THIS MAP SHOULD ONLY DISPLAY VERY BASIC INFORMATION.</td>
<td></td>
</tr>
<tr>
<td>2) Information which is not likely to change may be drawn in lightly with pencil and then permanently marked in during the meeting. Examples are:</td>
<td></td>
</tr>
<tr>
<td>a) Branch/Division boundaries</td>
<td></td>
</tr>
<tr>
<td>b) Facility locations</td>
<td></td>
</tr>
<tr>
<td>b. Operational briefing map</td>
<td></td>
</tr>
<tr>
<td>These maps are large sketch maps used to explain the plan during the briefing.</td>
<td></td>
</tr>
<tr>
<td>1) Maps are drawn on easel or butcher paper.</td>
<td></td>
</tr>
<tr>
<td>2) Must be large enough for all attendees to see. The minimum recommended paper size is 24&quot;x36&quot;.</td>
<td></td>
</tr>
</tbody>
</table>
3) Should correspond to Incident Action Plan map to avoid confusion.

4) Should display same information as Incident Action Plan map.

5) Should use color coding for clarity.

c. Traffic plan and facility maps

In addition to the maps for traffic planning, which will be discussed later, there may be some specialized maps needed for logistical support.

1) Photocopied street maps are frequently unreadable because of poor copy quality or too much detail. A simple line drawing map showing only pertinent information can be used to direct support personnel to incident facilities or off-incident points.

2) Detailed facility layout maps may be required. The Display Processor can assist in the development of these maps.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities or Ground Support personnel will explain what the map needs are to display.</td>
<td></td>
</tr>
<tr>
<td>d. I.C.P. and general display maps</td>
<td></td>
</tr>
<tr>
<td>A large scale drawing of the Incident displaying significant information. May be displayed at the I.C.P. and other locations. This map is similar to the operational briefing map.</td>
<td></td>
</tr>
<tr>
<td>4. Acquiring maps</td>
<td></td>
</tr>
<tr>
<td>a. The Supply Unit is responsible for acquiring maps.</td>
<td></td>
</tr>
<tr>
<td>b. If you need maps that you don't have, or if you need additional maps, make your request to the Situation Unit Leader.</td>
<td></td>
</tr>
<tr>
<td>5. A good map should STAND alone.</td>
<td></td>
</tr>
<tr>
<td>a. S = scale</td>
<td></td>
</tr>
<tr>
<td>b. T = title</td>
<td></td>
</tr>
<tr>
<td>c. A = author</td>
<td></td>
</tr>
<tr>
<td>d. N = north arrow</td>
<td></td>
</tr>
<tr>
<td>e. D = date</td>
<td></td>
</tr>
</tbody>
</table>
C. Summary of required maps

1. Situation Unit Map
   a. Never leaves the unit
   b. Is the most current map
   c. Has an overlay

2. Planning meeting detail map
   a. Basically same as Situation Unit map
   b. Used to clarify points and information during meeting
   c. Must have overlay

3. Incident Action Plan map
   Field operations reference attached to Incident Action Plan.

4. Incident Command Post map
   a. Posted at ICP
   b. Has overlay for updates
   c. Usually topographic map

5. General Display Map
   a. Same as ICP map
   b. Posted at various locations

6. Planning Meeting sketch map
   a. Butcher paper
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Only prominent details are indicated</td>
<td></td>
</tr>
<tr>
<td>7. Operational Briefing Map</td>
<td></td>
</tr>
<tr>
<td>a. Butcher paper</td>
<td></td>
</tr>
<tr>
<td>b. Shows details generated during planning meeting</td>
<td></td>
</tr>
<tr>
<td>8. Traffic plan and facility maps</td>
<td></td>
</tr>
<tr>
<td>a. Usually line drawings showing significant reference points</td>
<td></td>
</tr>
<tr>
<td>b. The traffic plan map is included in the Incident Action Plan.</td>
<td></td>
</tr>
</tbody>
</table>
DETAILED LESSON PLAN OUTLINE

CURRICULUM: Incident Command System
COURSE: I-244 Field Observer/Display Processor
UNIT: 6—Process and Display Data
LESSON: 3—Reports and Plans
SUGGESTED TIME:

OBJECTIVES: Upon completion of this lesson, the trainee should be able to:

1. Prepare an Incident Status Summary (ICS Form 209).
2. Prepare required agency reports.

TRAINING AIDS: Overhead projector, screen
OUTLINE

I  Introduction

PRESENT LESSON OBJECTIVES.

The Display Processor is responsible for reporting incident status and for completing the Traffic Plan as an attachment to the Incident Action Plan.

II  Presentation

A.  Prepare Incident Status Summary (ICS 209)

HAND OUT INCIDENT STATUS SUMMARY INSTRUCTIONS.  06-01-I244-HO

1.  The Incident Status Summary serves the following purposes:

   Summary

   a.  It is used by the Situation Unit for posting information on Incident Command Post displays.

   b.  When duplicated and provided to Command Staff members, it provides them with basic information for use in planning for the next operational period.

   c.  It provides basic information to the Information Officer for preparation of media releases.

   d.  It provides incident information to agency dispatch and off-incident coordination centers.
2. Preparation
   a. The Incident Status Summary is prepared by the Display Processor.
   b. Resources information is obtained from the Resources Unit.

3. It is presented to the Planning Section Chief and other General Staff members prior to each Planning Meeting, but it may be required at more frequent intervals by the Incident Commander or Planning Section Chief.

4. Distribution
   When completed, the form is duplicated and copies are distributed to the Incident Commander and staff, all Section Chiefs, Planning Section Unit Leaders, and Agency Dispatch Centers. It is also posted on the display board located at the ICP.

5. If an Incident Status Summary computer program is available, the summary information is entered into the program and is made available to on and off incident users.

If you don't know how to enter information, the terminal operator can assist you.
USE THE COMPUTER PROGRAM IF AVAILABLE, AT THE TRAINING SITE.

B. Agency Reports

ASK STUDENTS FOR SOME EXAMPLES OF AGENCY REPORTS WHICH THE SITUATION UNIT MAY BE ASKED TO PREPARE.

1. Some agencies may require specialized reports.

2. If you are unfamiliar with the requirements of the reports ask the requester or Agency Representative.

C. Prepare a Traffic Plan

The Situation Unit is responsible for collecting information for use in preparing a plan to control incident traffic. The traffic plan, which is prepared by the Display Processor, includes access to and egress from incident facilities and operational areas. The plan should consider both internal and external traffic.

This includes specific routes to reporting locations at the incident for resources dispatched by various agencies; route to and from incident facilities and work locations; and traffic flow within facilities, such as the Base or Camps.

The plan is presented to the Planning Section Chief for review and coordination with the Logistics Section. The Ground Support Unit is responsible for implementation of the Traffic Plan.
1. For internal traffic planning, appropriate Situation Unit personnel must work closely with Facilities and Ground Support Unit personnel.

ASK STUDENTS: WHO CAN PROVIDE INFORMATION ON ACCESS ROUTES? (I.E., GROUND SUPPORT, FIELD OBSERVER, AND PERSONNEL WHO ARE USING THE ROUTES.)

2. The Situation Unit should have the earliest and most complete overview of the situation and the most current information regarding possible traffic hazards, road closures, and access routes. Thus, it is normally in the best position to develop a Traffic Plan.

3. Whenever it becomes apparent that any routing included in the initial plan may be threatened by incident developments or external conditions, the Situation Unit should provide the Planning Section Chief with recommended alternatives.

4. After the Traffic Plan is approved, it is distributed to the following:
   a. Logistics Section Chief
   b. Planning Section Chief
   c. Ground Support Unit Leader
   d. Facilities Unit Leader
   e. Communications Unit Leader
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>f. Participating and cooperating agency dispatchers</td>
<td></td>
</tr>
<tr>
<td>g. Documentation Unit</td>
<td>Unit 6 Quiz</td>
</tr>
<tr>
<td>h. Others, as recommended by Logistics and Planning Section Chiefs</td>
<td>06-02-1244 HO</td>
</tr>
<tr>
<td>i. Attached to the Incident Action Plan</td>
<td>Solution:</td>
</tr>
<tr>
<td></td>
<td>Instr. Guide</td>
</tr>
<tr>
<td></td>
<td>pgs. 226-228</td>
</tr>
</tbody>
</table>

DISTRIBUTE UNIT 6 QUIZ.

ALLOW 30 MINUTES FOR QUIZ.
III. Primary carrier of fire is debris beneath a timber stand.

A. Live fuels are present in sufficient quantity to influence fire behavior. The load of I-H-I-I-I-TL fuels is heavy...........Model 10

B. Surface fuels are mostly foliage litter, with little or no live fuel.

1. I-H-I-I-TL fuel load consists of leaves; I-H-I-I-TL fuels are sparse. Folage litter is loose, space pin or brush leaves loosely packed.............Model 9

2. I-H-I-I-I-TL fuel load consists of about equal to I-H-I-I-I-TL load. Folage litter is tight, closely compressed or space lowwood leaves, tightly packed..........................Model 8

IV. Primary carrier of fire is slash.

A. Slash is not continuous. Other ground fuels must be present to help carry the fire. Average slash depth is about 1 foot.................................Model 11

B. Slash is continuous or nearly so. Other surface fuels need not be present to carry the fire. Average slash depth is about 3 feet.................................Model 13

C. Slash generally covers the ground, though there may be bare spots in areas of light surface. Average slash depth is about 2 feet.................................Model 12
FUEL MODEL KEY

1. Primary carrier of fire is grass. Expected rate of spread is moderate to high, with low to moderate intensity.
   A. Grass is a relatively fire-resistant, it generally burns once only and is easy to walk through. Level 1
   B. Grass has thick, coarse stems, is more near level, and is difficult to walk through. Level 3
   C. Mixture of grass and litter beneath open timber or brush cover that does not burn. Level 2

II. Primary carrier of fire is brush. Expected rate of spread and intensity are both accelerate.
   A. Vegetation type is southern brush or low poodle. Level 1
   B. Live fuels absent or sparse with no capability to result fire spread rate. Level 6
   C. Live fuel moisture can have a significant damping effect on fire behavior.
      1. Brush is light with a light loading of 1-tl fuels. Level 5
      2. Brush is close to 50% high with a heavy loading of 1-tl fuels. Level 4
Field Exercise
GRADING OF FIELD EXERCISE

Each team is graded as Field Observers and Display Processors.

Much of the grading will have to be judgement by the instructor because of variable conditions caused by selecting different exercise areas. Partial points can be given based on quality.

FIELD OBSERVER

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate perimeter</td>
<td>10</td>
</tr>
<tr>
<td>Data recorded on FO map</td>
<td></td>
</tr>
<tr>
<td>Symbology</td>
<td>2</td>
</tr>
<tr>
<td>Water source</td>
<td>1</td>
</tr>
<tr>
<td>Hazards</td>
<td>1</td>
</tr>
<tr>
<td>Proposed control line</td>
<td>1</td>
</tr>
<tr>
<td>Weather observation records (5)</td>
<td>1 point each</td>
</tr>
<tr>
<td>Fuel types (5)</td>
<td>1 point each</td>
</tr>
<tr>
<td>Proposed line evaluation</td>
<td>5</td>
</tr>
<tr>
<td>Access and traffic info</td>
<td>5</td>
</tr>
<tr>
<td>Safety zone evaluation</td>
<td>5</td>
</tr>
<tr>
<td>Water source</td>
<td>5</td>
</tr>
<tr>
<td>Mission completed on time</td>
<td>50</td>
</tr>
</tbody>
</table>

50 points
**DISPLAY PROCESSOR**

<table>
<thead>
<tr>
<th>Item</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic Plan Narrative w/map</td>
<td>5</td>
</tr>
<tr>
<td>Planning Meeting Map</td>
<td>5</td>
</tr>
<tr>
<td>Planning Detail Map w/overlay</td>
<td>10</td>
</tr>
<tr>
<td>Action Plan Map</td>
<td>5</td>
</tr>
<tr>
<td>Acreage Calculation</td>
<td>5</td>
</tr>
<tr>
<td>Status Summary</td>
<td>5</td>
</tr>
<tr>
<td>Special Map</td>
<td>5</td>
</tr>
<tr>
<td>Special Report</td>
<td>5</td>
</tr>
<tr>
<td>Completed on time</td>
<td>5</td>
</tr>
</tbody>
</table>

Total score is computed by adding scores from Field Observer and Display Processor exercises. 70 percent is passing.
<table>
<thead>
<tr>
<th>OUTLINE</th>
<th>KEY POINTS &amp; AIDS</th>
</tr>
</thead>
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<td>C. Summary of required maps</td>
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<tr>
<td>1. Situation Unit Map</td>
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</tr>
<tr>
<td>a. Never leaves the unit</td>
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<tr>
<td>b. Is the most current map</td>
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<td>c. Has an overlay</td>
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<tr>
<td>2. Planning meeting detail map</td>
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</tr>
<tr>
<td>a. Basically same as Situation Unit map</td>
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</tr>
<tr>
<td>b. Used to clarify points and information during meeting</td>
<td></td>
</tr>
<tr>
<td>c. Must have overlay</td>
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<tr>
<td>3. Incident Action Plan map</td>
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<tr>
<td>Field operations reference attached to Incident Action Plan.</td>
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<td>4. Incident Command Post map</td>
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<tr>
<td>a. Posted at ICP</td>
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<tr>
<td>b. Has overlay for updates</td>
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<tr>
<td>c. Usually topographic map</td>
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<td>5. General Display Map</td>
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<tr>
<td>a. Same as ICP map</td>
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<tr>
<td>b. Posted at various locations</td>
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<td>6. Planning Meeting sketch map</td>
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<tr>
<td>a. Butcher paper</td>
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<tr>
<td>OUTLINE</td>
<td>KEY POINTS &amp; AIDS</td>
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<tr>
<td>b. Only prominent details are indicated</td>
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<td>7. <strong>Operational Briefing Map</strong></td>
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<tr>
<td>a. Butcher paper</td>
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<tr>
<td>b. Shows details generated during planning meeting</td>
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<td>8. <strong>Traffic plan and facility maps</strong></td>
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<tr>
<td>a. Usually line drawings showing significant reference points</td>
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<tr>
<td>b. The traffic plan map is included in the Incident Action Plan.</td>
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- Support to camp
- Support to facilities unit, internal
APPENDIX C

FIELD OBSERVER/DISPLAY PROCESSOR I-244

EQUIPMENT AND MATERIALS
APPENDIX C: EQUIPMENT AND MATERIALS

Equipment/Materials List and Ordering Guide

Published National Wildfire Coordinating Group courses are available for purchase through:

National AudioVisual Center (NAC)
General Services Administration
Order Section
Washington, D.C. 20409
Phone (301) 763-1896

Various packages are available from NAC and include:

Instructor's guides, prepackaged handout materials, prepackaged student workbooks, 35mm slides, audio tapes, color slides of all viewgraphs for optional use and 16mm films available separately.

For information about the packaging and costs of the Field Observer/Display Processor I-244 course, contact the National AudioVisual Center at the above address or BIFC, Division of Training, 3905 Vista Avenue, Boise, Idaho 83705.

Items required for the presentation of the Field Observer/Display Processor I-244 course that must be obtained locally by the instructor are:

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<tr>
<th>Item</th>
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<tr>
<td>A.</td>
<td>Overhead projector</td>
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<td>B.</td>
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<td>C.</td>
<td>Transparency marking pens</td>
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<td>D.</td>
<td>Flip charts</td>
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<td>E.</td>
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<td>F.</td>
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<td>G.</td>
<td>Handout material--Appendix D</td>
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<td>H.</td>
<td>Viewgraph materials -- Appendix E</td>
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<td>I.</td>
<td>Planning Section Kit, if available, should be used as &quot;show and tell&quot; display during the course.</td>
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<td>Item</td>
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<td>J. Agency evaluation forms</td>
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<tr>
<td>K. State road map</td>
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<tr>
<td>L. Cajon topographic maps</td>
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<td>M. Cajon orthophoto maps (optional)</td>
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<tr>
<td>N. Firescope Response Booklet Circular</td>
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<td>O. Topographic Map Index</td>
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<td>P. Topographic Map Symbol Sheet</td>
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<td>Q. Acreage dot grids</td>
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<tr>
<td>R. Slope Calculator Overlay</td>
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<td>V. audiogram Overlay</td>
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<td>W. Street atlas</td>
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<td>X. Topographic maps of the Field Exercise areas.</td>
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<td>Z. Barometer/Altimeter</td>
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<tr>
<td>AA. Asney Level/Clinometer</td>
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<tr>
<td>BB. Belt Weather Kit</td>
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<tr>
<td>CC. Hand Held Radios</td>
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<td>DD. Assorted marking pens for paper and mylar</td>
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<td>EE. Compass</td>
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<td>FF. Slide projector</td>
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<td>GG. Pencils (black, red, blue, orange)</td>
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<td>10. overlay material</td>
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<td>11. drop pouches</td>
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EACH STUDENT SHOULD BRING:

A. Clothing suitable for field work, including boots, hat, safety gear.
B. Belt Weather Kit
C. Compass
D. Map Wheel (optional)
E. Barometer/Altimeter (optional)
F. Abney Level/Clinometer (optional)
G. Calculator
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TOTAL $35.82
## PACIFIC SOUTHWEST REGION FIRE CACHE SYSTEM

### OFFICE SUPPLY KIT

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## Proposed Field Observer's Kit

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<th>UI</th>
<th>NFES</th>
<th>Item Description</th>
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<td>WATCH, WRIST.</td>
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</table>
Recommendation 10

- Basic field observer kit
  - belt weather kit (w/ humidity chart)
- scale (Dwyer 1556 P)
- Silva "range" compass 15TD
- dot grids
- audiograms (2 w/ quadrants)
- altimeter
determiner

MRT
- cruise vest (nomex)
- baseline CC
tidelm

observation checklist
- acetate (matte)
pencils
light
- electrical audiogram
3 colors of audiogram
- plastic marker
dot grid

Planning
- planimeter
- F.O. checklist
- map wheel
- light table
- overlays
- audiogram
- predictor
- dot grid

NCIC
TOPO MKPS
(415) 383-8111 EXT 2866
<table>
<thead>
<tr>
<th>Number</th>
<th>Item Description</th>
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<tr>
<td>1</td>
<td>Rothermel - How to Predict Fire Behavior</td>
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<td>2</td>
<td>Anderson - Aids in Determining Fuel Models</td>
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<td>3</td>
<td>Atlas Street Guide</td>
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<td>4</td>
<td>California State Maps</td>
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<tr>
<td>5</td>
<td>Topographic Map Symbols</td>
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<td>6</td>
<td>Belt Weather Kit</td>
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<td>7</td>
<td>Masking Tape</td>
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<td>8</td>
<td>Scotch Tape</td>
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<td>9</td>
<td>Field Operation Guide</td>
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<tr>
<td>10</td>
<td>Fireline Handbook - Supplementals</td>
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<td>11</td>
<td>Vis-a-Vis Pens: Red, Blue, Black, Brown, Green, Orange</td>
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<td>12</td>
<td>Felt Tip Markers: Red, Blue, Black, Brown, Green, Orange</td>
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<td>13</td>
<td>Rulers - Clear, one foot</td>
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<td>Scales - tenths of an inch</td>
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<td>Scales - Engineers</td>
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<td>17</td>
<td>Stapler</td>
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<td>18</td>
<td>Scissors</td>
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<td>Pencils</td>
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<td>Pens - Black/Blue</td>
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<tr>
<td>21</td>
<td>Map Wheel</td>
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<tr>
<td>22</td>
<td>Sunland Blue Line 7½&quot;</td>
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<td>23</td>
<td>Sunland 7½&quot; Colored</td>
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<td>24</td>
<td>Cajon 7½&quot; Blueline</td>
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<td>25</td>
<td>Cajon 7½&quot; Ortho</td>
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<td>Cajon 7½&quot; Colored</td>
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<td>27</td>
<td>Cajon 7½&quot; Grid</td>
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<tr>
<td>28</td>
<td>Yucaipa - 4&quot;-mi</td>
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(OUT) CHECKED BY(S) ___________ DATE ___________ GROUP LEADER ___________

(IN) CHECKED BY(S) ___________ DATE ___________ GROUP LEADER ___________
29. ___ Yucaipa 7½" Bluelined
30. ___ Oildale 7½" Bluelined
31. ___ Oildale 7½" Colored
32. ___ 7½" Colored
33. ___ 7½" Bluelined
34. ___ 7½" Colored
35. ___ 7½" Bluelined
36. ___ Mylar, Large Sheets
37. ___ Mylar, Small Sheets
38. ___ Handi - Talkie
39. ___ Local Road Maps
40. ___ 8 ½" x 11" Pad of Lined Paper
41. ___ Silva Compass
42. ___ "K" Tag
43. ___ Clipboard
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<td>Local Road Map</td>
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<tr>
<td>01-02</td>
<td>Floor Plan</td>
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<tr>
<td>01-03</td>
<td>Orthophoto Map</td>
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<td>01-04</td>
<td>Topographic Map</td>
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<td>01-05</td>
<td>GEOLOC System</td>
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<tr>
<td>01-06</td>
<td>Topographic Map Symbols</td>
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<td>01-07</td>
<td>NFPA Symbology</td>
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<td>01-08</td>
<td>ICS Operational Symbology</td>
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<td>Matte Acetate Overlay</td>
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<td>Bearings/Azimuths</td>
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<td>Unit 3 Field Exercise</td>
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<td>Regulations for Operation of Aircraft</td>
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<td>Aircraft Dispatch Information (Optional)</td>
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<td>04-03</td>
<td>Airlift Transportation Manifest (Optional)</td>
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<tr>
<td>04-04</td>
<td>Aircraft Passenger Operations/Manifest (Optional)</td>
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<td>04-05</td>
<td>Incident Approach/Arrival Procedures</td>
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<tr>
<td>04-06</td>
<td>Incident Air Traffic control (4 pages)</td>
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<td>Quick Acreage Estimation</td>
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<td>Map Overlay Information</td>
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<td>Petrolia &amp; Buckeye Mtn. 7.5' photocopies (Optional)</td>
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<td>San Rafael 7.5' Quad photocopy (Optional)</td>
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<td>Recommended Map Dropping Procedures</td>
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<td>Fire Safety Card</td>
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<td>Observation Checklist Card</td>
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<td>NFFL Fuel Model Descriptions</td>
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<td>Incident Status Summary Instructions</td>
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<td>Final Exam</td>
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<td>00-03</td>
<td>Course Evaluation</td>
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LOCAL ROAD MAP (AAA, THOMAS BROS. ETC.)
FIRESCOPE GEOGRAPHIC LOCATOR SYSTEM (GEOLOC)

All of the FIRESCOPE Map Products designed for real-time incident use contain the GEOLOC Locator System. GEOLOC is the only locator system which can be universally applied by all Southern California Fire Service Agencies for locating and dispatching personnel and equipment to emergency incidents.

SPECIFICATIONS

- Based upon map quadrangle formats previously established by the USGS National Mapping Division.

- Locates easily to within a 100 acre cell.

- Application extended to Local, State, and National programs.

- Easily cross-referenced to other coordinate systems.

ADVANTAGES

- Gives Agencies a common language during mutual aid response.

- Provides a single piece of information for both location and map page.

- Provides a data base for storage of other data: fuels, slope, aspect, weather data, response times.

- Interfaces with fundamental fire modeling routines.

- Increased efficiency of dispatch.

- Establishes a locator system not subject to change.
## Topographic Map Symbols

**Variations Will Be Found on Older Maps**

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
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<tbody>
<tr>
<td>Primary highway, hard surface</td>
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<tr>
<td>Secondary highway, hard surface</td>
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<tr>
<td>Light-duty road, hard or improved surface</td>
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<tr>
<td>Unimproved road</td>
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<tr>
<td>Road under construction, alignment known</td>
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<tr>
<td>Proposed road</td>
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<tr>
<td>Dual highway, dividing strip 25 feet or less</td>
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<tr>
<td>Dual highway, dividing strip exceeding 25 feet</td>
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<tr>
<td>Trail</td>
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<td>Railroad: single track and multiple track</td>
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<td>Railroads in juxtaposition</td>
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<tr>
<td>Narrow gauge: single track and multiple track</td>
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<tr>
<td>Railroad in street and carline</td>
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<tr>
<td>Bridge: road and railroad</td>
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<tr>
<td>Drawbridge: road and railroad</td>
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<tr>
<td>Footbridge</td>
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<td>Tunnel: road and railroad</td>
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<tr>
<td>Overpass and underpass</td>
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<tr>
<td>Small masonry or concrete dam</td>
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<tr>
<td>Dam with lock</td>
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<td>Dam with road</td>
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<tr>
<td>Canal with lock</td>
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<tr>
<td>Buildings (dwelling, place of employment, etc.)</td>
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<tr>
<td>School, church, and cemetery</td>
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<tr>
<td>Buildings (barn, warehouse, etc.)</td>
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<tr>
<td>Power transmission line with located metal tower</td>
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<tr>
<td>Telephone line, pipeline, etc. (labeled as to type)</td>
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<tr>
<td>Wells other than water (labeled as to type)</td>
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<tr>
<td>Tanks: oil, water, etc. (labeled only if water)</td>
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<tr>
<td>Located or landmark object: windmill</td>
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<tr>
<td>Open pit, mine, or quarry; prospect</td>
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<tr>
<td>Shaft and tunnel entrance</td>
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</tbody>
</table>

### Boundaries:
- National
- State
- County, parish, municipio
- Civil township, precinct, town, parish
- Incorporated city, village, town, hamlet
- Reservation, National or State
- Small park, cemetery, airport, etc.
- Land grant
- Township or range line, United States land survey
- Township or range line, approximate location
- Section line, United States land survey
- Section line, approximate location
- Township line, not United States land survey
- Section line, not United States land survey
- Found corners, section and closing
- Boundary monument: land grant and other
- Fence or field line

### Index Contours:
- Intermediate contour

### Supplementary Contours:
- Depression contours

### Sections:
- Cut
- Levee
- Levee with road
- Wash
- Tailings
- Tailings pond
- Intricate surface
- Gravel beach

### Landform:
- Perennial streams
- Intermittent streams
- Elevated aqueduct
- Aqueduct tunnel
- Water well and spring
- Glacier
- Small rapids
- Small falls
- Large rapids
- Large falls
- Intermittent lake
- Dry lake bed
- Foreshore flat
- Rock or coral reef
- Sounding, depth curve
- Piling or colonn

### Exposed Wreck:
- Sunken wreck
- Rock, bare or awash; dangerous to navigation

### Vegetation:
- Marsh (swamp)
- Submerged marsh
- Wooded marsh
- Mangrove
- Woods or brushwood
- Orchard
- Vineyard
- Scrub

### Land Subject to Controlled Muddation:
- Urban area
OPERATIONAL SYMBOLS

$^{57 \text{LAC}}$ — Fire Protection Facility (with Agency designator)

**HYDRANTS**

*Outlet Size*

- • — Unclassified
-  — 2.5"
-  — 4" x 2.5"
-  — 4" x 4" x 2.5"
-  — 4" x 2.5" x 2.5"
-  — 2.5" x 2.5"
-  — 4.5" x 2.5"
-  — Marine
-  — Indicated Main Size (may appear with any hydrant)

14CO — Street Number and Directional Arrow

VNC — Special Hazard (with Agency designator - Reference No.)

—— Unsafe Bridge

—— Gate

Glenora — Firebreak or Fuelbreak

$^{3 \text{BNS}}$ — Helisport (with Agency designator and name)

$^{\text{WT}}_2$ — Fixed Water Source (with capacity)

LPF — Responsibility Boundary (with Agency designation)

—— Power Substation
# ICS Map Display Symbolology

<table>
<thead>
<tr>
<th>MINIMUM RECOMMENDED</th>
<th>SUGGESTED FOR PLACEMENT ON OVERLAYS</th>
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<tbody>
<tr>
<td><strong>BLACK</strong></td>
<td>10 AUG 1979 <em>UNCONTROLLED FIRE EDGE</em></td>
</tr>
<tr>
<td>1 HIGHLIGHTED GEOGRAPHIC OR MANMADE FEATURES</td>
<td>10 AUG 1979 <em>SPOT FIRE</em></td>
</tr>
<tr>
<td>1 COMPLETED DOZER LINE</td>
<td>10 AUG 1979 <em>HOT SPOT</em></td>
</tr>
<tr>
<td>1 LINE BREAK COMPLETED</td>
<td>15 AUG 2000 <em>FIRE SPREAD PREDICTION</em></td>
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<tr>
<td><strong>RED</strong></td>
<td>15 AUG 2000 <em>PLANNED FIRE LINE</em></td>
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<td>10 AUG 1979 <em>HAZARD IDENTIFY TYPE OF HAZARD E.G. POWER LINES</em></td>
<td>15 AUG 2000 <em>PLANNED SECONDARY LINE</em></td>
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<td><strong>BLUE</strong></td>
<td>15 AUG 1979 <em>WIND SPEED AND DIRECTION</em></td>
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<td>INCIDENT COMMAND POST</td>
<td>15 AUG 1979 <em>INITIALLY NUMBERED CLOCKWISE FROM FIRE ORIGIN</em></td>
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<td>9 HLT/CAMP IDENTIFY BY NAME</td>
<td>15 AUG 1979 <em>INITIALLY LETTERED CLOCKWISE FROM FIRE ORIGIN</em></td>
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<tr>
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<td>15 AUG 1979 <em>PROPOSED DOZER LINE</em></td>
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<td>0 SHELFSPOT</td>
<td>15 AUG 1979 <em>PROPOSED DOZER LINE</em></td>
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<tr>
<td>0 REPEATER/MOBILE RELAY</td>
<td>15 AUG 1979 <em>PROPOSED DOZER LINE</em></td>
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<td><strong>BLUE</strong></td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
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<td>OPTIONAL</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
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<tr>
<td>0 TELEPHONE</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
<tr>
<td>0 FIRE STATION</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
<tr>
<td>0 WATER SOURCE IDENTIFY TYPE: I.E. POND, CISTERN, HYDRANTS</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
<tr>
<td>0 MOBILE WEATHER UNIT</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
<tr>
<td>0 IN GROUND LINE</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
<tr>
<td>0 FIRST AID STATION</td>
<td>15 AUG 1979 <em>FIRE BREAK (PLANNED OR INCOMPLETE)</em></td>
</tr>
</tbody>
</table>

* TO BE USED ON INCIDENT BRIEFING AND ACTION PLAN MAPS (NO COLOR)
SLOPE INDICATOR

1. PLACE RECTANGLE OVER AREA.
2. COUNT CONTOUR LINES WITHIN RECTANGLE (DO NOT COUNT ACROSS RIDGES OR CREEKS).
3. IN TABLE BELOW FIND NUMBER CLOSEST TO NUMBER OF CONTOUR LINES COUNTED (NEXT TO PROPER CONTOUR INTERVAL FOR YOUR QUAD) AND READ % SLOPE AT BOTTOM.

<table>
<thead>
<tr>
<th>CONTOUR INTERVAL</th>
<th>NUMBER CONTOUR LINES COUNTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>20'</td>
<td>5 10 15 20 25 30 35 40</td>
</tr>
<tr>
<td>40'</td>
<td>2 5 7 10 12 15 17 20</td>
</tr>
<tr>
<td>80'</td>
<td>1 2 4 5 6 8 9 10</td>
</tr>
<tr>
<td>% SLOPE</td>
<td>10 20 30 40 50 60 70 80</td>
</tr>
</tbody>
</table>

7.5 MINUTE SCALES

MILES

YARDS

CHAINS

15 MINUTE SCALES

MILES

YARDS
CONVERSIONS

UNIT OF MEASURE

LINEAR

12" = 1 foot
3' = 1 yard
5280' = 1 mile
66' = 1 chain
80 ch. = 1 mile

AREA

1 acre = 208' x 208'
1 acre = 43,560 square feet
1 acre = 10 square chains

640 acres = 1 square mile
1 section = 1 square mile
1/2 section = 320 acres
1/4 section = 160 acres

LENGTH X WIDTH = AREA
MODIFIED ACREAGE GRID
PLACE GRID OVER AREA TO BE MEASURED; COUNT DOTS, MULTIPLY BY CONVERTING FACTOR TO COMPUTE TOTAL ACREAGE. WHEN DOTS FALL ON AREA BOUNDARY COUNT ALTERNATE DOTS.

### MAP SCALES AND EQUIVALENTS

<table>
<thead>
<tr>
<th>SCALE</th>
<th>INCHES PER MILE</th>
<th>ACRES PER INCH²</th>
<th>CONVERTING FACTOR EACH DOT EQUALS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:20,000</td>
<td>3.168</td>
<td>63.769</td>
<td>1.736 ACRES</td>
</tr>
<tr>
<td>1:24,000</td>
<td>2.540</td>
<td>91.827</td>
<td>2.500 ACRES</td>
</tr>
<tr>
<td>1:62,500</td>
<td>1.014</td>
<td>622.449</td>
<td>16.946 ACRES</td>
</tr>
<tr>
<td>1:63,350</td>
<td>1.000</td>
<td>640.000</td>
<td>17.424 ACRES</td>
</tr>
</tbody>
</table>
ACREAGE CHART

LENGTH OF GROUND IN FEET

ACRES

WIDTH FEET

A

B

C

2000

200

300

400

500

600

700

800

900

1000

200

300

400

500

600

700

800

900

1000

10

.01

.02

.03

.05

1

2

3

5

10

20

30

40

0.002

0.003

0.005

0.01

0.2

0.3

0.5

0.1

20

30

40

50

60

70

80

90

100
**Bearings**

**Bearings:** are measured from N and S to the E and W.

**Azimuths**

**Azimuths:** are the clockwise angle measured from N.
REGULATIONS
For Operation of
AIRCRAFT

Commencing January 1920

1. Don't take the machine into the air unless you are satisfied it will fly.
2. Never leave the ground with the motor leaking.
3. Don't turn sharply when taxing. Instead of turning sharp, have someone lift the tail around.
4. In taking off, look at the ground and the air.
5. Never get out of a machine with the motor running until the pilot relieving you can reach the engine controls.
6. Pilot's should carry hankies in a handy position to wipe off goggles.
7. Riding on the steps, wings, or tail of a machine is prohibited.
8. In case the engine fails on takeoff, land straight ahead regardless of obstacles.
9. No machine must taxi faster than a man can walk.
10. Never run motor so that blast will blow on other machines.
11. Learn to gauge altitude, especially on landing.
12. If you see another machine near you, get out of the way.
13. No two cadets should ever ride together in the same machine.
14. Do not trust altitude instruments.
15. Before you begin a landing glide, see that no machines are under you.
16. Hedgehopping will not be tolerated.
17. No spins on back or tail slides will be indulged in as they unnecessarily strain the machines.
18. If flying against the wind and you wish to fly with the wind, don't make a sharp turn near the ground. You may crash.
19. Motors have been known to stop during a long glide. If pilot wishes to use motor for landing, he should open throttle.
20. Don't attempt to force machine onto ground with more than flying speed. The result is bouncing and ricocheting.
21. Pilots will not wear spurs while flying.
22. Do not use aviation gasoline in cars or motorcycles.
23. You must not take off or land closer than 50 feet to the hanger.
24. Never take a machine into the air until you are familiar with its controls and instruments.
25. If an emergency occurs while flying, land as soon as possible.
AIRCRAFT DISPATCH INFORMATION

1. ORDER NO. ____________________________

2. DATE ____________________________ TIME ____________________________

3. SEC.______TWN.______RNG. RESPONSE AREA ____________________________

4. REQUEST NUMBER______ NO. OF TANKERS NEEDED ______ TYPE ____________________________

PILOT INFORMATION

5. MAGNETIC BEARING __________________ FROM __________________ IN MILES __________________

6. CONTACT _______ RADIO NET [ ] GREEN [ ] RED [ ] YELLOW [ ] 122.9
   [ ] BLUE [ ] USFS

7. DESCRIPTIVE LOCATION ____________________________

8. RELOAD ____________________________

9. OTHER AIRCRAFT IN THE AREA ____________________________

10. HAZARUS ____________________________
### CDF Airlift Transportation Manifest

<table>
<thead>
<tr>
<th>ORDER NO.</th>
<th>FIRE NAME</th>
<th>DATE</th>
<th>DEPARTURE TIME</th>
<th>DEPARTURE PLACE</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>AIRCRAFT AGENCY</th>
<th>AIRCRAFT #</th>
<th>ARRIVAL TIME</th>
<th>ARRIVAL PLACE</th>
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</thead>
</table>

**Operation or Travel Instructions**

<table>
<thead>
<tr>
<th>CHIEF OF PARTY, TITLE</th>
<th>ON ARRIVAL CONTACT</th>
<th>IN CASE OF DELAYS CALL</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PHONE #</td>
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<table>
<thead>
<tr>
<th>VEHICLES</th>
<th>X NO.</th>
<th>WEIGHT</th>
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<table>
<thead>
<tr>
<th>LIFE</th>
<th>RADIO #</th>
<th>WATER DRAINED FROM TANKS</th>
<th>FUEL TANKS 1/2 TO 3/4</th>
<th>ALL TOOLS SECURED</th>
<th>OTHER FUEL OK</th>
</tr>
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</table>

**Liaison Officer**

<table>
<thead>
<tr>
<th>TITLE</th>
<th>TOTAL PERSONNEL</th>
</tr>
</thead>
</table>
INCIDENT APPROACH/ARRIVAL PROCEDURES

1. Use maps to stay oriented as to your location while enroute to an incident.

2. Report three minutes out on air-to-air frequency.
   a. Direction
   b. Altitude

3. Check for other traffic.
   a. Look
   b. Listen to assigned air tactics frequencies.

4. Check incident location
   a. Index and topog maps
   b. Section, township, range
   c. Advise ECC if different than dispatch

5. Survey incident scene
   a. Flight hazards
   b. Incident situation
   c. Ground units
   d. Log arrival time and situation

6. Report arrival on air-to-air frequency
   a. Location
   b. Altitude
   c. Advise Air Attack of your intentions

7. Report to Air Operations Director/Situation Unit (if needed) on assigned ground tactics frequency.
   a. At scene
   b. Report on conditions
   c. Location - section, township, range (if needed).
INCIDENT AIR TRAFFIC CONTROL

A. An Air Attack Supervisor's most important job of maintaining a safe, orderly flow of air traffic in a fire area is very similar to that of an FAA Air Traffic Controller. He:
1. Relies on pilots' use of standard flight rules and visual separation.
2. Assists with maintaining separation by:
   a. Visual observation
   b. Requiring standard radio procedures and position reports.
   c. Providing priority clearances and clearances for non-standard maneuvers.
   d. Specifying flight patterns and/or altitudes, if necessary, and
   e. Takes action to protect traffic from pilots not conforming to the flight rules or communication requirements.

B. Flight safety in a fire area thus depends upon:
1. Understanding of and adherence to the basic flight rules by all pilots and control aircraft.
2. Precise communication interaction among all aircraft, and
3. Use of proper techniques by Air Attack Managers to assure traffic separation.

C. Basic flight rules for approaching and operating in a fire area.
1. All aircraft maintain visual separation - do not approach or orbit through heavy smoke.
2. Vertical separation of airplanes and helicopters on approach:
a. Fixed wing aircraft approach and orbit at or above 1,000 ft. A.G.L. with at least 500 ft. vertical separation between orbit levels (in the same horizontal orbit area).

b. Helicopters approach and operate in the fire area at or below 500 ft. A.G.L. and avoid the flow of fixed wing traffic.

3. "Normal" fixed wing vertical separation in orbit.
   a. Airtankers – 1,000 ft. through 1,500 ft. A.G.L. Air Attack Management will normally operate at 2,000 ft. A.G.L. or above. In the case of large air organization, normal "stacking" is as follows:
   b. Airtanker/Helicopter Coordinators at 2,000 ft. A.G.L. or above.
   c. Air Attack, Recon., etc. – 500 ft. or more above Coordinator(s).

4. Horizontal separation and flight patterns.
   a. Air Attack Supervisors and Coordinators fly right-traffic -- normally inside of airtanker orbits.
   b. All airtankers fly left-traffic.
   c. First airtanker in line to drop flies pattern close-in to target.
   d. Each successive tanker flies further out and keeps aircraft he is following in front and to the left.
   e. Helicopter patterns vary according to mission – maintain visual separation and avoid fixed wing traffic.

5. No fixed wing flights will be made below an altitude that will allow clearance of surrounding terrain by level flight, 180 degree turn, or "normal" climb out with the load on-board.

6. All airtanker drops must be made from a descent or level flight path (no "uphill" drops).
D. Incident Air Traffic Control Procedures

1. Air attack must announce, direct or clear changes from normal flight patterns to prevent this from happening.
   a. Air attack announces changes in his altitude or flight pattern prior to execution, and
   b. Directs changes in airtanker and/or helicopter flight patterns as needed to maintain separation.
   c. Clearance must be obtained from air attack for:
      1) Non-standard maneuvers by airtankers.
      2) Airtanker drop runs.
      3) Helicopter operations in, near or through airtankers operating areas.

2. Position reports - the following position reports are required for air traffic control purposes:
   a. ALL inbound aircraft - 3 minutes out from fire area - report
      1) Direction approaching from
      2) Altitude
   b. ALL aircraft entering the traffic pattern at the fire location and altitude.
   c. Airtankers - on "base" or "final" - for drop run.
   d. Helitankers - "lifting off" with a load or "inbound" with a load - before entering airtanker target area.
   e. Helicopters on other missions
      1) Call for clearance before first lift-off for a new mission (from-to).
      2) When approaching "check points" for multiple helicopter operations.
      3) Prior to entering airtanker operating areas.

3. Operating in a fire area.
   a. Inform inbound aircraft (at 3 min. check) of:
      1) Your altitude and location.
      2) Part of fire being worked.
      3) Other traffic and his position in line.
b. Notify other aircraft if and when he is "in sight."
   1) Helps cut unnecessary radio traffic short.
   2) Give your position relative to HIS clock (his nose being 12 o'clock).
4. The only response necessary is performance of action requested.

E. Approaching a fire with other traffic already in the area.
   1. Enter high with the fire to your:
      a. Right (air attack)
      b. Helicopters - fit in with the flow.
   2. If entering low, stay wide of the fire with the fire on your left, to fit into flow of airtanker traffic.
   3. Announce your location, altitude and intentions before entering the traffic pattern.
   4. Stay clear of heavy smoke and check for traffic in the pattern before entering.
   5. If you are relieving another air attack unit enter the area at least 500 feet above the other traffic until you have him in sight.
   6. For an orientation recon with the aircraft being relieved descend to his altitude outside his flight path with the other aircraft in sight. Follow him around the fire just outside and behind him and tell him where you are at.

F. Summary
   1. Control must be based on position reports or visual observations, depending on traffic density.
   2. Don't make your pilots be mind readers, give clear instructions.
   3. Check the fire area for obstacles before clearing low approaches (drops, helicopter landings).
   4. Remind pilots to look for hazards.
   5. Announce your altitude changes or movements into and out of the area.
MAPPING FROM AIRCRAFT
QUICK ACREAGE ESTIMATION

<table>
<thead>
<tr>
<th>Acreage</th>
<th>640</th>
<th>160</th>
<th>40</th>
<th>10</th>
<th>2.5</th>
<th>0.625</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ft/Side</td>
<td>5280</td>
<td>2640</td>
<td>1320</td>
<td>660</td>
<td>330</td>
<td>165</td>
</tr>
<tr>
<td>Yds/Side</td>
<td>1760</td>
<td>880</td>
<td>440</td>
<td>220</td>
<td>110</td>
<td>55</td>
</tr>
<tr>
<td>Mileage</td>
<td>1</td>
<td>0.5</td>
<td>0.25</td>
<td>0.125</td>
<td>0.0625</td>
<td>0.03125</td>
</tr>
<tr>
<td>Mi. Around</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0.5</td>
<td>0.25</td>
<td>0.125</td>
</tr>
</tbody>
</table>

COMPARISON DATA

<table>
<thead>
<tr>
<th>Reference</th>
<th>Area</th>
<th>Dimensions</th>
<th>Acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>One acre =</td>
<td>43560 sq ft</td>
<td>208.7 Ft/ SIDE</td>
<td>1</td>
</tr>
<tr>
<td>One Football Field =</td>
<td>47970 sq ft</td>
<td>(100x53.3 yds)</td>
<td>1.10</td>
</tr>
<tr>
<td>Incl. End Zones</td>
<td>57564 sq ft</td>
<td>(120x53.3 yds)</td>
<td>1.32</td>
</tr>
<tr>
<td>Inside Track</td>
<td>108900 sq ft</td>
<td>(1/4 mile)</td>
<td>2.50</td>
</tr>
<tr>
<td>One Baseball Diamond =</td>
<td>8100 sq ft</td>
<td>(90x90 ft)</td>
<td>0.19</td>
</tr>
<tr>
<td>*Playing Field</td>
<td>91924 sq ft</td>
<td>(325'lines, )</td>
<td>2.11</td>
</tr>
<tr>
<td>*(Obviously variable)</td>
<td>122500 sq ft</td>
<td>400'center)</td>
<td>2.81</td>
</tr>
</tbody>
</table>
MAPPING FROM AIR
MAPS AND MAP OVERLAYS
INFORMATION SHEET

1. Identify the map
   a. Name and index number (Scotia quad 7.5 min.)
   b. CDF Admin. map, Thomas Bros., Triple A road map, etc.

2. Fire name

3. Fire location - section, township, range B&M, general location.

4. The cartographer, who made the map.

5. The date and time the map was prepared.

6. Fire outline and geographical features
   a. Roads and road intersections.
   b. Creeks, streams, rivers, etc.
   c. Section corners, at least three points of reference include section numbers, township lines, etc.

7. Incident number

8. Fire size, acreage

9. Other information as requested.

10. If additional symbols are required, other than what is covered by ICS, use agency specific symbols and identify.
RECOMMENDED MAP DROPPING PROCEDURES

1. Secure the overlay in the message packet and seal it. Fold streamer in accordion type fold in compact packet.

2. Secure all loose items in the aircraft cabin to keep the wind from blowing them around.

3. Take off your glasses, wrist watch, and button your shirt pockets.

4. Clear the area for other aircraft before descending. When clear, make a slow circling descent. Make sure you and the pilot agree on the target, approach and departure path, and airspeed for opening the window.

5. Check the wind in the drop area for drift on approach and release location.
   a. Look for smoke drift, if close to the fire, to indicate which direction the prevailing wind is from.
   b. Make a high flight above the anticipated flight path to check wind and hazards.

6. Advise the recipient you are beginning the map drop run.

7. Make a prelanding check of the aircraft, except keep gear up.

8. Call off prelanding checklist to the pilot as they are made and ask for the okay to open the window. When cleared to open, tell the pilot you are going to remove your headset, that you will be off the air. Remove your headset. Secure the headset, check the airspeed and open the window slowly.

9. Watch the approach and lineup. If it looks good throw the map packet down hard. Close the window slowly and depart drop area. If there are other aircraft in the area advise them of your departure.

10. Never descend below 500 feet above the ground level to make a map drop. If it is important take it to the nearest airport authorized for your aircraft and have someone meet you there.

11. If you have any doubt about the success of the mission, cancel it and go to the alternate plan.
TEN STANDARD FIREFIGHTING ORDERS

1. Keep informed on fire weather conditions and forecasts.

2. Know what your fire is doing at all times - observe personally, use scouts.

3. Base all action on current and expected behavior of fire.

4. Have escape routes for everyone and make them known.

5. Post a lookout when there is possible danger.


7. Maintain prompt communication with your crew, your boss, and adjoining forces.

8. Give clear instructions and be sure they are understood.

9. Maintain control of your crew at all times.

10. Fight fire aggressively but provide for safety first.
OBSERVATION CHECKLIST

Access Routes
Road Conditions
Bridges
Turnouts
Water Sources
Access
Improvements
Facility Locations
Possible Line Locations
Resource Limitations
Topography
Fuel
Weather
General Behavior
Specialized Resources

Pocket size to cut out and laminate
Aids to Determining Fuel Models For Estimating Fire Behavior

Hal E. Anderson
FUEL MODEL KEY

I. PRIMARY CARRIER OF FIRE IS GRASS. EXPECTED RATE OF SPREAD IS MODERATE TO HIGH, WITH LOW TO MODERATE INTENSITY.
   A. Grass has a relatively fine structure, is generally below knee level, and is easy to walk through. MODEL 1
   B. Grass has thick, coarse stems, is above knee level, and is difficult to walk through. MODEL 3
   C. Mixture of grass and litter beneath open timber or brush overstory that does not burn. MODEL 2

II. PRIMARY CARRIER OF FIRE IS BRUSH. EXPECTED RATE OF SPREAD AND INTENSITY ARE BOTH MODERATE.
   A. Vegetation type is southern rough or low pocosin. MODEL 7
   B. Live fuels absent or sparse with no capability to reduce fire spread rate. MODEL 5
   C. Live fuel moisture can have a significant damping effect on the fire behavior.
      1. Brush is about knee deep with a light loading of 1-H TL fuels. MODEL 5
      2. Brush is close to head high with a heavy loading of 1-H TL fuels. MODEL 4

   (see reverse side)

III. PRIMARY CARRIER OF FIRE IS DEBRIS BENEATH A TIMBER STAND.
   A. Live fuels are present in sufficient quantity to influence fire behavior. The load of 10-H TL fuels is heavy. MODEL 10
   B. Surface fuels are mostly foliage litter, with little or no live fuel.
      1. 1-H TL load strongly predominates; 10-H and 100-H TL fuels are sparse. Foliage litter is long needle pine or hardwood leaves loosely compacted. MODEL 9
      2. 1-H and 10-H TL fuel load combined is about equal to 100-H TL load. Foliage litter is short needle coniferous or small hardwood leaves, tightly compacted. MODEL 8

IV. PRIMARY CARRIER OF FIRE IS SLASH.
   A. Slash is not continuous. Other ground fuels must be present to help carry the fire. Average slash depth is about 1 foot. MODEL 11
   B. Slash is continuous or nearly so. Other surface fuels need not be present to carry the fire. Average slash depth is about 3 feet. MODEL 13
   C. Slash generally covers the ground, though there may be bare spots or areas of light coverage. Average slash depth is about 2 feet. MODEL 12

Pocket size to cut out and laminate
INCIDENT STATUS SUMMARY (ICS Form 209)

a. **Purpose.** The Incident Status Summary serves the following purposes:

1. It is used by Situation Unit personnel for posting information on Incident Command Post displays.

2. When duplicated and provided to Command Staff members, it provides them with basic information for use in planning for the next operational period.

3. It provides basic information to the Information Officer for preparation of media releases.

4. It provides incident information to agency dispatch and off incident coordination centers.

b. **Preparation.** The Incident Status Summary is prepared by the Situation Unit. Resources information should be obtained from the Resources Unit. It is scheduled for presentation to the Planning Section Chief and other General Staff members prior to each Planning Meeting and may be required at more frequent intervals by the Incident Commander or Planning Section Chief.

c. **Distribution.** When completed, the form is duplicated and copies are distributed to the Incident Commander and staff, and all Section Chiefs, Planning Section Unit Leaders, and Agency Dispatch Centers. It is also posted on the display board located at the ICP.
INSTRUCTIONS FOR COMPLETING THE INCIDENT STATUS SUMMARY
(ICS FORM 209)

Completion of the Incident Status Summary will be as specified by Agency or municipality. Report by telephone, teletype, computer, or facsimile to the local Agency or municipality headquarters by 2100 hours daily on incidents as required by Agency or municipality (reports are normally required on life threatening situations, real property threatened or destroyed, high resource damage potential, and complex incidents that could have political ramifications). Normally wildland agencies require a report on all Class D (100 acres plus) and larger incidents (unless primarily grass type in which case report Class E, 300 acres or larger). The first summary will cover the period from the start of the incident to 2100 hour the first day of the incident, if at least four hours have elapsed; thereafter the summary will cover the 24 hour period ending at 1900 (this reporting time will enable compilation of reporting data and submission of report to local Agency or municipality headquarters by 2100 hours) daily until incident is under control. Wildland fire agencies will send the summary to NIFC by 2100 hours Mountain Time.

1. Enter date and time report completed.
2. Check appropriate space.
3. Provide name given to incident by Incident Commander or Agency.
4. Enter number assigned to incident by Agency.
5. Enter first initial and last name of Incident Commander.
6. Enter Agency or Municipality.
7. Enter County where incident is occurring.
8. Enter type incident e.g., wildland fire (enter fuel type), structure fire, hazardous chemical spill, etc.
9. Enter legal description and general location. Use remarks for additional data if necessary.
10. Enter date and military time incident started.
11. Enter specific cause or under investigation.
12. Enter area involved e.g., 50 acres, top three floors of building, etc.
13. Enter estimate of percent of containment.
14. Enter estimate of date and time of total containment.
15. Enter estimated date and time of control.
16. Enter actual date and time fire was declared controlled.
17. Report significant threat to structures, watershed, timber, wildlife habitat or other valuable resources.
18. Enter control problems e.g., accessibility, fuels, rocky terrain, high winds, structures.
19. Enter estimated dollar value of total damage to date. Include structures, watershed, timber, etc. Be specific in remarks.
20. Enter estimate of values saved as result of all suppression efforts.
21. Enter any serious injuries or deaths which have occurred since the last report. Be specific in remarks.
22. Indicate the extent of line completed by chains or other units of measurement.
23. Indicate line to be constructed by chains or other units of measurement.
24. Indicate current weather conditions at the incident.
25. Indicate predicted weather conditions for the next operational period.
26. Provide total incident cost to date.
27. Provide estimated total cost for entire incident.
28. List agencies which have resources assigned to the incident.
29. Enter resource information under appropriate Agency column by single resource or strike team.
30. List by name those agencies which are providing support (e.g., Salvation Army, Red Cross, Law Enforcement, National Weather Service, etc.).
31. The Remarks space can be used to (1) list additional resources not covered in Section 28/29; (2) provide more information on location; (3) enter additional information regarding threat control problems, anticipated release or demobilization, etc.
32. This will normally be the Incident Situation Status Unit Leader.
33. This will normally be the Incident Planning Section Chief.
34. The ID of the Agency entering the report will be entered (computer entry).

FOR THOSE AREAS USING EXISTING COMPUTER SYSTEM REFER TO USER'S MANUAL
Maximum number of characters allowed for each block are specified in parenthesis on front of form.
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<td>Truck C's</td>
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<td>Rescue/Med.</td>
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<td>Water Tenders</td>
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<td>Remarks</td>
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APPENDIX E
FIELD OBSERVER/DISPLAY PROCESSOR I-244
VIEWGRAPHS AND SLIDES
05-07-I244 VG Situation 2
05-08-I244 VG Situation 3
05-09-I244 VG Situation 4
05-10-I244 VG Situation 5
05-11-I244 VG Situation 6
05-12-I244 VG Situation 7
05-13-I244 VG Situation 8
05-14-I244 VG Situation 9
05-15-I244 VG Situation 10
05-16-I244 VG Situation 11
05-17-I244 VG Situation 12
05-18-I244 VG Situation 13
05-19-I244 VG Objectives
05-20-I244 VG Observation Record
05-21-I244 VG 20 Foot Windspeed
05-22-I244 VG Flame Length
05-23-I244 VG Objectives

06-01-I244 VG Objectives
06-02-I244 VG Objectives
06-03-I244 VG ICS Map Display Symbology
06-04-I244 VG Branch, Group, and Division Designators
06-05-I244 VG Simple Traffic Map
06-06-I244 VG Objectives
06-07-I244 VG ICS 209
06-08-I244 VG Map
06-09-I244 VG Map

Slides

04-01-I244 SL
through
04-68-I244 SL Mapping From Air Slide Series
FIELD OBSERVER, DISPLAY PROCESSOR

COURSE OBJECTIVES:

- IDENTIFY TYPES OF MAPS
- INTERPRET MAP INFORMATION
- USE COMMON METHODS OF LAND DESCRIPTION
- USE MAP SYMBOLOGY
- CALCULATE DISTANCE, ELEVATION, SLOPE AND AREA
- USE MAPPING AIDS
- COLLECT FIELD DATA
- TRANSMIT FIELD DATA
- ANALYZE FIELD DATA
- DISPLAY DATA
UNIT 1 LESSON 1 OBJECTIVES

INTRODUCTION TO MAPS

- DEFINE:

  PLANIMETRIC MAP
  TOPOGRAPHIC MAP
  ORTHOPHOTO MAP
  QUADRANGLE
UNIT 1 LESSON 2 OBJECTIVES

MAP INTERPRETATION INFORMATION

- DETERMINE GEOGRAPHICAL AREA REPRESENTED
- DEFINE:
  MAP SCALE
  COMPARISON SCALE
  REPRESENTATIVE FRACTION
- DETERMINE CARDINAL DIRECTIONS
- INTERPRET MAP LEGEND
- LOCATE REVISION DATE
- DETERMINE ADJOINING MAPS
- USE GEOLOC SYSTEM
NARRATIVE DESCRIPTION
ZONE DIVISIONS FOR THE U.S.
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FG 19

32-7½' QUADS
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7½'

1-7½' QUAD
TOPOGRAPHIC MAPS

UNIT 1  LESSON 3

OBJECTIVES

- EXPLAIN BASIC MAPPING COLORS
- INTERPRET TOPOGRAPHIC MAP SYMBOLS
- INTERPRET MARGIN INFORMATION
- USE USGS TOPOGRAPHIC MAP INDEX CIRCULAR
- USE CONTOUR LINES TO IDENTIFY
  TOPOGRAPHIC FEATURES
TOPOGRAPHIC MAP MARGINS:

A. GEOGRAPHIC AREA REPRESENTED
B. SCALE
C. CONTOUR INTERVAL
D. MAGNETIC DECLINATIONS
E. ADJOINING MAPS
F. LEGAL DESCRIPTIONS
G. LONGITUDE AND LATITUDE
H. REVISION DATE
SYSTEM OF LAND DESCRIPTION IN THE UNITED STATES

OBJECTIVES
- Define:
  - Base Line and Principal Meridian
  - Township
  - Range Lines
  - Section

Describe the Township Numbering System

Divide a Section

List Four Methods of Land Description
# Typical Township

<table>
<thead>
<tr>
<th></th>
<th>31</th>
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</tbody>
</table>

T5N, R7W
HALF SECTIONS

SECTION 22, T5N, R7W, MDB&M

320 ACRES
QUARTER SECTIONS

SECTION 22, T5N, R7W, MDB&M

160 ACRES

A B

C D
QUARTER SECTION DIVISIONS

SECTION 22, T5N, R7W, MDB&M

A, B - 160 ACRES
C, D, E, F - 40 ACRES
OTHER
COMMON MAPS & SYMBOLS
UNIT 1 LESSON 5

OBJECTIVES

INTERPRET SYMBOLOGY USED
ON OTHER COMMON MAPS
ICS OPERATIONAL SYMBOLS

1400

Street No. & Directional Arrow

VNC 7

Special Hazard, with Agency Designator—Reference Number

Unsafe Bridge

Gate

Glendora

Firebreak or Fuelbreak

H SBN Baldy

Helibase with Agency Designator and Name

WT 2M □ 85M

Fixed Water Source, with Capacity

LPF SBN

Responsibility Boundary, with Agency Designation

Power Substation
ICS OPERATIONAL SYMBOLS

LAC

FIRE PROTECTION FACILITY WITH AGENCY DESIGNATOR

HYDRANTS

○ - UNCLASSIFIED
○ - 2.5''
○ - 4'' x 2.5''
○ - 4'' x 4'' x 2.5''
○ - 4'' x 2.5'' x 2.5''
○ - 2.5'' x 2.5''
○ - 4.5'' x 2.5''
○H - MARINE
○6 - INDICATED MAIN SIZE
### ICS Map Display Symbolology

<table>
<thead>
<tr>
<th>MINIMUM RECOMMENDED</th>
<th>SUGGESTED FOR PLACEMENT ON OVERLAYS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BLACK</strong></td>
<td></td>
</tr>
<tr>
<td>Ridge</td>
<td>Highlighted geographic or manmade features</td>
</tr>
<tr>
<td>Completed dozer line</td>
<td></td>
</tr>
<tr>
<td>Completed line</td>
<td></td>
</tr>
<tr>
<td>Line break completed</td>
<td></td>
</tr>
<tr>
<td>Fire origin</td>
<td><em>Uncontrolled fire edge</em></td>
</tr>
<tr>
<td>Hazard (identify type of hazard, e.g., power lines)</td>
<td><em>Spot fire</em></td>
</tr>
<tr>
<td>Incident Command Post</td>
<td><em>Hot spot</em></td>
</tr>
<tr>
<td>Incident Base</td>
<td></td>
</tr>
<tr>
<td>H/C (identify by name)</td>
<td><em>Fire spread prediction</em></td>
</tr>
<tr>
<td>Optional</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td></td>
</tr>
<tr>
<td>Fire station</td>
<td></td>
</tr>
<tr>
<td>Water source (identify type, e.g., pond, cistern, hydrant)</td>
<td><em>Planned fire line</em></td>
</tr>
<tr>
<td>Mobile weather unit</td>
<td><em>Planned secondary line</em></td>
</tr>
<tr>
<td>Ground link</td>
<td><em>Divisions</em></td>
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<tr>
<td>First aid station</td>
<td><em>Proposed dozer line</em></td>
</tr>
<tr>
<td>Red</td>
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<tr>
<td>Orange</td>
<td></td>
</tr>
<tr>
<td>Blue</td>
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<tr>
<td>Redfern (identify by name)</td>
<td><em>Fire break (planned or incomplete)</em></td>
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</tbody>
</table>

* - To be used on incident briefing and action plan maps (no color)

All overlays must contain registration marks. These may consist of identified road intersections, township/range coordinates, map corners, etc.
OBJECTIVES

UNIT 2 LESSON 1

Determining Slope and Distance, Elevation
DETERMINING AREA

UNIT 2  LESSON 2

OBJECTIVES

DETERMINE AREA USING...

- MATHEMATICAL CALCULATIONS
- DOT AND ACRE GRIDS
- ESTIMATION
OBJECTIVES

UNIT 3 LESSON 1

ANEROID BAROMETER, ABNEY LEVEL
  - Determine distance with an odometer
  - Measure slope with an abney level
  - Determine elevation with an aneroid barometer
UNIT 3  LESSON 2

PACE DISTANCE BETWEEN
POINTS

ESTABLISH PACE DISTANCE

PACING

OBJECTIVES
INTERSECTION
- LOCATE OBJECTS BY RESECTION AND
- ORIENT A MAP
- CALCULATE BACK AZIMUTH
- USE A PROTRACTOR FOR INTERSECTION
- WALK A COMPASS COURSE
- TAKE FIELD BEARINGS

OBJECTIVES

UNIT 3 LESSON 3
COMPASS AND PROTRACTOR
PARTS OF A COMPASS

- Bottom of compass housing (transparent on some models) with orienting arrow.
- Compass needle with colored direction.
- Cardinal points on upper rim.
- Degree dial around lower rim.

Base plate with direction-of-travel arrowhead, direction line (index pointer) and ruled edges.
Using the protractor:

1. Place the initial point at the starting point.
2. Align the protractor so that it touches the initial point.
3. Rotate the protractor until it points to the object.
4. Read the bearing here.
TAKE A COMPASS BEARING

282°

38°
WILDLAND FIRE OBSERVATIONS

UNIT 5 LESSON 2

OBJECTIVES

- LIST 10 STANDARD FIREFIGHTING ORDERS
- LIST 13 SITUATIONS THAT SHOUT "WATCH OUT!"

EVALUATE:
- ACCESS ROUTES
- CONTROL LINE LOCATIONS
- RESISTANCE TO CONTROL
- SPECIAL EQUIPMENT NEEDS
TEN STANDARD FIREFIGHTING ORDERS

1. KEEP INFORMED OF FIRE WEATHER CONDITIONS AND FORECASTS.
2. KNOW WHAT YOUR FIRE IS DOING AT ALL TIMES – OBSERVE PERSONALLY, USE SCOUTS.
3. BASE ALL ACTION ON CURRENT AND EXPECTED BEHAVIOR OF FIRE.
4. HAVE ESCAPE ROUTES FOR EVERYONE AND MAKE THEM KNOWN.
5. POST A LOOKOUT WHEN THERE IS POSSIBLE DANGER.
6. BE ALERT, KEEP CALM, THINK CLEARLY, ACT DECISIVELY.
7. MAINTAIN PROMPT COMMUNICATION WITH YOUR CREW MEMBERS, YOUR BOSS, AND ADJOINING FORCES.
8. GIVE CLEAR INSTRUCTIONS AND BE SURE THEY ARE UNDERSTOOD.
9. MAINTAIN CONTROL OF YOUR FIREFIGHTERS AT ALL TIMES.
10. FIGHT FIRE AGGRESSIVELY BUT PROVIDE FOR SAFETY FIRST.
FIRE SITUATIONS THAT SHOUT

"WATCH OUT!"

1. You are building line downhill toward a fire.
2. You are fighting fire on a hillside where rolling material can ignite fuel below you.
3. You notice the wind begin to blow or increase or change direction.
4. You feel the weather getting hotter and drier.
5. You are cutting line in heavy cover with unburned fuel between you and the fire.
6. You are away from burned area where terrain and/or cover makes the travel difficult and slow.
7. You are in country you have not seen in the daylight.
8. You are in an area where you are unfamiliar with local factors influencing fire behavior.
9. You are getting frequent spot fires over your line.
10. You are attempting a frontal assault on a fire with engines.
11. You cannot see the main fire and you are not in communication with anyone who can.
12. You have been given an assignment or instructions not clear to you.
13. You feel like taking a little nap near the fireline.
YOU are building a line downhill TOWARD A FIRE!

1. HAVE ESCAPE ROUTES ESTABLISHED.
2. EXTREMELY DANGEROUS SITUATION.
3. STAY WITH YOUR CREW.
4. POST LOOKOUTS AS NECESSARY. BE ALERT TO CONDITIONS.
5. ADVANCED FUELS ON UPSLOPE ARE PRE-HEATED. WILL RAPIDLY BURN.
6. SPOT FIRES ON UPSLOPE CAN BE EXPECTED.
7. FIRE MAY GENERATE MOMENTUM UPSLOPE AND JUMP OVER HOSELAYS OR CONSTRUCTED HAND LINES.
1. Properly construct trenches on slopes to hold rolling material.
2. Have established escape routes. Know where they are.
3. Cut your way into spot fire areas. Don't just walk thru the green.
4. Post lookouts as necessary.

You on hillside—rolling fire can ignite fuel below you!
1. FIRE MAY BEGIN TO SPREAD IN A DIFFERENT DIRECTION
2. YOUR METHOD OF ATTACKING AND APPROACH MAY NOW NEED TO BE CHANGED.
3. BE ALERT. POST LOOKOUT AS NECESSARY.
4. OBSERVE FOR CHANGES IN FIRE BEHAVIOR.

YOU
notice wind
CHANGE!
1. There will be a decrease in fuel moisture and humidity.
2. Forest fuels will burn faster.
3. Note for increase in hot spots appearing on the fire line.
4. Be more alert to changes in fire behavior.

You

Feel weather getting hotter and drier!
YOU — in heavy cover with unburned fuel Between YOU and FIRE!
1. KNOW WHERE THE FIRE IS AT ALL TIMES.
2. KNOW WHERE YOU ARE GOING
3. STAY AS CLOSE TO THE BURN AS POSSIBLE.
4. DON'T BUNCH UP, SPREAD OUT AND BE ALERT FOR ROLLING ROCKS TOWARD MEN BELOW.

YOU

in area where Terrain and/or cover make **Travel** SLOW and **DIFFICULT**
1. DON'T GET LOST. STAY WITH YOUR CREW
2. ADVANCED SCOUTING IS ESSENTIAL. OBSERVE FOR SHEER DROP-OFFS, SHAFTS, ROCK SLIDES, ETC
3. USE HEADLAMPS FOR ALL NIGHT ACTIVITIES
4. MAINTAIN COMMUNICATIONS WITH YOUR FIRE LINE SUPERVISOR.
5. STAY CLOSE TO FIRE LINE.

YOU —

in country

YOU have NOT

Seen in Daylight!
1. BE ALERT, OBSERVE FOR CHANGES IN FIRE BEHAVIOR.
2. WATCH FOR NATURE'S DANGER SIGNALS.
3. KEEP INFORMED ON WEATHER FORECASTS.
4. MAINTAIN COMMUNICATIONS WITH YOUR FIRE LINE SUPERVISOR.

YOU -
in area where
You are Unfamiliar with
Local Factors Influencing
FIRE BEHAVIOR
1. Watch for and suppress spot fires across road or line.
2. Have established escape routes.
3. Do not wander into the green at an oncoming fire. Wait until it gets to where you are supposed to attack it.
4. Follow orders.
5. Be alert.

YOU are attempting a Frontal Assault on a FIRE with TANKERS.
1. This is an indication fire conditions and weather are changing.
2. Don't become trapped between two fires.
3. If spot fires are taking off, this indicates lower fuel moisture.
4. Be alert to what is happening around you.

You are getting frequent Spot Fires over your line.
1. POST A LOOKOUT OR LOOKOUTS AS NECESSARY.
2. AREA SHOULD BE THOROUGHLY SCOUTED.
3. A DANGEROUS SITUATION AT ANY TIME.
4. BE WEATHER ALERT.
5. OBEY YOUR SUPERVISOR.

YOU cannot see **Main Fire** and **YOU are NOT** in Communication with anyone who can!!
1. WHEN GIVEN INSTRUCTIONS, REPEAT THEM BACK, PARTICULARLY IF UNCLEAR.
2. KNOW WHAT YOU ARE SUPPOSED TO DO, BEFORE GOING ON THE LINE.
3. COMMUNICATE WITH YOUR SUPERVISOR.
4. WHEN POSSIBLE, WRITE DOWN YOUR INSTRUCTIONS.

YOU have been given an assignment.
and/or instructions
NOT CLEAR TO YOU
1. Sleep in shifts if necessary.
2. Sleep as a group and sleep only with permission from your fire line supervisor.
3. Don't wander off from crew, stay together.
4. Never sleep in the green, always in the burn.
5. Post a lookout to stay awake and protect men from fire.

You feel like "Taking a little nap" near the fireline!
WILDLAND
FIRE BEHAVIOR OBSERVATIONS

UNIT 5 LESSON 3

OBJECTIVES

- MAKE WEATHER OBSERVATIONS
- RECORD WEATHER OBSERVATIONS
- IDENTIFY FUEL TYPES

VERIFY:
- FLAME LENGTH
- RATE OF SPREAD
# OBSERVATION RECORD

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Elevation</th>
<th>Aspect</th>
<th>Cover Type</th>
<th>Wind Density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure (Hedgerow, slope, etc.)</th>
<th>Temperature (Degrees F.)</th>
<th>Relative Humidity (Percent)</th>
<th>Speed (MPH)</th>
<th>Direction</th>
<th>Characteristics and Comments (See instructions on next page)</th>
</tr>
</thead>
<tbody>
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</table>

05-20-1244 VG
20 FOOT WINDSPEED IS ADJUSTED TO MIDFLAME WINDSPEED BASED ON OVERSTORY.
FLAME LENGTH
TRANSMIT FIELD DATA

UNIT 5  LESSON 4

OBJECTIVES

TRANSMIT FIELD DATA BY:

- NARRATIVE DESCRIPTION
- LEGAL DESCRIPTION
- MILE COORDINATES
- AUDIOGRAM

IDENTIFY TELECOMMUNICATION SYSTEMS
COLLECT AND ANALYZE DATA

UNIT 6    LESSON 1

OBJECTIVES

- COLLECT DATA
- CATEGORIZE DATA
- ANALYZE DATA
- PROVIDE INFORMATION UPON REQUEST
MAPS AND DISPLAYS

UNIT 6  LESSON 2

OBJECTIVES

PREPARE MAPS FOR:

- OPERATION SUPPORT
- PLANNING PURPOSES
- LOGISTICAL SUPPORT
- COMMAND POST DISPLAYS
- SPECIALIZED PURPOSES
# ICS Map Display Symbology

## Suggested for Placement on Base Map

<table>
<thead>
<tr>
<th>Minimum Recommended</th>
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<tbody>
<tr>
<td><strong>Black</strong></td>
</tr>
<tr>
<td><img src="image" alt="Ridge" /></td>
</tr>
<tr>
<td><img src="image" alt="Completed Dozer Line" /></td>
</tr>
<tr>
<td><img src="image" alt="Line Break Completed" /></td>
</tr>
<tr>
<td><strong>Red</strong></td>
</tr>
<tr>
<td><img src="image" alt="Fire Origin" /></td>
</tr>
<tr>
<td><img src="image" alt="Hazard" /></td>
</tr>
<tr>
<td><img src="image" alt="Incident Command Post" /></td>
</tr>
<tr>
<td><img src="image" alt="Incident Base" /></td>
</tr>
<tr>
<td><img src="image" alt="HOLT Camp" /></td>
</tr>
<tr>
<td><strong>Blue</strong></td>
</tr>
<tr>
<td><img src="image" alt="Helispot" /></td>
</tr>
<tr>
<td><img src="image" alt="Helibase" /></td>
</tr>
<tr>
<td><img src="image" alt="Repeated/Mobile Relay" /></td>
</tr>
</tbody>
</table>

## Suggested for Placement on Overlays

<table>
<thead>
<tr>
<th>Overlays</th>
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<tbody>
<tr>
<td><strong>Red</strong></td>
</tr>
<tr>
<td><img src="image" alt="Uncontrolled Fire Edge" /></td>
</tr>
<tr>
<td><img src="image" alt="Spot Fire" /></td>
</tr>
<tr>
<td><img src="image" alt="Hot Spot" /></td>
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<tr>
<td><strong>Orange</strong></td>
</tr>
<tr>
<td><img src="image" alt="Fire Spread Prediction" /></td>
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## Optional

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<th>Telephone</th>
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<tbody>
<tr>
<td><img src="image" alt="Fire Station" /></td>
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<tr>
<td><img src="image" alt="Water Source" /></td>
</tr>
<tr>
<td><img src="image" alt="Mobile Weather Unit" /></td>
</tr>
<tr>
<td><img src="image" alt="First Aid Station" /></td>
</tr>
</tbody>
</table>

*To be used on incident briefing and action plan maps (no color)*

---

All overlays must contain registration marks. These may consist of identified road intersections, township/parcel coordinates, map corners, etc.
GO EAST ON HWY 95 FOR 2 MILES TO ELM ST. TURN LEFT AND GO 1 MILE TO 1ST ST. TURN LEFT GO 1/2 MILE TO AIF ORT.
Reports and Plans

Unit 6 Lesson 3

Objectives

- Prepare an Incident Status Summary
- Prepare Agency Required Reports
- Prepare a Traffic Plan
### INCIDENT STATUS SUMMARY

**For Service for General Instructions**

1. Date
2. Time
3. INITIAL
4. UPDATE
5. FINAL
6. Incident Name
7. Incident Number

8. Initial Commander
9. Authorizing
10. Cause
11. Type Incident
12. Location
13. Control
14. Containment
15. Date
16. Time
17. Area
18. Containment
19. Diameter
20. Comments
21. Control
22. Comments
23. Control
24. Comments
25. Control
26. Comments
27. Control
28. Comments

### 28. AGENCIES

<table>
<thead>
<tr>
<th>Agency</th>
<th>Kind of Resource</th>
<th>1ST</th>
<th>2ND</th>
<th>3RD</th>
<th>4TH</th>
<th>5TH</th>
<th>6TH</th>
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</thead>
<tbody>
<tr>
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<td></td>
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<td></td>
<td>CREWS</td>
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<td>HELICOPTERS</td>
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<td></td>
<td>AIRTANKERS</td>
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<td></td>
<td>TRUCK CO.</td>
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<td>RESCUE RIGS</td>
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<td></td>
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<tr>
<td></td>
<td>WATER TENDERS</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td></td>
<td>OVERHEAD PERSONNEL</td>
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<tr>
<td></td>
<td>TOTAL PERSONNEL</td>
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</tr>
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</table>

### 29. Communicating Agencies

<table>
<thead>
<tr>
<th>Agency</th>
<th>Comments</th>
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<tbody>
<tr>
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</table>

### 30. Reports

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>By</th>
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**I.C.S. 209**

**06-07-1244 VG**
Quiz
FIELD OBSERVER/DISPLAY PROCESSOR I-244
FINAL EVALUATION

NAME: JEFF OHLMES

1. Describe a "planimetric map".  1  
   MAP SHOWING RELATIONSHIPS
   Do not show relief

2. Describe a "topographic map".  1
   MAP DEPICTING NATURAL FEATURES
   Shows relief - contour

3. Where would you usually find the information relating to revision date, adjoining maps, contour interval, and magnetic declination on a topographic map? Bottom & margins

THE NEXT FIVE QUESTIONS REFER TO THE BASIC COLORS USED ON A TOPOGRAPHIC MAP. BRIEFLY EXPLAIN WHAT FEATURES THE COLORS REPRESENT.

4. Black  HUMAN-MADE FEATURES & BOUNDARIES  1

5. Blue  WATER FEATURES  1

6. Green  VEGETATION  1

7. Brown  RELIEF FEATURES  1

00-02 Final Exam
8. Red MAIN ROADS, BUILT-UP AREAS, SECTIONS, TOWNSHIP RANGE BOUNDARIES, SPECIAL FEATURES

DRAW THE ICS DISPLAY SYMBOL FOR THE FOLLOWING ITEMS.

9. ICP □ (blue)

10. Uncontrolled perimeter ___________ 1930 8/9 (red)

11. Origin ________ 1230 8/9 (red)

12. Staging Area ________ Hope (blue)

13. A ridge ____________ (black)

14. Number the Sections in this typical Township.
USING THE EXERCISE SKETCH AT THE BOTTOM OF THE PAGE, REPRESENTING A SECTION COMPRISING 640 ACRES, SOLVE THE FOLLOWING PROBLEMS:

15. How many acres in area A? \(60\) 3

16. How many acres in area B? \(40\) 3

17. How many acres in area C? \(40\) 3
LIST THE 10 STANDARD FIREFIGHTING ORDERS.

18. KEEP INFORMED OF WEATHER CONDITIONS & FORECASTS

19. KNOW WHAT YOUR FIRE IS DOING AT ALL TIMES - OBSERVE PERSONALLY, USE SCOUTS.

20. BASE ALL ACTION ON CURRENT & EXPECTED BEHAVIOR OF FIRE.

21. HAVE ESCAPE ROUTES FOR EVERYONE & MAKE THEM KNOWN.

22. POST A LOOKOUT WHEN THERE IS POSSIBLE DANGER.

23. BE ALERT, KEEP CALM, THINK CLEARLY, ACT DECISIVELY.

24. MAINTAIN PROMPT COMMUNICATIONS W/ YOUR CREW, SUPV., OTHERS.

25. GIVE CLEAR INSTRUCTIONS & BE SURE THEY ARE UNDERSTOOD.

26. MAINTAIN CONTROL OF FIREFIGHTERS AT ALL TIMES.

27. FIGHT FIRE AGGRESSIVELY BUT PROVIDE FOR SAFETY FIRST.

BRIEFLY DEFINE THE FOLLOWING NFNL FIRE BEHAVIOR FUEL MODELS.

28. Model 2 Fine Herbaceous Fuels, Curving or Dead, Mixtures of Grass & Litter Beneath Open Timber.

29. Model 4 Brush is close to Head High with a Heavy Loading of Fine Fuels.
30. List the two items which must be considered when selecting base maps for an incident.
   a. PREDICTION OF INCIDENT PROGRESSION
   b. DETAIL & QUALITY

31. What two positions in the Logistics Section can provide the best input in developing the internal traffic patterns.
   a. GROUND SUPPORT
   b. FACILITIES

32. List three sources of information for developing external traffic patterns.
   a. HIGHWAY MAP
   b. FIELD OBSERVERS
   c. LOCALS

33. How often is an Incident Status Summary (ICS Form 209) prepared? PRIOR TO EACH PLANNING MEETING

LIST SEVEN OF THE REQUIRED ICS MAPS WHICH MUST BE PREPARED

34. SITUATION UNIT MAP
35. INCIDENT ACTION PLAN MAP
36. PLANNING MEETING & OPS DISPLAY MAPS
37. EXTERNAL TRAFFIC PLAN MAP
38. INTERNAL TRAFFIC FLOW MAP
39. RIOT MEDIA MAP
40. ICP MAP
USE THE CAJON QUAD AND ANY MAPPING AIDS YOU DESIRE TO ANSWER THE NEXT 5 QUESTIONS.

41. In the SW1/4 of the NW1/4 of Section 29, T3N, R5W, you will see a trail that intersects an unimproved dirt road. Calculate the trail length (in feet) from this intersection to the unimproved dirt road in Section 26, T3N, R5W.

\[ 7200 - 7800 \] (3760 ft)

42. What is the elevation of the west end of this trail?

43. What is the average percent of slope of the section line from the common corner of Sec. 29, 28, 32, 33, T3, R5W to the north section line of Section 4, T2N, R5W?

\[ \frac{2800}{500} \times 100 \approx 27.0\% \]

44. You are trying to determine your location on the map. You use your compass and determine that Cleghorn Mountain bears \( 330^\circ \) from your location. Cajon Mountain Lookout bears \( 268^\circ \). Both of these are true azimuths. Describe your location.

45. Calculate the acreage of the area bounded by Hesperia Road to the north and west, Highway 138 to the south, and the map margin to the east.

\[ 1557 \text{ acres} \]
FIELD OBSERVER/DISPLAY PROCESSOR
UNIT 1 QUIZ

1. Describe a "planimetric map". A map which does not depict the shape of the land or only incidentally shows it. (i.e., road map)

2. Describe a "topographic map". A map depicting natural features.

3. Describe an "orthophoto map". A map depicting terrain and other map features by color-enhanced photographic images.

4. Define the term "quad". A unit of geodetic measurement equaling 15' or 7/8" of latitude, or 10" of longitude. It is a topographic map named after the geographical area.

5. Define "comparison scale". Scale comparing inches to feet, miles, other distances.

6. Define "representative fraction". Scale comparing one unit of measurement on the map equal to the same unit on the ground.

7. What is a map legend? Shows information needed to interpret the map.

8. Where would you usually find the information relating to revision date, adjoining maps, contour interval, and magnetic declination on a topographic map? Bottom margin.
THE NEXT FIVE QUESTIONS REFER TO THE BASIC COLORS USED ON A TOPOGRAPHIC MAP. BRIEFLY EXPLAIN WHAT FEATURES THE COLORS REPRESENT.

9. Black **HUMAN-MADE FEATURES & BOUNDARIES**

10. Blue **WATER FEATURES**

11. Green **VEGETATION**

12. Brown **RELIEF FEATURES**

13. Red **MAIN ROADS, BUILT-UP AREAS, SECTIONS, TOWNSHIPS & RANGE BOUNDARIES, SPECIAL FEATURES.**

14. List two items found in the margin of a topographic map. Do not list those items referred to in Question #8.

   SCALE

   **PHYSIOGRAPHIC AREA REPRESENTED**

15. Briefly define the USGS Topographic Map Index Circular.

   THE MAP OF THE STATE SHOWING THE DIVIDED QUADRANGLES

BRIEFLY DEFINE THE FOLLOWING TERMS:

16. Baseline **EAST-WEST LINES THROUGH INITIAL POINT**
17. Principal Meridian  NORTH-SOUTH LINES THROUGH THE
PRINCIPAL MERIDIAN

18. Township lines  A SERIES OF LINES RUNNING PARALLEL TO
THE BASE LINE, AT 6 MILE INTERVALS,
BOTH ON THE NORTH AND SOUTH SIDES.

19. Range lines  A SERIES OF LINES 6 MILES APART WHICH RUN
NORTH AND SOUTH PARALLEL TO THE PRINCIPAL
MERIDIAN.

20. Township  A "36" SQUARE MILE AREA BETWEEN
TOWNSHIP AND RANGE LINES.

21. Section  A "1" SQUARE MILE SUBUNIT OF THE TOWNSHIP.

DRAW THE ICS DISPLAY SYMBOL FOR THE FOLLOWING ITEMS.

22. ICP  [ ] (blue)

23. Uncontrolled perimeter  [ ]

24. Origin  [ ] 1930 8/9 (ASD)

25. Staging Area  [ ] Hope (blue)

26. A ridge  [ ] (black)
THE NEXT EIGHT QUESTIONS REFER TO THE DRAWINGS.

27. Number the Sections in this typical Township.
Describe the section divisions with letters in them. The township and range is T5N, R7W, M.D.B. & M.

28. A =

N1/2, Sec. 3, T5N, R7W, mom

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

29. B =

E1/2, Sec. 3, T5N, R7W, mom

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>4</td>
<td></td>
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</table>

30. C = S1/4, Sec. 33, T5N, R7W, mom
30. D = SE1/4, Sec. 33, T5N, R7W, mom

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<thead>
<tr>
<th></th>
<th>31</th>
<th>32</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>32</td>
<td>CD</td>
<td></td>
</tr>
</tbody>
</table>
Using the exercise sketch at the bottom of the page, representing a section comprising 640 acres, solve the following problems:

31. How many acres in area A? 160

32. How many acres in area B & C? 40

33. How many acres in area D? 10
USE THE CAJON TOPOGRAPHIC MAP FOR THIS QUIZ. YOU MAY USE ANY MAPPING AIDS YOU WISH ON THIS QUIZ.

1. In the lower left corner of the map there is a road which goes to Stockton Flat Campground to the west and to Scotland to the south.

   A. Calculate the distance, in feet, of the road.

   B. Using the road and the map margin as boundaries, calculate the acreage of the area inside this road.

2. The measured distance from the northwest end of Lost Lake to the Gaging Station near the weighing station is 1-1/2 inches.

   A. How many inches does this represent on the ground?

   B. How many chains does this represent?

3. A. What is the elevation at the junction of State Route 138 and Interstate 15? Calculate from directly under the "U" in junction.

   B. What is the average slope between the highway junction and Hill 3690 which is due north of the junction?
4. What is the average slope between BM 3257 near the Glenn Ranch in Section 15, T2N, R6W and VABM 4306 on Lower Lytle Creek ridge north of the ranch?

\[ \frac{1649 \times 100}{2400} = 68\% \]

25% or 30%
1. Given a field location, map of the area, compass, declination for the area, two landmarks visible during daylight hours and identifiable on the map, the Field Observer will orient the map, locate self on the map, and describe the location in terms of coordinates of local land surveys or other commonly used systems. Coordinates will be within 300 feet of actual location.

2. Calculate the distance between two points by pacing. The calculation must be within 5% of the measured distance.

3. Walk a three-legged compass course and return to within 10 feet of the starting point.

4. Complete a closed traverse course with 6-10 stations. Student will shoot and record azimuths and pace and record distances between stations.
FIELD OBSERVER/DISPLAY PROCESSOR I-244
UNIT 5 QUIZ

All of the questions on this quiz may not have been covered in class. However, if you have met the course prerequisites, you should have no trouble with the quiz. If you do have trouble, you should do some review work on the areas covered on the quiz because there will be similar questions on the Final Written Test.

1. Draw the ICS symbology indicating:
   a. uncontrolled fire edge
   b. spot fire
   c. wind direction
   d. completed line
   e. helispot
   f. helibase
   g. first aid station
   h. proposed dozer line

2. List the 10 Standard Firefighting Orders.
   a. Keep informed on fire weather conditions & forecast
   b. Know fire is dangerous at all times – observe personally, use scouts
   c. Be an active and current, expected behavior of fire
   d. Have escape routes & make them known
   e. Post a lookout when there is possible danger
   f. Be alert! Keep calm, think clearly, act decisively
   g. Maintain constant communication with your crew members, your boss, and others
   h. Give clear instructions & be sure they are understood
   i. Maintain control of your firefighters at all times
   j. Fight fire aggressively but provide for safety first
3. List 3 of the 13 Situations That Shout "Watch Out!"
   a. building fire down hill toward a fire
   b. hillsides fine, rolling material can ignite fuel below you.
   c. napping near the fireline
   d. a frontal assault on a fire with engines
   e. feel the weather getting hotter and drier.
   f. wind begins to blow or increase or change direction
   g. cutting line in heavy cover with unburned fuel between you and the fire
   h. cannot see main fire if you are not in communications with anyone who can

4. List the 3 major factors that affect the fire environment.
   a. topography
   b. weather
   c. fuels

5. Briefly define the following terms:
   a. ground fire — fire consuming the organic material beneath the surface litter ground.
   b. surface fire
   c. crown fire — fire advanci ley from top to top of trees or shrubs more or less independently of the surface fine.
   d. spot fire — fire set outside the perimeter of the main fire by flying sparks or embers
   e. hot spot — a particularly active part of a fire
   f. island
   g. flame length
6. Briefly define the following fuel terms:
   a. snag
   b. canopy
   c. flashy fuels
   d. a fuel model

7. Briefly define the following topographic terms:
   a. chimney/chute
   b. aspect
   c. natural barrier

8. Briefly define the following rate of spread terms:
   a. slow
   b. moderate
   c. dangerous
   d. critical
9. Briefly define the following weather terms:
   a. dry bulb
   b. wet bulb
   c. dew point
   d. relative humidity
   e. sling psychrometer
   f. anemometer
   g. inversion

10. List three dangers that a spot fire could present.
    a.
    b.
    c.

11. Briefly define the following National Forest Fire Lab Fire Behavior Fuel Models:
    a. Model 2
    b. Model 4
    c. Model 10
    d. Model 13
12. What is the rule of thumb for the width of a control line?

13. Briefly explain the effects of the following conditions in relation to resistance to control. Also, list the suppression tools which would be effective under these conditions:
   a. light fuel on 15% slope
   b. 6' brush on level ground
   c. patchy brush on a rocky 40% slope
   d. chimney with light patchy fuel
   e. surface fire in heavy slash
FIELD OBSERVER/DISPLAY PROCESSOR
UNIT 6 QUIZ

1. List five sources of data on an incident.
   a. MAPS
   b. OPERATIONS PERSONNEL
   c. INCIDENT GENERATED FORMS
   d. RESOURCES UNIT
   e. FACILITIES & GROUND SUPPORT UNITS

2. Why is a centralized location for the receipt of incoming data needed? So everyone knows where to deliver. It's easier for personnel not to have to look for you.

3. Why do critical time frames need to be identified? So data can be analyzed and processed prior to the planning meeting.

4. List the two items which must be considered when selecting base maps for an incident.
   a. PREDICTION OF INCIDENT PROGRESSION
   b. CLARITY & DETAIL

5. List the two locations where incident maps must be posted.
   a. ICP
   b. SITUATION UNIT

6. What must be posted with the displays to assure that they are understandable? LEGEND, ICS MAP SYMBOL
7. List seven items of information which should be included on the overlays.
   a. INFORMATION WHICH WILL CHANGE
   b. DATE & TIME
   c. 2 OR MORE REGISTRATION MARKS
   d. AUTHOR
   e. SCALE
   f. NORTH
   g. TITLE

8. List seven items or features that will be on the Incident Action Plan map.
   a. BRANCH/DIVISION LOCATIONS/LINES
   b. UNCONTROLLED PERIMETER
   c. UINOSPEED & DIRECTION
   d. SPOT FIRES
   e. LEGEND
   f. HAZARDS
   g. INCIDENT FACILITIES

9. The original Incident Action Plan map is given to ____________________________

10. Why shouldn't the Incident Action Plan map be color coded?
    ______________________________________
    (REPRODUCED IN BLACK & WHITE)

11. Explain the difference between internal and external traffic patterns.
    INTERNAL IS BASE CAMP & TCP
    EXTERNAL IS FIRE LOCATION, HOSPITALS, AIRPORTS, STORAGE AREAS, ETC...

12. What is done with the Traffic Plan after it is prepared?
    INCLUDED IN IAP
13. What two positions in the Logistics Section can provide the best input in developing the internal traffic patterns.
   a. FACILITIES UNIT LEADER
   b. GROUND SUPPORT UNIT LEADER

14. List three facilities that should be included on the Traffic Plan.
   a.
   b.
   c.

15. The Traffic Plan will allow ____________ to arrive at designated locations in time to meet logistical and operational needs.

16. List three sources of information for developing external traffic patterns.
   a.
   b.
   c.
NATIONAL INTERAGENCY
INCIDENT MANAGEMENT SYSTEM

INCIDENT COMMAND SYSTEM
POSITION MANUAL

INCIDENT COMMANDER
ICS-220-1

SEPTEMBER 1, 1982
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CHAPTER 1 CHECKLIST

1.1 CHECKLIST USE The checklist of activities presented below should be considered as a minimum requirement for the Incident Commander position. Users of this manual are encouraged to augment this list as necessary.

Note that some activities are one time actions while others are on-going or repetitive for the duration of an incident.

1.2 INCIDENT COMMANDER'S CHECKLIST

a. Obtain incident briefing and Incident Briefing Form (ICS Form 201) from prior Incident Commander.

b. Assess incident situation.

c. Conduct initial briefing.

d. Activate elements of the Incident Command System.

e. Brief Command Staff and Section Chiefs.

f. Ensure planning meetings are conducted.

g. Approve and authorize implementation of Incident Action Plan.

h. Determine information needs and inform command personnel of needs.

i. Coordinate staff activity.

j. Manage incident operations.

k. Approve requests for additional resources and requests for release of resources.

l. Approve the use of trainees on the incident.

m. Authorize release of information to news media.

n. Ensure Incident Status Summary (ICS Form 209) is completed and forwarded to dispatch center(s).

o. Approve plan for demobilization.

p. Release resources and supplies.
CHAPTER 2 ORGANIZATION AND PROCEDURES

2.1 ORGANIZATION The Incident Commander is responsible for the overall management of all incident activities including the development and implementation of strategy and for approving the ordering and release of resources. In multi-jurisdiction incidents, the duties of the Incident Commander may be carried out by a unified command established jointly by the agencies who have direct jurisdictional or functional responsibility for the incident. In those single-jurisdiction incidents where assisting agencies have significant resources committed, the jurisdictionally responsible agency may establish a unified command at the Incident Commander level, or place assisting agency personnel in key positions within the organization structure. The Incident Commander may have a deputy. The deputy's responsibilities will be as delegated by the Incident Commander.

2.2 ASSUMPTION OF COMMAND

a. Taking over the command of the Incident requires that the Incident Commander obtain a complete and up to date incident briefing. This can only be accomplished if the individual who is presently in command can bring the new commander up to date on what the situation is at the time of the briefing. Therefore, it is important that the commander being relieved prepares the incident briefing as completely as possible for the new commander.

b. The Incident Commander will assume command of an incident after the overall situation is reviewed; sufficient information is available to make logical decisions; and takeover coordination can be accomplished. The Incident Commander must make it known to the General and Command Staffs when command is assumed. Prior to the briefing, the initial attack (or reinforced attack) Incident Commander must ensure that sufficient resources have been ordered. He must also ensure that a designated individual is left in charge, while he is briefing the incoming Incident Commander.

2.3 MAJOR ACTIVITIES AND PROCEDURES The major responsibilities of the Incident Commander are stated below. Following each responsibility are procedures for implementing the activity.

a. Conduct Initial Briefing

1. Obtain and review the Incident Briefing Form (ICS Form 201) from Incident Commander.

2. Meet with the prior Incident Commander and selected staff available at that time.

3. Review and/or prepare plans for the use of on-the-scene and allocated resources due to arrive before the next planning meeting.
b. Set up Required Organization Elements

1. Confirm dispatch and/or arrival of requested organizational elements.

2. Give briefing and work tasks to General and Command Staffs. This briefing should include:
   (a) The contents of the Incident Briefing Form
   (b) A summary of the incident organization
   (c) A review of current incident activities
   (d) A summary of resources already dispatched
   (e) The time and location of first planning meeting
   (f) Special instructions, including specific delegation of authority to carry out particular functions

3. Reassign prior Incident Commander to a position within the incident organization (as appropriate).

4. Request required additional resources through normal dispatch channels.

5. Notify Resources Unit of Command and General Staff organizational elements activated, including name of person assigned to each position.

c. Ensure Planning Meetings are Conducted

1. Schedule meeting time and location.

2. Notify attendees to include:
   (a) Prior Incident Commander (required at first general planning meeting)
   (b) Command and General Staffs
   (c) Others as desired (e.g., Air Operations, Communications, Resources and Situation Units and Operations Branch Directors)

3. Develop the general objectives for the Incident Action Plan.

4. Participate in development of Incident Action Plan for the next operational period.

5. Participate in preparation of logistics services and support requirements associated with the Incident Action Plan (e.g., Communications Plan).
6. Review safety considerations with the Safety Officer.
   - Summarize decisions made with regard to:
     (a) General strategy selected
     (b) Control objectives selected for the next operational period
     (c) Resources required
     (d) Service and support requirements

d. Approve and Authorize Implementation of Incident Action Plan. In some instances this may be done orally.
   2. Make any required changes and authorize release of plan.

e. Determine Information Needs from Staff
   1. Identify any special information desired from each Section Chief.
   2. Prepare information item lists for each Section and Command Staff element (as appropriate).
   3. Provide lists to appropriate personnel or facility. This may be done orally in some situations.

f. Coordinate Staff Activity
   1. Periodically check work progress on assigned tasks of Logistics, Planning, Operations, and Finance Sections as well as Command Staff Personnel.
   2. Ensure that the general welfare and safety of personnel is adequate.
   3. Notify Resources Unit of changes to Command or General Staff organization including the name of the person assigned to each position.

g. Manage Incident Operations
   1. Review information concerning significant changes in the status of the situation, predicted incident behavior, weather, or status of resources.
   2. Review modification to the current Incident Action Plan received from the Operations Section Chief.
   3. Identify any major changes to incident operations which are immediately required.
h. Approve Requests for Additional Resources

1. Review requests for additional resources.

2. Determine condition and advisability of activating out-of-service resources.

3. If out-of-service resources are to be activated, have the Planning Section Chief provide a list of resources for reassignment. Include time of need, reporting location and to whom to report.

4. To obtain additional resources from off the incident, direct the Logistics Chief to forward request thru normal channels.

l. Authorize Information Release

1. Review material submitted by the Information Officer for release to news media.

2. Check information release policies and constraints with involved jurisdiction officials.

3. Authorize release of final copy.

j. Report Incident Status

1. Have Incident Status Summary report (ICS Form 209) prepared.

2. Ensure that Incident Status Summary is submitted to local agency dispatch centers as required.

k. Approve Demobilization Planning

1. Review recommendations for release of resources and supplies from the Demobilization Unit.

2. Schedule demobilization planning meeting.

3. Ensure that current and future resource and supply requirements have been closely estimated.

4. Establish general service and support requirements.

5. Modify specific work assignments for General and Command Staff as required.

6. Review safety considerations with the Safety Officer.

7. Summarize actions to be taken.

8. Direct the Planning Section Chief to document the Demobilization Plan.
1. Release Resources and Supplies

1. Review recommendations for any release of resources and supplies from the General Staff.

2. Approve release recommendations.

3. Ensure that local agency dispatch centers are notified of intended release.

4. Direct the Planning Section Chief to prepare an assignment list for release of resources.

5. Direct the Logistics Section Chief to release supplies.
UNIFIED COMMAND INDIVIDUAL RESPONSIBILITIES

1. INCIDENT COMMANDER #1
   GENERAL STAFF
   1. Plans Section Chief
   2. Logistics Section Chief
   3. Finance Section Chief

2. INCIDENT COMMANDER #2
   COMMAND STAFF
   1. Safety
   2. Information
   3. Liaison

3. INCIDENT COMMANDER #3
   EXTERNAL INFLUENCES
   1. MACS
   2. Agency Administrators
   3. Political
   4. Legal

4. INCIDENT COMMANDER #4
   CRS SECTION
   1. Field Operations
UNIFIED COMMAND
PROCEDURES AND TIME FRAMES

1. AGENCY ADMINISTRATORS BRIEFING
   A. USE CHECKLIST marthie

   TIME ______

2. INCIDENT COMMANDER'S BRIEFING
   A. USE CHECKLIST marthie

   TIME ______

3. UNIFIED COMMAND MEETING
   A. USE CHECKLIST Jim

   TIME ______

4. UNIFIED COMMAND BRIEF COMMAND & GENERAL
   A. USE CHECKLISTS Gary Jo

   TIME ______

5. PLANS MEETING Lewis

   TIME ______

6. UNIFIED COMMAND MEETING Jim

   TIME ______

7. AGENCY ADMINISTRATOR'S BRIEFING Gary

   TIME ______

8. BE AVAILABLE FOR NEWS CONFERENCES at I.C.

   TIME ______

9. COMMAND AND GENERAL STAFF MEETING Jim

   TIME ______

10. OPERATIONS BRIEFING Lewis

    TIME ______

(NEXT OPERATIONAL PERIOD - START AT 6 AND GO THROUGH 10)
LARGE INCIDENT MANAGEMENT

GUIDELINES FOR THE TAKE-OVER AND RELEASE OF FIRE TEAMS

Incident Name ___________________________ Agency ___________________________

Date ___________________________

The following are guidelines for Fire Teams to orderly transfer fire suppression responsibilities. The guide is for the assumption and release of incoming Teams plus a checklist of information and data the receiving Agency needs to provide. Some information will be in writing and some will be verbal.

I. The Taking Over of a Major Incident by a Fire Team

A. The assumption of an Incident by a Fire Team must be as smooth and orderly as possible. It must be remembered that the local Fire Team is in charge until officially released.

B. Ordering Agency should specify expected time of arrival and expected time of take-over by the Team.

C. The Fire Team Incident Commander should contact the local Agency Dispatchers in advance and arrange for: (1) expected support staff, (2) location of Administrators briefing, and (3) transportation needs.

D. The ordering Agency should do the following prior to the arrival of the Fire Team.

1. Determine ICP/Base location.

2. Order support equipment, supplies, and initial basic support organization for the Incident.

3. Order or make ample supply of topography maps, base maps, etc.

4. Determine transportation needs of Fire Team. (From ordering Agency to Incident and on Incident.)

5. Determine Agency Administrators' briefing time and location.

6. Obtain necessary information for Agency Administrators briefing. (See below.)

7. Order communication cache and communication vehicle.

E. There should be two briefings of the Fire Team. First briefing should be by Agency Administrators at a site away from the Incident. Second briefing should be by the Local Incident Commander at the fire site. Transition period of take-over will depend upon complexity, expertise of local team, and/or other problems.
F. Agency Administrators. Should be as soon as possible after arrival of all members of the team. It is impossible to list everything a team needs to know. The following is the more important items that should be discussed.

1. General.
   a. Name of Incident________________________
   b. Approximate size of Incident________________________ Location of Incident________________________
   c. Name of local Incident Commander________________________
   d. General weather conditions________________________
   e. Fire behavior________________________
   f. Fuel types________________________
   g. Is it an air tanker show?________________________
   h. Is it a helicopter show?________________________
   i. ICP/Base location________________________
   j. Other fires in local area________________________

2. Delegation of authority and assignment of responsibility________________________

3. Agency Administration representative________________________

4. Recommend local participating in fire team organization________________________

5. Evaluation team assigned? Names________________________

6. Names of resource advisors assigned to fire________________________

7. Local fire policy________________________

8. Resource values, land values, wilderness, roadless areas, rare and endangered species?________________________
F. 9. Priorities for control, escape fire analysis approved?

10. Local unusual fire behavior and fire history in area of fire.

11. Money limitations and constraints

12. Legal consideration (current investigations in action)

13. Pre-attack plans -- Yes  No

14. News media relations

15. Information Officer - Report to Incident Commander

Report to Agency Administration

16. Other off-site incident reporting/information requirements

17. Known political considerations

18. Local political considerations

19. Finance chief assigned

20. Training specialist assigned or ordered

21. Other agencies on fire

Agency Liaison

22. Transportation Routes
23. Air Operations --
   a. Airtankers assigned_________________________________
   b. Effectiveness of airtankers to date_______________________
   c. Air Attack Manager - Name______________________________
      Air Base___________________________________________
      Telephone_________________________________________
   d. Helicopters assigned__________________________________

24. Air operations technical specialist assigned or ordered
   _______________________________________________________

25. Manpower on Fire (general)_______________________________
   _______________________________________________________

26. Equipment on fire (general)_______________________________
   (Exact numbers, names, ETA's provided if available)

27. Supply system to be used (local supply, cache, ordering procedures)
   _______________________________________________________

28. Buying unit in place or ordered.___________________________

29. Land Status___________________________________________

30. Physical condition of Local team__________________________

31. Capability of Agency to support Fire Team________________
   (suppression and support)

32. Rehabilitation policies (Anything the team may need to know about)
   _______________________________________________________

33. Estimated time when the Regional team will assume command
   _______________________________________________________
F. 34. Closest medical facilities

Closest burn center

35. Agency Demobilization Procedures

36. Agency expanded Dispatch procedure

G. Local Incident Commander Briefing - Fire Team will be briefed by local incident commander upon arrival at fire. Fire team should not assume fire until they are thoroughly briefed and comfortable with the situation. Both Incident Commanders will determine exact hour of command change. After briefing, functions will start phasing into their areas of responsibility, but will not assume control until the predetermined time. Local team may continue to work on fire in various functions depending upon physical condition and Agency Administrators' direction.

1. Map of fire (best available)

2. Time of start

3. Spread - fire behavior

4. Fuels - at fire

Ahead of fire

5. Anchor points

6. Line held (on map)

7. Natural barriers

8. Weather forecast

9. ICP and Base/Camp sites:

Established

Possible

10. Airtanker effectiveness to date

11. Hazards (aircraft and people)
G. 12. Access from base to line

13. Manpower and equipment on line

14. Manpower and equipment ordered (confirm information received at line officer briefing)

15. Photos – Yes____ No____

16. Helibase helislot locations (use map)

17. Communication system in use: Radio
   Telephone_________ Mobile Phone

18. Water availability

19. Base fire protection
   Crash fire protection at helibase
   Medivac arrangements

20. Review of existing plans for control in effect; copy of approved Escaped Fire Analysis.

21. Smoke conditions

22. Local political issues

23. Any security problems?

24. Overhead on line-(Names and location - put on map).

25. Copy machine in Incident Command Post - Yes____ No____

Release of Fire Team

A. Release of Fire Team is basically the reverse of the above. Date and time must be approved by Agency Administrator or his representative. It must be as smooth as possible and local team members should be assigned and start working with Fire members at the predetermined time.

Fire Team should start phasing in Local Team as soon as demobilization begins.
C. Fire Team should not be released from the Incident until:

1. Fire management activity is at the level and workload a Local Team can reasonably assume.
   a. Fire must be controlled.
   b. Most all line crewmembers released that are not needed for patrol and mop-up.
   c. Base camp shut down, reduced, or in the process.
   d. Plans Chief has prepared a rough copy of fire report and narrative.
   e. Finance Chief should have most all known finance problems resolved. Contact made with Agency budget and financial personnel.
   f. Resource rehab work completed or done to Agency satisfaction.
   g. Overhead ratings completed.

2. Finance and Logistics Chiefs may have to stay longer or return to local Agency to resolve problems.

D. Fire Team should have closed debriefing session prior to meeting with Agency Administrator.

E. Agency Administrator and Evaluation Team should debrief Fire Team and prepare evaluation as soon as possible after release. Set up meeting with line officer.

Items to cover:

1. Using Agency should give team written performance evaluation.
2. Were objectives met. (See approved Escape Fire Analysis)
5. Outstanding or poor performance of individuals and crews.

III. Should a Fire Team be assigned to a fire and the above or portions of the above procedures cannot be followed due to emergency conditions or other problems, the assigned team Incident Commander and his staff will work with members of the using Agency in obtaining the necessary information to make the transition periods effective and organized.
UNIFIED COMMAND MEETING
Check List

1. Introduction and role statement of each Incident Commander.
2. Appoint Meeting Manager/Spokesman or determine each Incident Commander's responsibilities.
3. Assign Recorder.
4. Review sequence of events (ICS-201) and E.F.S.A.
5. Brief on incident situation.
6. Identify and document agency concerns.
7. Evaluate concerns and develop a system to resolve potential conflict.
8. Resolve any conflict.
9. Develop Objectives.
10. Agree on Incident Management Organization.
15. Establish Time Frames.
COMMAND AND GENERAL STAFF BRIEFING
BY INCIDENT COMMANDERS

1. Assess Incident Situation.
2. Cover Agency Administrators Directions and Concerns.
3. Cover Incident Commander Briefing.
4. Explain Unified Incident Commander Responsibilities.
5. Explain What Incident Commanders Should Be Informed Of.
8. Explain Fiscal Arrangements.
9. Set Time Table for Plans and Operations Sections.
10. Set Time for Next Command and General Staff Meeting.
11. Cover Incident Objectives.
12. Duration of Assignment.
13. Set Staffing Levels and Overhead Ordering Procedures
15. Discuss Staff Level Coordination.
16. Displays
17. Who Will Attend Planning Meeting.
18. Division and Branch Separations By Agency.
19. Consolidate Resources Into Task Forces or Strike Teams.
20. Identify Excess Resources.
22. Feeding

   Approval of Motels.
   Any Agency Specifics.
EXAMPLES OF SIGNIFICANT EVENTS ARE:

1. Deadlines not being met
2. Logistics Section Systems breakdowns
3. Request from other Section Chiefs not being handled
4. Major accident, injuries, accidents, or death
5. Unexpected changes in Incident Action Plan
6. Thefts
7. Communicable Disease outbreak
8. Poor or exceptional performance of subordinate personnel
9. Lack of timely status from Planning Section
10. Cooperating agency or interagency problems
11. Political concerns of community
12. Problems with new media
13. Unresolved conflict
14. High cost overruns
15. Lack of ability to get resources needed
16. Outside request for incident resources
17. Concerns of agency administrators
18. Community evacuations
19. Inability to get trained and qualified personnel
OPERATIONS — TIMETABLE

2. Communicate to Command & General Staff Any Changes Required in Incident Action Plan for Next Operational Period.
3. Prepare to Brief Next Operational Period O.C., Command Staff on Current & General Operations.
7. 0600 & 1800 Brief on Next Operational Tactics.
8. 0600 & 1800 Brief on Next Operational Tactics.
11. PLANNING MEETING
PLANNING — TIMETABLE

1. Prepare and finalize Incident Action Plan
2. Prepare for Briefing
3. Briefing
4. HC Brief Staff
5. Operational Action Plan and prepare Agency Specific Forms
6. Shift Change
7. Planning Section
8. Planning Meeting
9. Prepare for Planning Meeting
10. HC Brief Staff
11. Planning Meeting
12. 0600 & 1800 Shift Change for Operational Section

05-02-1440-VG
Planning Meeting Attendees

For wildland incidents, attendees should include:

* Incident Commander
* Command Staff Members
  - Liaison Officer
  - Safety Officer
  - Information Officer
* General Staff Members
  - Planning Section Chief
  - Logistics Section Chief
  - Operations Section Chief
  - Finance Chief
* Resource Status Unit Leader
* Situation Status Unit Leader
* Air Operations
* Communications Unit Leader
* Technical Specialists (As Required)
* Agency Representatives (As Required)
* Recorders
13 - ADMINISTRATION

GUIDELINES FOR THE TAKEOVER AND RELEASE OF INCIDENT MANAGEMENT TEAMS

Incident Name__________________________ Unit__________________________
Date__________________________ Incident Management Team Assigned__________________________

The following are guidelines for Incident Management Teams for the orderly transfer of fire suppression responsibilities. This guide is for the assumption and release of incoming Teams plus a checklist of information and data the receiving Unit needs to provide. Some information will be in writing and some will be verbal.

1. The Taking Over of a Major Fire by an Incident Management Team
   a. The assumption of an Incident by an Incident Management Team must be as smooth and orderly as possible. Remember that the local Team is in charge until officially released.
   b. Ordering unit should specify expected time of arrival and expected time of takeover by an Incident Management Team.
   c. The Incident Commander should contact the local dispatchers in advance and arrange for: (a) expected support staff, (b) location of Agency Administrator briefing, (c) transportation needs. Team Incident Commander should also contact ordering Agency Administration or designated alternate immediately upon team assignment.
   d. The Ordering Unit should do the following prior to the arrival of the Incident Management Team:
      (1) Determine ICP/Base location.
      (2) Order support equipment, supplies, and initial basic support organization for the fire.
      (3) Order or make ample supply of topography maps, base maps, etc.
      (4) Determine transportation needs of the Incident Management Team. (From Ordering Unit to fire and on fire.)
      (5) Determine Agency Administrator briefing time and location.
      (6) Obtain necessary information for Agency Administrator briefing (see below).
      (7) Order communication cache and communication vehicle.
e. There should be two briefings of the Incident Management Team. First briefing should be by Agency Administrator at a site away from the fire. Second briefing should be by the local Incident Commander at the ICP. Transition period of takeover will depend upon complexity, expertise of local team, and/or other problems.

2. **Agency Administrator Briefing.** Should be as soon as possible after arrival of all members on the team. It is impossible to list everything a team needs to know. The following are the more important items for discussion:

   a. General.

   (1) Name of Incident

   (a) Incident Number

   (b) Approximate size

   Location

   Land status

   (c) Name of local Incident Commander

   (d) General weather conditions

   (e) Fire behavior

   (f) Fuel types

   (g) Current tactics

   (h) ICP/location

   (i) Base location

   (j) Other incidents impacting strategy and tactics

   (2) Written delegation of authority and assignment of responsibility.

   Agency Administrator representative

   (3) Recommend local participation in Incident management team organization

   (4) Unified Command Organization (if needed or anticipated)

   (5) Evaluation team assigned?

   Names

   (6) Names of technical specialist assigned to fire

   (7) Local fire policy
FIREFIELD HANDBOOK

(8) Resource values, land values, wilderness, roadless areas, cultural resources, rare and endangered species

(9) Priorities for control, Escaped Fire Analysis approved and provided?

(10) News media relations

Information Officer - Report to Incident Commander or Agency Administrator

(11) Political considerations

(12) Liaison Officer Assigned

(13) Training considerations

(14) Other agencies on incident

(15) Estimated time when the Incident Management Team will assume command

(16) Accidents to date

Status of reports

(17) Safety Issues

(18) Are there any areas with existing or potential hazardous materials?

b. Operations (Considered in I.C. briefing)

STRATEGY

c. Plans.

(1) Local unusual fire behavior and fire history in area

(2) Legal considerations (current investigations in process)

(3) Pre Attack or Resource Protection Plans

Yes  No
FIRELINE HANDBOOK

(4) Incident Status Summary (ICS 209) reporting requirements

(5) Copy of Current Incident Status Summary (ICS 209) supplied to Team

(6) Training Specialist assigned or ordered

(7) Status of Local Team

(8) Status of personnel on Agency Unit

(9) Capability of Unit to support Incident Management Team (operations and support)

(10) Rehabilitation policies

(11) Agency demobilization policies

Logistics

(1) Transportation routes

(2) Ordering system to be used

(3) Buying unit in place or ordered

(4) How incident feeding provided

(5) Closest medical facilities

(6) Closest burn center

Finance

(1) Fiscal limitations and constraints

(2) Cost sharing (on Multiagency fires)
3. **Local Incident Commander Briefing** - The local Incident Commander shall brief the Incident Management Team upon their arrival. Incident Management Team should not assume command until thoroughly briefed and exact hour of command change is determined. After briefing, functions will start phasing into their areas of responsibility, but will not assume control until the predetermined time. Local team may continue to work in various functions depending upon physical condition and Agency Administrators direction.

a. **IC/General Staff**
   - (1) Incident map
   - (2) Time of start
   - (3) Point of origin
   - (4) Fuels
   - (5) Weather
   - (6) Topography
   - (7) Fire behavior
   - (8) Hazards (aircraft, people and equipment)

   (9) Review of existing plans for control (copy of current Incident Action Plan to Team)
   (10) Agency Representatives identified

b. **Operations**
   - (1) Strategy
   - (2) Tactics
   - (3) Aircraft questions
   - (4) Handcrew operations
   - (5) Dozer operations
   - (6) Engine operations
   - (7) Helibase/helispot locations (use map)
   - (8) Crash fire protection at helibase
   - (9) Smoke conditions (inversions, etc.)
FIRELINE HANDBOOK

c. Plans
   (1) Resources ordered:
      Aircraft______________________________
      Overhead______________________________
      Engines______________________________
      Handcrews______________________________
      Other______________________________
   (2) Aerial photos___yes___no
   (3) Infrared requested___yes___no
   (4) Water availability______________________________
   (5) Duplicating capability______________________________

   (6) Traffic Plan prepared?

d. Logistics
   (1) ICP and Base/Camp sites______________________________

   (2) Access from base to line______________________________

   (3) Communication Plan prepared___yes___no
   (4) Medical Plan prepared (ICS 206)___yes___no
   (5) Any security problems?

e. Finance
   (1) Status of rental agreements______________________________
   (2) Status of current and anticipated claims______________________________

4. Release of an Incident Management Team
   a. Release of an Incident Management Team is basically the reverse of the above. The Agency Administrator or a representative must approve the date and time. It must be as smooth as possible and local team members be assigned should start working with Incident Management Team members at the predetermined time. Local Team should be off 24 hours prior to takeover.

   b. Incident Management Team should start phasing-in local team as soon as demobilization begins.

   c. Incident Management Team should not be released from the Incident until fire management activity and work load is at a level a local team can reasonably assume. Some considerations to assist in this determination are:
      (1) Fire must be controlled.
      (2) Line crews released that are not needed for patrol and mop-up.
FIRELINE HANDBOOK

(3) Base camp shut down, reduced, or in the process.
(4) Planning Section Chief has prepared a rough copy of fire report and narrative.
(5) Finance Chief should have most all known finance problems resolved. Contact made with unit budget and financial personnel.
(6) Resource rehabilitation work completed or done to unit satisfaction.
(7) Overhead ratings completed.

d. Incident Management Team should have an internal team de-briefing session prior to meeting with Agency Administrator.
e. Agency Administrator should debrief Incident Management Team and prepare a written evaluation as soon as possible after release.
NATIONAL INTERAGENCY
INCIDENT MANAGEMENT SYSTEM

INCIDENT COMMAND SYSTEM
POSITION MANUAL

SITUATION UNIT LEADER
ICS-221-2

AUGUST 1, 1982
CHAPTER 1

1 CHECKLIST USE The checklist presented below should be considered as a minimum requirement for this position. Users of this manual should feel free to augment this list as necessary. Note that some items are one-time actions and others are on-going or repetitive for the duration of an incident.

1.1 SITUATION STATUS UNIT LEADER'S CHECKLIST

   a. Report to and receive briefing and special instructions from person in charge of planning activities when you arrive.

   b. Prepare and maintain Command Post display.

   c. Assign duties to Situation Status personnel.

   d. Confirm dispatch and estimated time of arrival of ordered Situation Unit personnel and request additional personnel, or release excess personnel.

   e. Collect all incident related data at earliest possible opportunity and continue for duration of incident.

   f. Obtain and analyze infrared data as applicable.

   g. Post data on unit work displays and Command Post displays at scheduled intervals or as requested by Command Post personnel.

   h. Participate in incident planning meetings as required by the Incident Commander.

   i. Prepare the Incident Summary Form (ICS Form 209) before each planning meeting.

   j. Provide photographic services and maps.

   k. Provide resource and situation status information in response to specific requests.

   l. Maintain Situation Unit records.

   m. Receive order to demobilize Situation Unit.

   n. Dismantle Situation Unit displays and place in storage.

   o. List expendable supplies that need replenishing and file with Supply Unit.

   p. Maintain Unit Log (ICS Form 214).
a. Obtain briefing from Situation Unit Leader.

b. Determine:
   - Location of work assignment.
   - Numbers, types and locations of
     - Displays required.
     - Priorities
     - Map requirements for Incident action plans.
     - Time limits for completion.
     - Field observer assignments and communications means.

c. Obtain necessary equipment and supplies.

d. Obtain copy of Incident Action Plan for each operational period.

e. Assist Situation Leader in analyzing and evaluating field reports.

f. Develop required displays in accordance with time limits for completion.

g. Support special requirements for development of incident maps.

h. Demobilize incident displays in accordance with Incident Demobilization Plan.

1.4 WEATHER OBSERVER CHECKLIST The Weather Observer is responsible to collect current incident weather information and provide the information to an assigned meteorologist, Fire Behavior Specialist, or to the Situation Unit Leader.

a. Obtain briefing from Situation Unit Leader.

b. Determine:
   - Nature and location of work assignments.
   - Weather data collection methods to be used.
   - Priorities for collection.
   - Specific types of information required.
   - Frequency of reports.
   - Method of reporting.
   - Source of equipment.
CHAPTER 2 ORGANIZATION, PERSONNEL, AND PROCEDURES

2 ORGANIZATION

a. The Situation Unit (SITSTAT) is primarily responsible for the collection and organization of incident status and situation information, and the evaluation, analysis and display of that information for use by ICS personnel. The Situation Unit Leader is responsible for ensuring these major functions are performed by unit personnel. The SITSTAT Unit Leader reports to the Planning Section Chief (see Figure 2-1).

```
Incident Commander
   | Planning Section Chief
   | Situation Unit Leader
       | Display Processors
       | Field Observers
       | Weather Observer
```

Figure 2-1 Situation Unit and Incident Command System

b. The Situation Unit Leader may organize the unit as illustrated below.

```
SITUATION UNIT ORGANIZATION

SITUATION
Unit Leader

Field Observer(s)    Photographer    Display Processor
```

c. Field observers are responsible for the collection and providing operational situation data to the unit.

d. Display Processors are responsible for the evaluation, analysis and display of incident status information obtained from field observers, resource status reports, aerial and ortho photographs and infrared data.

e. The Photographer is responsible for taking photographs, and collecting and interpreting incident situation information.

2.1 PERSONNEL The number of personnel needed to perform the major functions and responsibilities assigned to the Situation Unit varies based on (1) the General Staff and Situation Unit Leader’s requirements, and (2) the size and complexity of the incident (i.e., number of personnel and equipment committed to an incident). The recommended minimum number of personnel needed for each 12-hour period of operations is presented in Table 2-1. The amounts and types
briefings. To support the data collection effort, the Situation Unit monitors tactical radio frequencies to obtain information concerning control operations and other information the unit needs to maintain a current description of the incident.

b. The sources and types of information the Situation Unit collects in order to maintain displays and develop briefing materials are listed below:

1. Initial Attack Commander's Incident Briefing report (ICS Form 201) for initial information about the incident, current organization, resources assigned, and the location and type of incident facilities established. Similar information can be obtained from the Incident Action Plan for later operational periods.

2. Planning Section Chief, Resources Unit, and Communications Unit for other incident generated information recorded on the following forms.

   a) Incident Action Plan for information about plans for controlling the incident.

   b) Organization Assignment List (ICS Form 203) for units activated and names of supervisors.

   c) Incident Communications Plan (ICS Form 205) for information on what communications are available and in use.

3. Division/Group Supervisors or Branch Directors for information concerning the deployment of operations resources on the perimeter.

4. Air Operations for information about location of fire perimeter and barriers.

5. Facilities Unit for information about incident site locations (e.g., command post, camps, etc.).

6. Fire Behavior Specialist for fire projection or prediction information (rate of forward and lateral spread).

7. Resource Unit for information about the type and number of suppression resources currently assigned to the incident.

8. Technical Specialists for information about local area environmental characteristics, values data, and water resources.

2.4 MAJOR ACTIVITIES AND PROCEDURES The major activities of the Situation Unit are listed below. Following each activity are procedures for implementing the activity.

a. Obtain Situation Unit Work Materials

1. Pickup Situation Unit work material such as forms, logs, manuals and supplies from Planning Section Kit.
(i) Values data

(j) Incident facilities

d. Assemble and Analyze Situation Data Before Situation Unit can display information on maps or prepare forms or reports, it may be necessary to organize and evaluate a large amount of data collected from the various sources discussed in Section 2-4. Several steps and procedures may assist in performing this activity.

1. Sort the data into required categories of information (e.g., perimeter data, values and risk data, incident facilities locations, etc.).

2. Review all data for completeness, accuracy, and relevancy.

3. Make preliminary postings on displays in Situation Unit work area.

4. Request any missing or amplifying information.

e. Maintain Situation Display

1. The Situation Display at the ICP Command Post Display should accommodate up to nine topographic maps.

2. Update the display periodically so that current information is available to command personnel (e.g., division/group and branch designators, planned control line) etc.

3. Use the agreed upon ICS symbology codes to display situation information on overlays. The symbology recommended for use on the Command Post Map displays is illustrated in Table 2-2.
4. Use the recommended color coding which allows for drawing over previously displayed information with later data (e.g., orange projections may be covered with red as a fire progresses).

f. Prepare Incident Summary Report

1. An Incident Summary form (ICS Form 209) will be prepared by the Situation Unit in cooperation with the Resources Unit prior to each planning meeting.

2. Once completed, the form is submitted to the Documentation Unit for duplication and distribution to the General Staff.

3. The form contains the following types of information:

   (a) General Staff assignments

   (b) Jurisdictional, assisting, and cooperating agencies involved in the incident

   (c) Incident origin

   (d) Incident situation (acres burned, percent contained)

   (e) Personnel casualties

   (f) Structural losses

   (g) Current weather

   (h) Resources assigned to the incident

   Detailed information on completing the Incident Summary Report may be found in ICS 230-2, ICS Forms Manual.

g. Provide Map Service In addition to maintaining the Command Post map displays, the Situation Unit is responsible for creating the maps that accompany the Incident Action Plan and also for acquiring specialized maps at the request of General Staff personnel.

1. Attach to the Incident Action Plan planning maps which are sketched or traced from the Command Post displays.

2. Features to be included on these Action Plan maps may include:

   (a) Registration references

   (b) Outstanding terrain features

   (c) Branch and/or Division/Group locations and areas of responsibility

   (d) Staging areas and other incident facilities

   (e) Hazardous areas
(1) Other, as recommended by Logistics and Planning Section Chiefs

5. Ground Support Unit is responsible for implementing that portion of the traffic plan pertaining to internal traffic flow.

1. Support Infrared Operations The use of infrared imagery is one of the more accurate ways of determining the actual fire perimeter and the location of hot spots. The results of IR fire surveys are displayed by the Situation Unit on various Command Post displays.

1. IR information may be provided to the Situation Unit from the IR aircraft via a ground link located at the incident. In this case, the IR interpreter(s) is responsible for interpretation of IR data, transfer to map overlays, and briefing key planning and operations personnel when requested.

2. IR information also may be made available to Situation Unit via telecopter from an agency dispatch center or Situation Unit at another incident. In this case, the ground link van is located at the Dispatch Center or other incident.

h. Provide Photographic Services Photographic services can be provided through the Situation Unit to authorized incident personnel/units. Photographers required for the incident are assigned to the Situation Unit, which responds to requests on a priority basis.

1. Photography may be used for accident coverage, recording of operations activities, public information releases, damages (especially where potential claims can be anticipated), etc.

2. The Situation Unit Leader coordinates arrangements for timely post-processing, either through an agency-operated lab or via contract service by a commercial processing firm.

i. Maintain Unit Log

1. The Situation Unit is required to submit a Unit Log (ICS Form 214) at the end of each operational period (shift change).

2. Submit log to the Documentation Unit thru Planning Section Chief.

3. Attach maps or overlays that have been replaced during the shift with more current information.

4. Label all submissions with the date and time for which they are prepared.
SITUATION UNIT LEADER'S CHECKLIST

a. Report to and receive briefing and special instructions from person in charge of planning activities when you arrive.
b. Prepare and maintain Command Post display.
c. Assign duties to Situation Unit personnel.
d. Confirm dispatch and estimated time of arrival of ordered Situation Unit personnel and request additional personnel, or release excess personnel.
e. Collect all incident related data at earliest possible opportunity and continue for duration of incident.
f. Obtain and analyze infrared data as applicable.
g. Post data on unit work displays and Command Post displays at scheduled intervals or as requested by Command Post personnel.
h. Participate in Incident planning meetings as required by the Incident Commander.
i. Prepare the Incident Summary form (ICS Form 209) before each planning meeting.
j. Provide photographic services and maps.
k. Provide resource and situation status information in response to specific requests.
l. Maintain Situation Unit records.
m. Receive order to demobilize Situation Unit.
n. Dismantle Situation Unit displays and place in storage.
o. List expendable supplies that need replenishing and file with Supply Unit.
p. Maintain Unit Log (ICS Form 214.)

PREPARE AND FINALIZE INCIDENT ACTION PLAN

PREPARE FOR BRIEFING

0600 & 1800 SHIFT CHANGE FOR OPERATION SECTION

FINALIZE LAST OPERATIONAL ACTION PLAN AND PREPARE AGENCY SPECIFIC FORMS

PLANNING MEETING

PREPARE FOR PLANNING MEETING

PLANNING SECTION

SHIFT CHANGE

17
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<th>Unit Position</th>
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*Only needed if IR ground link has been requested.
Forms, Samples, & Position Aids
**INCIDENT STATUS SUMMARY**

- **DATE**: 07/28/4  
  **TIME**: 14:20

- **NAME**: BODFISH
- **JURIS**: 50
- **COUNTY**: KERN
- **LOCATION**: SEC. 22 T32S R3E
- **START DATE**: 7/17/94  
  **TIME**: 16:11
- **APPLICATION**: 23-200
- **EXPECTED CONTAINMENT DATE**: 7/13/94  
  **TIME**: 08:00
- **DECREASED CONTROL DATE**: 7/15/94  
  **TIME**: 18:00
- **CAUSE**: UNDER INVESTIGATION
- **PERCENT CONTAINED**: 50
- **THREAT**: PIUTE MOUNTAIN - TIMBER
- **PROBLEM**: ERRATIC FIRE BEHAVIOR, STRONG WINDS
- **EST. LOSS** (20)  
  **EST. SAVINGS** (21)
- **INJURIES/DEATHS**: LINE BLT (23)  
  **LINE BLD**: 17  
  **2320 C**  
  **1120 C**

- **CURRENT MTS**: 4
  **WEATHER**
  **PREDICTED**: 4-8
  **COSTS**

- **TO DATE**: $2,465,540
  **ESTIMATED TOTAL**: $4,500,000

**MORE? YES/NO RETURN CONTINUOUS (Y/N/R/C): N**

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**COOPERATING AGENCIES**: NAC - CHINA LAKE NAVAL WEAPONS CENTER

**REMARKS**

INJURIES INCLUDE: HEAT EXHAUSTION (2), ONE POSSIBLE BROKEN RIGHT THUMB, ONE ARN ON HAND (FIRST AND SECOND DEGREE), OTHERS WERE MINOR INJURIES.

PREVIOUS 209'S INCLUDE TERTIARY AND SECONDARY LINES CONSTRUCTED AND TO BE "KLT". THESE FIGURES REPRESENT DIRECT ATTACK ON THE PERIMETER.

**FIRST 209 SUBMITTED ON THE COMPUTER.**

**PREPARED BY**: TALEY  
**APPROVED BY**: DAGUE  
**BY**: CDI
FIELD OBSERVERS (working as a team)
1. Locate the fire.
2. Map the perimeter.
3. Upon reaching predesignated points, take weather observations and radio them and perimeter location to the Display Processor. (This will act as a control. If the mission is too far behind schedule SITSTAT can adjust or cancel part of the mission.)
4. Evaluate fuel conditions and classify fuels by NFPL type at each designated point.
5. Determine the feasibility of a proposed control line (SITSTAT will have to select this).
6. Evaluate access to incident.
7. Locate a safety zone on the perimeter.
8. Identify water sources.
9. Identify any hazards.
10. Identify any improvements which may be exposure problems.
12. Transmit data on perimeter, safety zone location, water sources, and proposed control line to the Display Processor.
13. All agency required safety gear will be used.
14. The mission must be complete and the Field Observers back at the Unit in 4 hours.

DISPLAY PROCESSORS (working as a team)
May be briefed separately or with the Field Observers
1. Use Incident Briefing to set up an ICP display.
2. Develop a Traffic Plan for the ICP (classroom area) and for resources going to the operational areas.
3. (Optional) Obtain FIREMOD predictions when perimeter and weather data is received.
4. Prepare a planning meeting map.
5. Prepare an Action Plan map.
6. Calculate acreage.
7. Compile Incident Status Summary (Optional: Enter information on computer).

8. Prepare a specialized map (SITSTAT will have to create a map requirement for this).

9. Prepare a specialized report (SITSTAT will provide requirements).

10. All tasks must be completed within 4 hours.

At the end of the Operational period (4 hours), the students will exchange roles. The new Field Observers will go out and map a different area.

(Example: Team 1 DPS will map Team 2's first fire.)

When both teams have completed the exercise, the Situation Unit Leader will hold a critique.
DATE: ________________

RECON CHECK LIST

FIRE NAME: ___________________ FIRE NO.: _______ SHIFT: _______

ZONE: _______ DIVISION: _______ SECTOR: _______ TOPOG MAP: _______

RATE OF SPREAD: FAST ___ MODERATE ___ SLOW ___ LAYED DOWN ____

TOPOGRAPHY ____________________________

GROUND COVER _________________________

FUEL TYPE(S) ___________________________

SOIL COMPOSITION _______________________

ON MAP, LOCATED (SEE OTHER SIDE):

LOCATION OF FIRE PERIMETER
HAZARDS
ACCESS
POSSIBLE LINE LOCATIONS
NATURAL BARRIERS
RECOMMENDED SECONDARY LINE LOCATIONS
WATER SOURCES
ESCAPE ROUTES
HELISPOT LOCATIONS
UNBURNED ISLANDS
FUEL DROP SITES

VALUES ________________________________

WEATHER CONDITIONS: TEMP. ___ HUMIDITY ___ WIND ___ DIRECTION ___

OTHER ___________________________________

_______________________________________

04-02-1346 HO
DEBRIEFING SHEET

DATE: __________
TIME: __________
SHIFT: __________

BRANCH ________________ DIVISION ____________________

PERSON INTERVIEWED: __________________________________

PRESENT ACTION: _______________________________________

EXPECTED RESULTS: ______________________________________

_______________________________________________________

EQUIPMENT AND MANPOWER PERFORMANCE: ________________

_______________________________________________________

TROUBLE SPOTS (SHOW ON MAP): __________________________

_______________________________________________________

CONDITION OF LINE:____________________________________

_______________________________________________________

INJURIES: ______________________________________________

_______________________________________________________

ANY PROBLEMS? (CHOW, SUPPLIES, COMMUNICATIONS, ETC.): __________

_______________________________________________________

RECOMMENDATIONS FOR NEXT SHIFT (INCLUDE EQUIPMENT & MANPOWER: __________

_______________________________________________________

_______________________________________________________

04-01-1346 HO
# Fire Weather Observation Form

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<td>N E S W</td>
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<tr>
<td>EXPOSURE (Ridgetop, slope)</td>
<td>COVER TYPE (As indicator of wind obstruction)</td>
<td>STAND DENSITY (As indicator of wind obstruction)</td>
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</tr>
<tr>
<td>TIME</td>
<td>TEMPERATURE (Degrees F.)</td>
<td>RELATIVE HUMIDITY (Percent)</td>
<td>SPEED (M.p.h.)</td>
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FIELD OBSERVER LOG

INCIDENT:
OPERATIONAL PERIOD:
DATE:

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# OPERATIONS CHECKLIST

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<td>Relieve</td>
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<tr>
<td>Inspections</td>
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## ORGANIZATIONAL CHECKLIST

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<td>Deputy (</td>
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<tr>
<td>Security Manager</td>
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</table>

( ) Indicate duty hours, fill in activated positions.
DEMOBILIZATION CHECKLIST

Release

Demobilization Plan developed
Demobilization Team assigned

Leader's name
Location (Facilities Unit Leader responsibility)

Surpluses determined

OK with Logistics Section Chief
Travel arrangements complete
Towing problems solved

Finance notified

Documents submitted on time/work completed

Unit Logs (ICS 214) OK
Demobilization Check-Out (ICS 221) to all units.
Agency representatives on board?

Area Restoration

Pre-clean up inspection with property representative
Cleanup organized

Post-clean up inspection with property representative
Further restoration agreed upon
Payment made (finance)
Miscellaneous Handouts
I.C.P. - IDEAL

COMMUNICATIONS

SAFETY
LIASON
INFO

LOGISTICS

PLANNING
SECTION

COPY MACHINE

LIGHTS
POWER

EAGLE

TACK BOARD

CHALK BOARD

SCREEN

IC
OPS
LOG
PLAN
SQAETY

PARKING

ENTRY

SIGN INDICATES BRIEFING TIMES - MEETING TIMES

LIGHT

LIGHT

LIGHT
"OWENS" INCIDENT DEMOB PLAN
INYO NATIONAL FOREST

Prepared 8/9/95 2000hrs

Resources will be held at the incident until processing has been completed, then reassigned to another incident or demobilized to home unit.

SAFETY CONSIDERATIONS

1. CDF resources: If combined shift and driving time exceeds 17 hours, they must have 8 hours rest before release.
2. USFS resources: 4 hours rest required prior to travel. If own transportation is provided and travel exceeds 12 hours, minimum of 8 hours rest is required. In all cases, arrival time must be before 2200 hrs.

RELEASE PRIORITIES

1. Local initial attack, all DWP cooperators, Sherwin resources
2. All CDF
3. Hotshot crews
4. FS regulars
5. AD (Blue Card) crews.

RESPONSIBILITIES AND RELEASE PROCEDURES

1. All resources will use the same order number by which the resource was originally ordered.
2. Demob. U.L. will have INF dispatcher check with the Operations Control Center (OCC) for release priorities established by the South Zone Coordinator.
3. All communications on releases and travel will be made only through INF-dispatch.
4. Section Chiefs will submit surplus resource lists to Demob. U.L.

Demob. U.L.

a. Compile surplus resource lists.
b. Confirm with Plans.
c. Submit to IC for review.
d. Contact INF dispatcher for reassignment of USFS resources to other incidents
   e. Page resources to explain checkout process outlined on attached K522.
   f. Collect performance evaluations, unit logs, and ETA's to be relayed to INF dispatcher. INF will cause home units to be notified.

Strike Team Leaders, Crew Supervisors, SFCO's etc., will check out for entire strike team or crew when paged by the Demob. U.L.

Individual personnel will follow checkout procedures when paged by Demob. U.L.

Contract equipment will follow checkout procedures.

PERFORMANCE RATINGS are required for USFS resources for:

1. Trainer.
2. Outstanding performance.
4. Personal request.
Dozers and Transports need overwidth/overweight permits for weekend travel. Crews, engines cleanup and dispose trash around sleeping areas, return bags (sleeping) to supply.
7. SUMMARY OF CURRENT ACTIONS

Actions to present - 1600 hrs

**DIVISION A**

Dozer, crews and engines are holding left flank from point of origin to pipeline with support of fixed-wing aircraft. Progress is slow. Dozers will reach slope limitations at approximately 1630. Topography above the pipeline steepens and direct attack will be limited to crews and airtankers.

**DIVISION B**

Dozers, crews, and engines are holding right flank from origin to just above pipeline. Dozer has reached slope limitation and is now improving the line. Helicopters are supporting crews with water drops. The helibase is currently at Lost Lake. BDF engine 373 is at the helibase for dust abatement and helicopter filling. BDF ST 6601-C is enroute up Clefton Truck Trail to: 1) hold the trail with direct attack or 2) fire out the road.

A Staging Area, Base and ICP have been established at Canyon Campground.

Weather from Canyon Lookout at 1400 hrs was:

Temp. 90°, Wind SW 20 MPH, FM 3.0, Humidity 20%
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<tr>
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<th>RESOURCE IDENTIFICATION</th>
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<th>ON SCENE</th>
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<td>AA 10</td>
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<p>| 201 ICS 3-82 | PAGE 4 |</p>
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<td>R. MURDOCK</td>
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<td>WHITICHI N.F.</td>
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<td>B. DEAN</td>
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<td>Orange County</td>
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**ACTIVITY LOG (CONTINUE ON REVERSE)**

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<td>1800</td>
<td>Took over Unit operations</td>
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5. GENERAL CONTROL OBJECTIVES FOR THE INCIDENT (INCLUDE ALTERNATIVES.)

- Protect Structures on the South West Side
- Keep the Fire to the east of Highway 17
- Keep the Fire to the west of the Loma Prieta Mt. Umunhum Ridge
- Keep the Fire to the North of Summit Road
- Keep the Fire out of and/or minimize damage to the Redwoods

6. WEATHER FORECAST FOR OPERATIONAL PERIOD

- See Attached forecast -

Threat of thunderstorms continuing into this evening

7. GENERAL/SAFETY MESSAGE

8. ATTACHMENTS (✓ IF ATTACHED)

- ORGANIZATION LIST (ICS 203)
- DIVISION ASSIGNMENT LISTS (ICS 204)
- COMMUNICATIONS PLAN (ICS 205)
- MEDICAL PLAN (ICS 206)
- INCIDENT MAP
- TRAFFIC PLAN

9. PREPARED BY (PLANNING SECTION CHIEF)

10. APPROVED BY (INCIDENT COMMANDER)
**ORGANIZATION ASSIGNMENT LIST ICS-203**

**LEXINGTON**

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<td>Dick Maldin</td>
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<td>LIAISON OFFICER</td>
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<tr>
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<td>F. Alexander</td>
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<td>S. ESPE</td>
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<td>DIRECTOR</td>
<td>John Richey</td>
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AGENCY REPS

Cal Trans  George Butler
CHP

Santa Clara Co. Sheriff  Bob Wilson
Santa Cruz Co. Sheriff  Harvey Flores

Santa Clara Co. Fire  I.C./Agency Rep D. Sporleder
Red Cross  Wendy Martin

Santa Clara Parks & Rec  Dale Jones
Los Gatos Search & Rescue  Jean Gomez
Los Gatos P.D.  SGT. Giordano
Santa Cruz Co. Emergency Services  LT. Plageman
Santa Clara Co.  Dick Mitchell
O.E.S. Region II  Dave Wold

Santa Cruz Co. Fire  Pete Yaninek
**DIVISION ASSIGNMENT LIST**

**1. BRANCH**  
II

**2. DIVISION/GROUP**  
A

**3. INCIDENT NAME**  
Lexington

**4. OPERATIONAL PERIOD**  
DATE: 7-10-85
TIME: 1200

**5. OPERATIONS PERSONNEL**

OPERATIONS CHIEF: Don McMurray  
DIVISION/GROUP SUPERVISOR:  
BRANCH DIRECTOR: Balisteri  
AIR ATTACK SUPERVISOR: Blaine Moore

**6. RESOURCES ASSIGNED THIS PERIOD**

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<th>STRIKE TEAM/TASK FORCE/RESOURCE DESIGNATOR</th>
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<th>PICK UP PT./TIME</th>
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**CONTROL OPERATIONS**

Hi. Pup and put out the division
High 100 feet in from the line
Cut down any burning limbs or trees

---

**8. SPECIAL INSTRUCTIONS**

---

**9. DIVISION/GROUP COMMUNICATION SUMMARY**

<table>
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<td>REPEAT</td>
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<td></td>
</tr>
</tbody>
</table>

**GROUND TO AIR**

PREPARED BY (RESOURCE UNIT LDR.)

APPROVED BY (PLANNING SECTION)  
DATE: 7540-130-0285  
TIME:
## DIVISION/GROUP ASSIGNMENT LIST

**5. OPERATIONS PERSONNEL**

- **OPERATIONS CHIEF**: Don McMurtry
- **DIVISION/GROUP SUPERVISOR**: Helberg
- **BRANCH DIRECTOR**: Ballestari
- **AIR ATTACK SUPERVISOR**: Blaine Moore

### 6. RESOURCES ASSIGNED THIS PERIOD

<table>
<thead>
<tr>
<th>STRIKE TEAM/TASK FORCE/RESOURCE DESIGNATOR</th>
<th>LEADER</th>
<th>NUMBER PERSONS</th>
<th>TRANS. NEEDED</th>
<th>DROP OFF PT./TIME</th>
<th>PICK UP PT./TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>9174 G</td>
<td>1801</td>
<td>43</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9175 G</td>
<td>1821</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5446</td>
<td>Wayne</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>94186 G</td>
<td>Green</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### CONTROL OPERATIONS

- Finish the burn/pase operation.
- Construct line with dozers - use handceasers where dozers cannot reach.

### 8. SPECIAL INSTRUCTIONS

#### 9. DIVISION/GROUP COMMUNICATION SUMMARY

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FREQ.</th>
<th>SYSTEM</th>
<th>CHAN.</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMAND</td>
<td>LOCAL</td>
<td>REPEAT</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SUPPORT</td>
<td>LOCAL</td>
<td>REPEAT</td>
</tr>
<tr>
<td>DIV/GROUP</td>
<td>TACTICAL</td>
<td>GROUND TO AIR</td>
<td></td>
</tr>
</tbody>
</table>

**PREPARED BY (RESOURCE UNIT LDR.)**

**APPROVED BY (PLANNING SECT. CH.)**

**DATE**: 7/10/85

**TIME**: 1:30

**7540-130-0285**
### Division Assignment List

**Date:** 7/10/85  
**Time:** 1500 - 0600

#### Operations Personnel
- **Operations Chief:** Doc. W. Murray
- **Branch Director:** Ditur
- **Division/Group Supervisor:**irie
- **Air Attack Supervisor:**

#### Resources Assigned This Period

<table>
<thead>
<tr>
<th>Strike Team/Task Force/Resource Designator</th>
<th>Leader</th>
<th>Number Persons</th>
<th>Trans. Needed</th>
<th>Drop Off Pt./Time</th>
<th>Pick Up Pt./Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 Heli Crew E11 River B</td>
<td>E11 River B</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1 Heli Crew Santa Cruz P.O. c/o</td>
<td></td>
<td>5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dogan</td>
<td></td>
<td>1</td>
<td>1</td>
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</tr>
<tr>
<td>Dogan</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Control Operations

**Cold Trail, drop up and patrol to secure any remaining ops line along this flank.**

#### Special Instructions

- [Handwritten notes]

#### Division/Group Communication Summary

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Command</td>
<td>Local</td>
<td></td>
<td></td>
<td>Support</td>
<td>Local</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Repeat</td>
<td></td>
<td></td>
<td></td>
<td>Repeat</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Prepared by:** (Resource Unit LDR)  
**Approved by:** (Planning Sect. Ch.)

**Date:** 7/10/85  
**Time:** 1600
**DIVISION ASSIGNMENT LIST**

**3. INCIDENT NAME:** Lexington

**4. OPERATIONAL PERIOD**

- **DATE:** 11/10/85
- **TIME:** 1800-0600

**5. OPERATIONS PERSONNEL**

- **OPERATIONS CHIEF:** Don McMurtry
- **DIVISION/GROUP SUPERVISOR:** [Blank]
- **BRANCH DIRECTOR:** DITUR
- **AIR ATTACK SUPERVISOR:** Blaine Moore

**6. RESOURCES ASSIGNED THIS PERIOD**

<table>
<thead>
<tr>
<th>STRIKE TEAM/TASK FORCE/RESOURCE DESIGNATOR</th>
<th>LEADER</th>
<th>NUMBER PERSONS</th>
<th>TRANS. NEEDED</th>
<th>DROP OFF PT./TIME</th>
<th>PICK UP PT./TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 1 Hand Crew</td>
<td>Alder 2</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type 1 Hand Crew</td>
<td>Alder 3</td>
<td>15</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Dozer</td>
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<td></td>
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</tr>
<tr>
<td>Dozer</td>
<td></td>
<td>1</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**CONTROL OPERATIONS**

Cold trail any remaining open line. Mop up and patrol to secure the line along its flanks.

**8. SPECIAL INSTRUCTIONS**

Mop up to last man from the line. Cut down any burning limbs or trees.

**9. DIVISION/GROUP COMMUNICATION SUMMARY**

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FREQ.</th>
<th>SYSTEM</th>
<th>CHAN.</th>
<th>FUNCTION</th>
<th>FREQ.</th>
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<td>REPEAT</td>
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<td></td>
</tr>
<tr>
<td>DIV/GROUP TACTICAL</td>
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<td>GROUND TO AIR</td>
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</table>

**PREPARED BY (RESOURCE UNIT LDR.):** Wayne Mitchell

**APPROVED BY (PLANNING SECT. CHI.):** [Signature]

**DATE:** 11/10/85

**TIME:** 1995

7540-130-0263
DIVISION ASSIGNMENT LIST

3. INCIDENT NAME: EXTINGUISH
4. OPERATIONAL PERIOD:
   DATE: 7/10/85
   TIME: 1600

5. OPERATIONS PERSONNEL
   CREATIONS CHIEF: Don McMurray
   DIVISION/GROUP SUPERVISOR: BLAINE WILSON
   BRANCH DIRECTOR: Ben Lopes
   AIR ATTACK SUPERVISOR: BLEIN WILSON

6. RESOURCES ASSIGNED THIS PERIOD

<table>
<thead>
<tr>
<th>STRIKE TEAM/TASK FORCE/RESOURCE DESIGNATOR</th>
<th>LEADER</th>
<th>NUMBER PERSONS NEEDED</th>
<th>DROP OFF PT./TIME</th>
<th>PICK UP PT./TIME</th>
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</thead>
<tbody>
<tr>
<td>42 Strike Teams</td>
<td></td>
<td>630</td>
<td></td>
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</tr>
</tbody>
</table>

7. CONTROL OPERATIONS
   Protect structures on the whole fire

8. SPECIAL INSTRUCTIONS
   Work with Branch I hand crews and
deploy in Divisions C & D along Summit Ridge
and around to Aldercrest Heights

9. DIVISION/GROUP COMMUNICATION SUMMARY

<table>
<thead>
<tr>
<th>FUNCTION</th>
<th>FREQ.</th>
<th>SYSTEM</th>
<th>CHAN.</th>
<th>FUNCTION</th>
<th>FREQ.</th>
<th>SYSTEM</th>
<th>CHAN.</th>
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<tr>
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<td>LOCAL</td>
<td>REPEAT</td>
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<td>SUPPORT</td>
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<td>REPEAT</td>
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<td>DIV/GROUP</td>
<td>TACTICAL</td>
<td></td>
<td></td>
<td>GROUND TO AIR</td>
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PREPARED BY: RESOURCE UNIT LDR.
APPROVED BY: PLANNING SETL. CH.
DATE: 7/10/85
TIME: 1600

Wayne Mitchell, Chief
### INCIDENT RADIO COMMUNICATIONS PLAN

<table>
<thead>
<tr>
<th>SYSTEM/CACHE</th>
<th>CHANNEL</th>
<th>FUNCTION</th>
<th>FREQUENCY</th>
<th>ASSIGNMENT</th>
<th>REMARKS</th>
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<tbody>
<tr>
<td>PIFC</td>
<td>4</td>
<td>Command c/c</td>
<td>168.700 Tx 168.700 Rx</td>
<td>I.C., Ops, Branch Incident Base Gen. Sta.</td>
<td>All USF6 PIFC Radios must check out in Communication Unit.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Tac 2</td>
<td>168.600 Tx 168.600 Rx</td>
<td>Branch 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Logistics In Campi</td>
<td>168.050 Tx 168.050 Rx</td>
<td>Plans, Logistics, Base, H.Q., Etc., Check-in, Class I.</td>
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</tr>
<tr>
<td></td>
<td>6</td>
<td>Air-to-Ground</td>
<td>168.100 Tx 168.100 Rx</td>
<td>Air Ops, I.C. Ops, Branch Div.</td>
<td></td>
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</table>

---

**ICS 79**

**Prepared by:** Communications Unit

**Prepared by:**

---
<table>
<thead>
<tr>
<th>SYSTEM/CACHE</th>
<th>CHANNEL</th>
<th>FUNCTION</th>
<th>FREQUENCY</th>
<th>ASSIGNMENT</th>
<th>REMARKS</th>
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</thead>
<tbody>
<tr>
<td>CDF</td>
<td>Tactical</td>
<td>Tx 151.280</td>
<td>Rx 151.280</td>
<td>Beach Div.</td>
<td>COF red net may be used as alternate on second air-to-ground freq.</td>
</tr>
<tr>
<td></td>
<td>Red Net</td>
<td>Tx 151.280</td>
<td>Rx 151.280</td>
<td></td>
<td>Assignment of specific to COF air net as authorized by Region ECo.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tx 151.275</td>
<td>Rx 151.275</td>
<td></td>
<td>All personnel assigned to incident must stay off C-band except as noted.</td>
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<tr>
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<td></td>
<td>Tx 151.310</td>
<td>Rx 151.310</td>
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<td></td>
<td></td>
<td>Tx 151.445</td>
<td>Rx 151.445</td>
<td>I.C. Ops</td>
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<td></td>
<td>Beach Div.</td>
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<td></td>
<td>Air Ops.</td>
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<td>Command</td>
<td>Tx 151.280</td>
<td>Rx 151.280</td>
<td>Deputy I.C.</td>
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<td>Net</td>
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<td></td>
</tr>
<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
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<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
<td></td>
</tr>
<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
<td></td>
</tr>
<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
<td></td>
</tr>
<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
<td></td>
</tr>
<tr>
<td>0:05:57</td>
<td>15:42 UTC</td>
<td>03:48 UTC</td>
<td>Command</td>
<td>03:48</td>
<td></td>
</tr>
</tbody>
</table>

**Remark**: The event occurred at 03:48 UTC on 03:48.
**MEDICAL PLAN**

**INCIDENT NAME**: Lexington  
**DATE PREPARED**: 7/10/85  
**TIME PREPARED**: 1600  
**OPERATIONAL PERIOD**: Night Shift

<table>
<thead>
<tr>
<th>MEDICAL AID STATIONS</th>
<th>LOCATION</th>
<th>PARAMEDICS</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Red Cross</td>
<td>Lexington Incident Base</td>
<td>X</td>
</tr>
<tr>
<td>Mobile Red Cross Unit</td>
<td>barber Fire Station</td>
<td>X</td>
</tr>
<tr>
<td>American Red Cross</td>
<td>Lexington Camp</td>
<td>X</td>
</tr>
</tbody>
</table>

**TRANSPORTATION**

**A. AMBULANCE SERVICES**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ADDRESS</th>
<th>PHONE</th>
<th>PARAMEDICS</th>
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</thead>
<tbody>
<tr>
<td>Santa Cruz Ambulance</td>
<td></td>
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</tr>
<tr>
<td>Medical Ambulance</td>
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<td>911</td>
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<tr>
<td>San Jose Ambulance</td>
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<td>911</td>
<td>X</td>
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**INCIDENT AMBULANCES**

<table>
<thead>
<tr>
<th>NAME</th>
<th>LOCATION</th>
<th>PARAMEDICS</th>
</tr>
</thead>
</table>

**HOSPITALS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>ADDRESS</th>
<th>TRAVEL TIME</th>
<th>PHONE</th>
<th>HELIPAD</th>
<th>BURN CENTER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Santa Clara Valley Med. Center</td>
<td></td>
<td>5 min, 8 min</td>
<td>416-775-4321</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>S.F. Mem. Hosp. (C.D.F. Approved Burn Center)</td>
<td></td>
<td>20 min, 1 hr</td>
<td>416-775-4321</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>S.F. General Hosp.</td>
<td>1001 Potrero</td>
<td>20 min, 1 hr</td>
<td>1197</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

In case of burn, use only to stabilize then transport to above.

**MEDICAL EMERGENCY PROCEDURES**

Contact Lexington Ops. via Supervisors - Ops. will arrange for proper type of transportation depending on Nature of Injury/ILLNESS. Helicopter is available during daylight hours for Medical Evacuation of Fire person.

**ICS**

9. PREPARED BY (MEDICAL UNIT LEADER): [Signature]  
10. REVIEWED BY (SAFETY OFFICER): [Signature]
Lexington Fire

Safety Bulletin
Night Shift 7/10/85

Fireline: Fire crews have been observed wearing required safety clothing. Keep up the good work.
Winds up to 25 m.p.h. are predicted for this evening. Be especially alert for possible erratic wind shifts.
Relative humidity will be lowest at highest elevations, this could cause sudden flare-ups.
Shallow inversion will result in smoke buildups in valleys, reducing visibility and increasing inhalation of smoke by fire crews.
As of 1500 hours today there have been 130 injuries. Red Cross is staffing a medical unit at Incident box and a mobil unit at Burrell Station.

Driving
Traffic on Highway 17 is heavy due to normal commute and rubber-neekers. Stay alert. Remember the 17 hour rule is to be followed.

Camp
Individuals have been observed riding on truck tailgates and hanging on to fire engine running boards. This is not a safe practice and is not acceptable.

Helitack box
Base was inspected today. Crews are doing a good job maintaining a safe environment.

Think Safety, it's our 1st priority!
WEATHER DISCUSSION: Band of clouds moving through the area tonight may cause some sudden wind shifts. There is a shallow marine layer over the fire which is causing humidity to be considerably lower at the higher elevations.

FORECAST FOR NIGHTSHIFT:

WEATHER: Becoming partly cloudy with a few sprinkles.

TEMPERATURE: Low tonight in the 60s.

HUMIDITY: 70-100 pct in valleys and 40-70 pct on the slopes.

RIDGE TOP WIND: Ridgetop winds variable 10-25 mph tonight with occasional sudden shifts.

SLOPE WINDS: downslope 3-7 mph with a few downdrafts 12-17 mph.

STABILITY: Shallow marine layer will cause KM smoke to thicken in valleys.

OUTLOOK FOR NEXT SHIFT:

Decreasing clouds and increasing sunlight for warmer drier conditions. Winds becoming upslope and gusty during the afternoon.

FURTHER OUTLOOK (36-48 Hours):

Temperatures warmer than normal.
External Traffic Map

Isong Lake to Park

Blossom Hill

Shoreline

Shannon

Hicks

Baldwin

No Turn

Guadalupe Reservoir

Blossom Hill Rd.
Right on Shoreline
Left on Shannon
Right on Hicks

Light on Air Force Rd.

N

S Ryan
7/10/85 0230

Not to Scale
CURRENT FIRE SITUATION
SOUTHERN CALIFORNIA

NUMBER: 12
DATE: 07/03/85
TIME: 18:00
MAJOR FIRES IN SOUTHZONE:

RIVERSIDE COUNTY

CABAZON FIRE - BDF# 85-0

Fire started at 10:58 A.M. on 06/27/85 southeast of Cabazon in the San Jacinto Mountains, San Bernardino National Forest. No estimate of containment has been given. No structures have been destroyed and there is no threat to structures at this time. The fire is moving in an easterly direction. Acreage burned is 4262 acres.

June 29, 1985: Regional fire team has been order due to the increase in acres. Decisions have been discussed to set up a camp at the Palm Springs High School to handle the east end of the fire.

June 29, 1985 at 1800 hours: area involved has increased to 5350 acres. The percent of containment has decreased to 25% due to erratic wind conditions. Efforts are going to be made to try and hold the fire in Chino Canyon on the eastside of the fire. Evacuation of the San Jacinto Wilderness State Park of an estimated 400 persons is being planned.

June 30, 1985. Firing operations were planned for this morning in the Chino Canyon area. The fire has grown to 10,000+ acres. It has moved into the habitat of the least Bell’s vireo – an endangered streamside bird; and, has burnt at least 10% of the Peninsular bighorn sheep range in the San Jacinto Mtn. area. Also, the Palm Springs Tramway and road to the area are closed until further notice. The Western Village, a residential and commercial area of 40-50 buildings and homes, was threatened for a short time, but is out of danger at this time.

July 01, 1985. Due to firing out operations the acreage has grown to 20,623 acres. The fire is 50% contained. 100% containment is planned for July 07, 1985. No structures have been burnt. The fire has not moved into the State Park Wilderness. As of this date it is still closed to the public, but the Tramway will be operating under normal conditions for the public beginning at 10:00 this morning. (NOTE: All FS hot shot crews in South Zone were on the fire – this is a first.)

July 01, 1985 - 15:00 hours. Manpower is being released to be available for other assignments.

July 02, 1985 - 0815 hours. Class I team released at 1600 hours.
SAN BERNARDINO COUNTY

KNOT FIRE - BDF #0981

Fire started at 1432 on July 01, 1985. As of 1759 hours it is reported as 25 acres. Heavy fuels and erratic wind conditions (15 - 25 mph) are creating problems for the 57 people on the ground fighting the fire. The location of the fire is south of Big Bear Lake close to the Snow Forest Ski area.

July 02, 1985 - 0800 hours. At this time it is 90% contained with a control time set for 1800 hours 7/2/85.

PARSONS FIRE - BDU - 7642

Fire started on July 03, 1985. As of 16:00 hours this date the fire is reported to be 1500+ acres with no known containment. This fire is located North West of Yucca Valley in the Pipes Canyon area, San Bernardino County. This fire is moving in a westerly direction at a rapid rate of spread. The flanks are being directed but the head of the fire is uncontrolled. There is no estimate of control at this time. The major problem on this fire is that there are no roads in the vicinity.

SIERRA FIRE - 3649

This new fire started on July 03, 1985 at 13:43 hours. It is located north of the City of Fontana, in the County of San Bernardino. The fire is reported to be 85 acres. There are currently 37 people fighting this fire.

KERN COUNTY

RICHBAR FIRE - SQF# 0215

Fire started at 1:06 P.M. on 06/28/85 10 miles northeast of Bakersfield in the Kern River Canyon. It is located on the south side of the Kern River, Sequoia National Forest and moving in a southeasterly direction toward the area of Breckenridge. The fire is moving into commercial timber areas. The area presently involved is 5500 acres. Estimated containment is for 6:00 p.m. on 06/29/85 (Sat).

June 29 1985. Acreage up to 6200. Fires forward spread has decreased, and demobilization is expected to start on the morning of June 30, 1985. Highway 158 has been reopened to public use as of 11:00 a.m., this date.

June 30, 1985. As of 06:35 A.M. this morning, the Richbar Fire has been 100% contained at 8100 acres.
VENTURA COUNTY

SHERWOOD FIRE - VCN-04

Started on June 30, 1985, at 1047 hours in the Lake Sherwood area; Combined units from Ventura County, Los Angeles County, L.A. City, and C.D.F. are on this fire just north of the L.A. County line. It is 3,500+ acres in size with no containment in site. Erratic winds are pushing the fire towards West Lake. No structures have been destroyed at this time.

June 30, 1985 - 17:30 hours. The fire has moved into Los Angeles County and is moving southeast toward Decker Canyon.

July 01, 1985. LA County has taken over the fire from Ventura County. One structure in Sycamore Canyon has been destroyed. There are 675 persons on the fire, and at this time there has been no containment time given.

July 02, 1985 - 0830 hours. 50% containment. Reduction in manpower to 337 people.

**UPDATE July 3, 1985 - 0114 hours
100% contained, 29 total injuries. 3,820 acres.

SOUTH MOUNTAIN #1 - VCN-05

This second fire was reported at approximately 1214 hours. It is located near Santa Paula. The acreage burned is approximately 400 acres. Crews are firing out the canyons and the west ridge.

June 30, 1985 - 17:30 hours. 50 % Contained. Little fire spread. Erratic wind conditions.

July 01, 1985. The fire has been controlled as of 0403 hours at 100 acres. No structures were damaged and no major injuries were reported.

WHEELER FIRE #2 - LPN - 549

The fire located off of Highway 33 north of Ojai, on the Los Padres National Forest, it started at 1515 hours. Ventura County is assisting the Forest Service with structure protection in the area. Residents in front of the fire are being evacuated. These are the areas of Wheeler Springs, Rose Valley, and Wheeler Springs Campground. Highway 33 is closed in both directions. The fire started at the tunnel south of Wheeler Gorge. There is no estimated containment time. 300 people are on the fire at this time.
VENTURA COUNTY

ERWOOD FIRE - VCN-04

Started on June 30, 1985, at 1047 hours in the Lake Sherwood area. Combined units from Ventura County, Los Angeles County, L.A. City, and C.D.F. are on this fire just north of the L.A. County line. It is 3,500+ acres in size with no containment in site. Erratic winds are pushing the fire towards West Lake. No structures have been destroyed at this time.

June 30, 1985 - 17:30 hours. The fire has moved into Los Angeles County and is moving southeast toward Decker Canyon.

July 01, 1985. LA County has taken over the fire from Ventura County. One structure in Sycamore Canyon has been destroyed. There are 675 persons on the fire, and at this time there has been no containment time given.

July 02, 1985 - 0830 hours. 50% containment. Reduction in manpower to 337 people.

** UPDATE July 3, 1985 - 0114 hours

100% contained, 29 total injuries. 3,820 acres.

SOUTH MOUNTAIN #1-VCN-05

This second fire was reported at approximately 1214 hours. It is located near Santa Paula. The acreage burned is approximately 400 acres. Crews are firing out the canyons and the west ridge.

June 30, 1985 - 17:30 hours. 50% Contained. Little fire spread. Erratic wind conditions

July 01, 1985. The fire has been controlled as of 0403 hours at 100 acres. No structures were damaged and no major injuries were reported.

WHEELER FIRE #2 - LPN - 549

The fire located off of Highway 33 north of Ojai, on the Los Padres National Forest, it started at 1515 hours. Ventura County is assisting the Forest Service with structure protection in the area. Residents in front of the fire are being evacuated. These are the areas of Wheeler Springs, Rose Valley, and Wheeler Springs Campground. Highway 33 is closed in both directions. The fire started at the tunnel south of Wheeler Gorge. There is no estimated containment time. 300 people are on the fire at this time.
July 02, 1985 - 1515 hours. The fire has spread to 6000+ acres. There are 562 persons on the fire at this time. Matilija Canyon, northeast of Ojai, has been evacuated. As of 10:00 hours this morning, 1,000 persons have been reported evacuated from areas in the path of the fire. Nordoff High School, Ojai, has been established as one of the evacuation centers. There have been three confirmed homes burnt in the Wheeler Springs area. The fire is spreading northeast towards Ortega Camp and east towards Senior Canyon.

July 03, 1985 0437 hours. Strong winds, very localized starting at about 0200 moved the fire into the northeast part of Ojai. Report of several homes on fire, and massive evacuation. Size has increased to 26,300 acres with 20% contained and unknown containment and control dates. Eight injuries to date. Evacuation areas include Miners Oakes, Mira Monte, Rose Valley Campground and portions of upper Ojai. Estimated 2180 personnel on the fire. Three residences destroyed at Wheeler Springs.

** UPDATE: - 1600 - hours. Fire has doubled in size and is currently 28,000 acres. Confirmed that 11 buildings have been damaged or destroyed, causing $1 million dollars in property damage. This fire is active on all fronts.

SAN DIEGO COUNTY

MILLER FIRE-MVU-1316

Fire started on June 30, 1985 at approximately 1147 hours. It started east of Lemon Grove. At least one home has been destroyed and several others are threatened. 600 acres have been lost.

June 30, 1985 - 17:30 hours. Acreage is 1,000+. Fire is moving toward Proctor Valley. 3 homes have been destroyed.

July 01, 1985. The fire has spread to over 8,000 acres. 3 homes, 1 shed, and 6 personal vehicles have been destroyed. The fire is reported at 86% contained; however, things are still "...hanging on a thread" according to Fire Information Officer Doug Allen.

July 02, 1985 - 0800 hours. The fire is 98% contained and is in the mop up stage. Units are being released. Total acreage is reported at 8,300 acres.

GOPHER FIRE - MVU -1345

Start time was 1323 on July 01, 1985. It is 90% contained at this time with control estimated for 1800, July 02, 1985. It is in the mop up stage. 1200 acres are reported burnt and 1 structure lost.
UPDATE: July 03, 1985 - 1000 hours. Fire is currently 1,400 acres and reported to be 100% contained.

ROBLAR FIRE - MVU - 1351

This fire started at 1617 on July 01, 1985. At this time it is reported to be entirely on the Camp Pendleton Marine Corps Base with 2 C.D.F. engine strike teams on the fire. 1100 acres have been burnt and the direction of spread is northeast. No structures have been threatened.

July 02, 1985 - 1530 hours. The fire is now 5,000+ acres. It has moved onto private land and homes are threatened. Deluz Canyon has been evacuated as of 1400 hours. There are now 402 people on the fire.

July 02, 1985 - 1900 hours. Acreage has grown to 5,000+ acres. Manpower on the fire has grown 876 persons. Fire is still moving in a northeast direction. Confirmed one home destroyed.

July 03, 1985 - 0327 hours. Cause has been determined as weapons firing. Percent contained 30%, with full containment expected 07/04/85 1800 hours. Two houses destroyed, orchards damaged. Current acres USMC 3600 acres, CDF 1400 acres. Final size expected to exceed 10,000 acres.

July 03, 1985 - 0827 hours. Current acreage is estimated at 10,000+ acres. Confirmed that 2 homes have been destroyed, 1 commercial nursery and several outbuildings.

UPDATE: July 03, 1985 - 1600 hours. This fire is currently estimated to be 15,000+ acres with 30% contained. Current property damage is listed at $280,000 dollars.

DEER SPRINGS FIRE - MVU-1359

The fire started at approximately 12:06 P.M. on July 02, 1985. The location is north of Escondido east of I-15. Acreage at this time is reported at 500+ acres.

July 02, 1985 - 2000 hours. Three areas were evacuated: Jesmond Dene, Ivy Dell and Sleepy Hollow. Homes are being threatened. 90% contained. Confirmed 6 homes destroyed and several out buildings.

OAK CREEK FIRE - MVU - 1372

This fire started on July 03, 1985 at 11:45 hours. It is located near the City of Lakeside in San Diego County. At the current time this fire is reported to be 220 acres in size with 75% contained. There are currently 69 people on the fire.

SAN DIEGO CITY ASSIST
This is an assist with the City of San Diego as a vegetation fire west of La Mesa, Mission Gorge area, Interstate 8 and the 805. 12 homes have been destroyed. Evacuation center has been set up.

June 30, 1985 - 17:30 hours. Nothing to report.

July 01, 1985 - 0830 hours. 47 homes have been confirmed destroyed. The fire is 100% contained. The residents were allowed back into the area last night at 2300 hours. Approximately 300 persons had been evacuated at one time. Most of the homes destroyed had not performed their annual fire clearing; however, they did have composition roofing.

July 02, 1985 - 1330 hours. Confirmed 600 acres consumed and 63 residences destroyed. Property loss is 8.5 million dollars.

SAN LUIS OBISPO COUNTY

LAS PILITAS - SLU 1430

Report time was 1327 on July 01, 1985. It is reported to be 300 acres and possibly has destroyed 2 structures. This fire is located S.E. of San Luis Obispo. This is a C.D.F. fire; however an engine strike team from the Los Padres National Forest has been dispatched to assist.

July 01, 1985 - 1840 hours. The size of the fire is reported at 1000 acres. 2 structures are confirmed destroyed. 30 homes are being threatened. 250 people are on the fire at this time.

July 02, 1985 - 0800 hours. The fire is 40% contained with full containment estimated for 1800 hours on 7/2/85. Acreage involved is 7500+. Damage is estimated at $150,000 which includes 2 private vehicles, 2 homes, a barn, and a cabin.

July 02, 1985 - 1330 hours. The fire is 12,500 acres and spreading in a southeast direction towards Santa Margarita Lake. It is 40% contained.

July 02, 1985 - 1929 hours. The fire is reported at 12,000+ acres. They have revised the percent contained to unknown. The spread is east and northeast. It has reached Santa Maragarita Lake.

** UPDATE: July 03, 1985 - 1600 hours. The size of the fire is currently reported to be 14,000+ acres. They have put the percentage of containment at 60%. Santa Margarity Lake Recreation Area has been evacuated. The fire has jumped Pozo Road and is now burning in the Santa Lucia Wilderness, burning towards the coast of California.
PEACHY - SLU - 1436

Start time on the fire was 1621 on July 01, 1985. It is presently reported at 300 acres. It is 50% contained with 94 persons on the fire. The fire is burning in rugged terrain and heavy brush. Cause of the fire is blamed on burning debris.

July 02, 1985 - 1330 hours. 100% contained. It is in the mopping up stage.

** UPDATE: July 02, 1985 - 1931 hours. Revised acreage is 54 acres. 100% contained.

ORANGE COUNTY

GREEN RIVER - ORC

This fire started at 1650 hours on 07/02/85. Cause of fire airplane crash. 500 acres have burned thus far. Estimated containment time unknown. Threat to ranches in local area. Injuries two fatalities aboard airplane. Three crewmen suffered minor injuries when a Naval Weapons Center engine was overrun and totally destroyed by fire.

** UPDATE: July 03, 1985 - 0438 hours. Update acreage to 740 acres, 20% contained. Expected containment 07/03/85 1200 hours. Control time 07/03/85 1800 hours. Three injuries and two deaths.

LOS ANGELES COUNTY

JOHNSON - LAC

This fire started at 1635 hours on 07/02/85. 200 acres burnt. Estimated containment 2400 hours. Fire located just north of City of Laverne.

LOS ANGELES CITY

BALDWIN - IC

Fire started 1448 hours 07/02/85 burned approximately 10 acres of vegetation destroyed 52 homes heavily damaged 13 other homes, caused $15 million dollars in property loss. Two civilian fatalities, four civilian injuries and four firefighter injuries.

** UPDATE 07/03/85 - 0137 Hours
Cause incendiary.
CLEVELAND N.F.

IDY - CNF

Fire started 1830 hours 07/02/85. 60 acres have burned, with 20% containment. Expected containment 07/03/85 0600; expected control 07/03/85 1800 hours.

NORTH ZONE

MARIPOSA COUNTY

YOSEMITE NATIONAL PARK

The Park has several small lightning fires and one major 1000 acre fire in an inaccessible area. Manpower on the 1000 acre fire is approximately 80 people. The fire started on June 30, 1985 at 1115 hours. Access to the fire is by helicopter.

SIERRA N.F.

MAMMOTH

Started 07/02/85 at 1625 hours. 250 acres burned; 50% contained.

07/03/85 0432 Hours - July 03, 1985. Percent contained reported at 70% with full containment expected 07/03/85 at 1300 hours today's date. Current acreage is reported at 540 acres.

MONTEREY COUNTY

SECO FIRE - LPF - 906

This fire was reported at 1634 hours on July 02, 1985. It is located 15 miles west of Greenfield on Arroyo Seco Road, on the Las Padres National Forest, Arroyo Seco Ranger District. It is currently reported burning in brush. Current acreage is 400. This fire is 20% contained with an expected containment date of 07/04/85 at 0600 hours. Currently there are 136 people on the fire.
A. B. C. MISCELLANEOUS FIRES

FOR THE PERIOD OF JUNE 28 - JULY 02, 1985

1) Institution Fire - San Bernardino CDF - 100+ acres. Declared 100% controlled 6/28/85 at 1700 hours.

2) Rey Fire - Cleveland NF - 370 acres. Estimated control 06/28/85 0800 hours.


4) Wheeler Fire - Ventura County - 70 acres. Declared controlled on 06/28/85 at 2207 hours.

5) Olsen Fire - Ventura County - 50 acres. Declared controlled on 06/30/85 at 0350 hours.

6) Corey Fire - Riverside County - 45 acres. Declared controlled on 07/01/85 at 2400 hours. Location is at 68th Ave and Downey in the Pedley area.

7) Gavilan - Riverside County - 473 acres. Contained.

8) Ortega - Riverside/Orange County - 20+ acres. Started 1853 hours 07/02/85.
California Department of Forestry

LIGHTNING DETECTION MAP

Number of strikes on this map: 932
First strike: 9-2 8:47
Last strike: 9-2 16:57

Map: 2.01 Merc - Pgm Rev: 09-03-87 1300 Hrs.
(p printed: 09-02-87 17:13 Hrs.)
GORDA FIRE
7/18/85
NIGHT SHIFT

LEGEND

xxx DOZER LINE

--- HAND LINE

/// FIRE EDGE

• OP1 DROP POINT

• HG4 HELISPOT

SCALE
0 1 2 MILE
INCIDENT STATUS SUMMARY

1. Date: 7-11-94  Time: 1800
2. Initial □ Update □ Final □
3. Incident Number: 344
4. Incident Commander: Millis
5. Jurisdiction: FS
6. County: Kern Co.
7. Type Incident: Keen WILDFIRE
8. Location: 7273, 7273, 534 E
9. Surveyed Date: 7-7-84
10. Surveyed Time: 1101

11. Cause: Under Investigation
12. Area Involved: 23,100 ac.
13. % Contained: 50
14. Expected Containment Date: New Est.
16. Declared Controlled Date: New Est.
17. Current Threat: Scattered dwellings on Pinto Ntn., timber
18. Control Problems: Rocky, steep terrain
21. Injuries: 0
22. Line Built: 2,750 ft.
23. Line to Build: 764 ft.
24. Current Weather: WS 18 95° 12%
26. Costs to Date: $2,393,231
27. Est. Total Cost: $8,000,000

28. AGENCIES

29. RESOURCES

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30. Cooperating Agencies

USFS, XKE, BFD, COF, OES, NWS, NPS, KSEO, NMT

31. Remarks

OES contact 16 in for OES references
*updated from last 209
*Archaeological sites within the incident area being protected
*Rehabilitation 10 being done on constructed lines by pulling in cross drains

32. Prepared By
Cathy Taule

33. Approved By

34. Sent To
XKE Command Center
Date: 7-11  Time: 1830

Previous edition is obsolete.
FIGURE 1. SLOPE ANGLE

FIGURE 2. PERCENT OF SLOPE
THIS HANDOUT FOR ALL WHO HAVE ATTENDED THE "FIELD OBSERVER - DISPLAY PROCESSOR" TRAINING (ICS 244). I HAVE PUT THIS TOGETHER TO SERVE AS A REFRESHER IN THE USE OF THE FIELD OBSERVATION AIDS (IF AND WHEN THE TIME COMES TO ACTUALLY USE IT).

ANEROID BAROMETER

The Aneroid Barometer (altimeter) is a convenient instrument for determining differences in elevation where a low order of accuracy will suffice. Because barometer readings are affected by constantly changing atmospheric pressures the best results are obtained when it is possible to tie into points of known elevation every two hours or less. Avoid using the barometer to check elevation on days of known changing weather conditions, using the barometer to watch the changing weather conditions can be helpful in gathering field data.

1. Before taking a reading tap the glass lightly.

2. Set the instrument at points of known elevation, such as a lookout tower, bench mark or any recognizable location on a topo map.

3. Always hold the instrument in the same position when taking a reading.

4. Wait a few minutes to allow needle to "catch up" after arrival at a reading is to be taken.

5. Take advantage of every opportunity to check with points of known elevation.

6. The Altimeter is very helpful in locating yourself in country where every thing looks the same (such as the timber country of Washington State). You will also find the altimeter very helpful when you have a walking line assignment, examples are when your in a area your not familiar with and its smoked in or its after dark in unfamiliar country.

ABNEY LEVEL / CLINOMETER

The Abney Level and the Clinometer are used to measure the angle between the horizontal plane and the line of sight along a slope. A percent abney and clinometer (for our purpose we will use the percent scale) measure the number of feet rise per 100 feet of horizontal distance.

EXAMPLE: a 20% slope is a 20° rise in 100° horizontal distance, a 100% slope is a 100° rise in 100° horizontal distance (a 45 degree angle).
The compass is an instrument which enables you to determine a general direction and travel that direction with accuracy whether day or night. Your compass is a delicate instrument, avoid rough handling.

The force that attracts the magnetized needle is the magnetism of the earth itself. The north end is the magnetised North Pole toward which the north end of the compass needle points when at rest. Unfortunately the magnetic North and the true North are located about 1,500 miles apart. Note: It is important to remember that "Magnetic north" is located South and East of "true North" (here on the West Coast). Your corrections for this deviation will always be "East" of True North, when taking map bearings and applying them to the field.

All maps that we will be using for display processing work will be oriented toward true North at the top of the page.

Always hold the compass level when taking a reading or you can wind up with a bad "bearing". This is a result of the tip of the magnetic needle coming in contact with protective cover.

Watch for the presence of any metal in the vicinity of the compass. Items such as the tip of your pencil, keys, hood of a vehicle, metal road barriers, metal drains. Any thing which can be magnetized can cause you trouble!

You can use compass to work at night by running a flashlight over the luminous portions. By using a "Intersection" (discussed later) you can locate spot fires, this task can be very difficult or impossible without a compass.

INSTRUCTIONS FOR USE

Two separate sets of rules apply to the use of the magnetic compass

1. One set applies if you are working "from map to terrain", in which case you are taking "map bearings", these are "true bearings".

2. The opposite rule applies if you are working "from terrain to map" In this situation you are using "field bearings" (also called "magnetic Bearings" or "compass bearings").

In the above paragraph the word "map" is broadly interpreted to also include charts, descriptions and even a mental knowledge of the terrain. In general you are seeking a spot on the terrain from written or mental information available to you, and the rules "from map to terrain" apply. These are called "map bearing rules".

On the other hand, if you see some object on the terrain and wish to plot it's location or determine the direction to it, then the opposite rules will apply, namely those "from terrain to map". Such rules are known as "field bearing rules".
In the following instructions, Sections A, B, C, D and E are based on working "from map to terrain". They are the "map bearing rules". Sections F, G, and H are exactly opposite and are based on working "from terrain to map". They are "field bearing rules".

SECTION A - Pointing Out Desired Directions

When using the compass to indicate directions in the field, two basic conditions must always be accomplished. These are:

FIRST: The dial must be set to the desired degree reading. If the degree or direction is known simply turn the dial so that the correct reading appears on the index line.

SECOND: WITHOUT CHANGING THE DIAL SETTING, the entire compass must be turned so that the orienting arrow lines up with the magnetic needle and the red end of the needle lies between the two orienting points.

For example in the above illustration the compass is set at 40 degrees

When the above two conditions are fulfilled, the desired direction is indicated by the sighting line.

If the degree is not known, then this information must be obtained in one way or another. Often a suitable map is used for this purpose.
SECTION B - Using Compass without the Sight

Keep in mind that the two conditions in Section A must be fulfilled. Therefore first set the dial according to Section A(1).

When the dial is set, you use your compass with the aid of the sighting line (as in the type contained in the belt weather kits) or with the mirror type by laying the unit flat and using the "sighting line", which is located on the mirror surface. This method of sighting is "quicker" and might be preferred where extreme accuracy is not important. With the units supplied in the belt weather kits we have no choice!

When you use the line of sight hold the sighting line pointing away from you, not back toward your body. The sighting line acts as a pointer. Pivot yourself and your compass around together until the orienting arrow is lined up with the magnetic needle. The sighting line now will be pointing toward the correct direction.

While holding the compass as above, imagine a line extending out from the sighting line. Your objective lies along that line. Note: if you are going any great distance, take sightings in short spurts and your chance of arriving at your destination will be better.
SECTION C - Using Compass with the Mirror Sight

For extreme accuracy in determining a bearing the mirror sight is far superior to the line of sight type compass.

To use this type of compass, determine your bearing (as described earlier) and:

1. Hold the compass at eye level and adjust the cover to slightly less than a 90 degree opening, so that mirror reflects a top view of the compass dial and the base lines.

   ![Fig. 7](image)

2. While looking in the mirror, move your sighting eye sideways until the sighting line hides the center index line as shown below.

3. Without changing the relationship between the compass and the eye, pivot yourself and compass together until you see in the mirror that the orienting arrow is lined up with the magnetic needle and the red end of the needle is between the orienting points.

4. Your direction or objective will now lie straight beyond the sight on the upper edge of the cover.

Note: Again be sure to keep the base plate level so that magnetic needle can turn freely.
SECTION E - Facts About Declination

What Is Declination?

The magnetic needle in a compass is attracted by the magnetism on the Earth, and that is why it always points North, in the Northern Hemisphere.

However, there are really two North Poles on the Earth. One is the "true" North Pole, which is located geographically, while the other is the "magnetic" North Pole, which is where the magnetic lines of force come together.

Maps and directions usually are based on "true" North and Magnetic North. The magnetic declination is the angle between True North and Magnetic North. The amount of declination at any given point depends on the location of that point on the continent. Where True and Magnetic North are in the same direction, the declination is zero (such as the Great Lakes Region of the U.S.).

In North America, this line runs roughly from West of Hudson Bay down along Lake Michigan to the Gulf Coast in western Florida. At any point on the West side of that line, your compass needle will point East of True North. This is called "Easterly Declination." In any point East of the zero line, your compass needle will point West of True North. This is called "Westerly Declination." In North America, magnetic declination varies from 30 degrees East in Alaska to 30 degrees West in Florida. Remember "Easterly" declination is determined from its relation to that zero line and not to the geography of the continent.

Above map shows declination of the compass in North America. East of the zero line, declination is "Easterly," West of the zero line, declination is "Westerly".
SECTION D - Obtaining Bearings from a map

If a bearing is not known it can be determined easily from any map which is scale. Your compass will serve well as a protractor. With the compass (or a protractor if you have one) you can take very accurate bearings. Only two steps are required to determine a bearing from a map. The "protractor" will be discussed later by itself.

1. Lay the compass on the map so that the side of the base plate is exactly on (or parallel with) the line on the map you wish to travel. The sighting line must point in the direction you wish to travel.

2. While holding the compass in position on the map rotate the dial to the meridian lines on the compass are exactly parallel with the meridian (North and South) lines on the map. Make sure that the "N" on the compass is pointing toward North on the map (not turned toward South).

You may now remove the compass from the map. In these two steps your compass was set for the degree reading to your destination and this reading may now be read at the center index line. However in order to use this reading you must first compensate for "declination", which brings us to the next topic!
SECTION E - Facts About Declination

Allowance for Declination

For rough compass work where accuracy is not too important, magnetic declination can be ignored.

Declination may also be ignored when the compass is used without reference to maps, so that its use is based on field bearings exclusively.

When the compass is used with a map, or in connection with map bearings, an adjustment must be made to allow for declination.

Adjusting Map Bearings for Declination

Allowance for declination is extremely simple with the type of compass we are working with. With only one slight turn of the dial you can make proper allowance for any declination wherever you may be. You must do this every time you wish to apply declination to a bearing.

Adjustment of map bearings are described here. Adjustment of field bearings are described in Section G.

First find out the amount of declination in your area (remember we are "Easterly" here) and the amount of declination, this is located on the bottom of the topo maps. The enclosed map will give you a pictorial view of how the system works.

To make the allowance, first take the bearing from the map (as was described earlier). When you have that bearing observe the degree reading at the index line.

Allowance for declination is then made by turning the dial to increase or decrease that reading according to the declination. If the declination is "Easterly" (as it is here), decrease the dial reading by that amount of declination. If you were East of the zero line we would have added that amount to the dial reading which is "Westerly".

For example: assume your bearing (from the map) is 100 degrees and the declination is 15 degrees East, you would DECREASE the reading by 15 degrees, by turning the dial to read 85 degrees. Contrarily, if the declination is 15 degrees West, you would INCREASE the reading of 100 degrees to read 115 degrees.
If you become confused as to whether to add or subtract declination remember these two little "aids": The first is "East Is Least" (which we are here), you must subtract the declination and "West is Best" so you add declination, ("East is Least — and West is Best"). The other is from our good friend LARS, what he said was if the magnetic North line is "left" of the True North line you add declination (LA), if the magnetic North line is "right" of the True North line you must subtract declination (RS). (here in Southern California magnetic North is "right" of True North so we subtract declination.) No need to get confused about this, you can either look at a map and read the declination or think in terms of "just where is magnetic North in relation to True North by looking toward the North and thinking it out".

SECTION F — How to take a bearing

A "bearing" means the direction (the degree reading) from one object to another. One of those objects is usually YOU. To take a "bearing" means to determine the direction from one object to another.

1. From a map, bearings are taken as described in Section D. The "bearing" is the degree reading indicated at the index line.

2. Out on the terrain, bearings are taken as we described in Sections B and C.
3. While keeping the edge of the compass base plate on the landmark selected, turn the compass on the map until the meridian lines in the bottom of the dial are parallel with the meridian lines on the map and so that the orienting arrow points toward the map North.

4. Draw a line on the map along the edge of the compass, intersecting the landmark you have selected. Your location is somewhere along this line.

5. To establish your position along this line, you need at least one more bearing. Take a reading on your second landmark and follow through as you did with the first landmark. Where the lines cross is your location. Note: a third or fourth reading will narrow down your location even more.

Note: Using the method I have just given you will eliminate the "Backbearing" method of determining "Resection." If you do use the "backbearing" method of "finding yourself," remember that you must first determine the "backbearing" reading, and you must point the sight arrow from the landmark towards your location. We have removed one step in the method I just given to you above however either one works.

INTERSECTION - Where Is It?

The "intersection" is used to determine the location of an object on a map from readings taken in the field. The "intersection" is the method the Fire Lookouts use in determining the location of a fire. You can use the "intersection" to plot on a map "anything" as long as it can be seen from at least two locations, and can be found on the map you are going to use. Here is the procedure:

1. From the first location, take a bearing on the object which you want to plot on the map.

2. Adjust for declination

3. Use your compass or protractor to plot this bearing on the map.

4. Draw a line from your location beyond the point where you think the object or location lies.

5. Move down the road to the "second" location and repeat the process.

6. A third and maybe a fourth location will help home in on the location

7. The object or location is located where the individual lines cross.

Note: This is very helpful in locating distant landmarks during the daylight hours and in finding a spotfire or lightning strike which is visible at night (using "intersection" you don't have to wait till daylight to find the location)
SECTION G - Declination Adjustment

To adjust field bearings for declination, first take your "bearing" in the normal manner. When you have that bearing, observe the degree reading on the index line. WE ARE TAKING A FIELD BEARING AND PUTTING IT ON A MAP.

Then to adjust for declination, we must "increase" the dial reading if we are "Easterly".

Example: assume your field bearing is 100 degrees, if the declination is 15 degrees East we must INCREASE by 15 degrees coming up with a reading 115 degrees. This reading can then be transferred to the map with accurate results.

Note: "once more" if you use a bearing FROM MAP TO FIELD you DECREASE your reading, if you plot a FIELD BEARING on a map you INCREASE your reading.

SECTION H - Plotting Locations on a Map

One good use of a compass is plotting onto a map your location map by using known landmarks for triangulation, this is known as a RESECTION, or "Where AM I?"

As a practical illustration assume you want to plot on a map the spot you are standing, (your exact location is unknown to you). Your first job is to find at least two landmarks on the map which you can identify on the ground. Once the landmarks are identified you can then take cross bearings. Proceed as follows:

1. Take a bearing on one of the landmarks, adjust for declination, (do not disturb dial setting while doing steps 2, 3, and 4).

2. Put the compass on the map so that either side of the base plate intersects the landmark sighted on.

Your exact position is where the two lines cross.
PROTRACTOR - Its Use In Map Work

The protractor is used to lay out compass bearings on a map.

The best type to use has the full 360 degree azimuth circle.

Using The Protractor

1. Draw a line from the initial point to the object or location that the bearing will be taken on.

2. Set the protractor so that the 360 - 180 degree line is on a North South line on the map.

3. Place the center mark of the protractor on the initial point (Usually your location) on the map.

4. The compass degree is read where the line you have drawn on the map intersects with the outer ring of the protractor.

5. This is a "true" North reading, remember to convert (subtract declination if it being used in the field).

ORIENTING THE MAP - Topographic Orientation

1. Find your approximate location on the map

2. Select two prominent landmarks visible to you as shown on the map.

3. Turn the map until the map landmarks are in proper relation to the actual landmarks.

4. The map is now oriented generally to True North. This is referred to as terrain association.

5. When the hood of a vehicle is used for holding a map, this method must be used as the compass can not be used.

Compass Orientation

1. True North is approx. 15 degrees WEST of magnetic north.

2. We can't move magnetic north nor can we move the terrain so we must move the map.
3. If we rotate the map 15 degrees West, the map is then oriented to the terrain, or True North.

4. The easiest way of doing this is to SUBTRACT the 15 degrees from 360 degrees (360 degrees minus 15 degrees gives us 285 degrees) which is placed on the index line. Place the edge of the compass along the North - South margin and line up the index arrow with the North arrow and the map is oriented to True North.