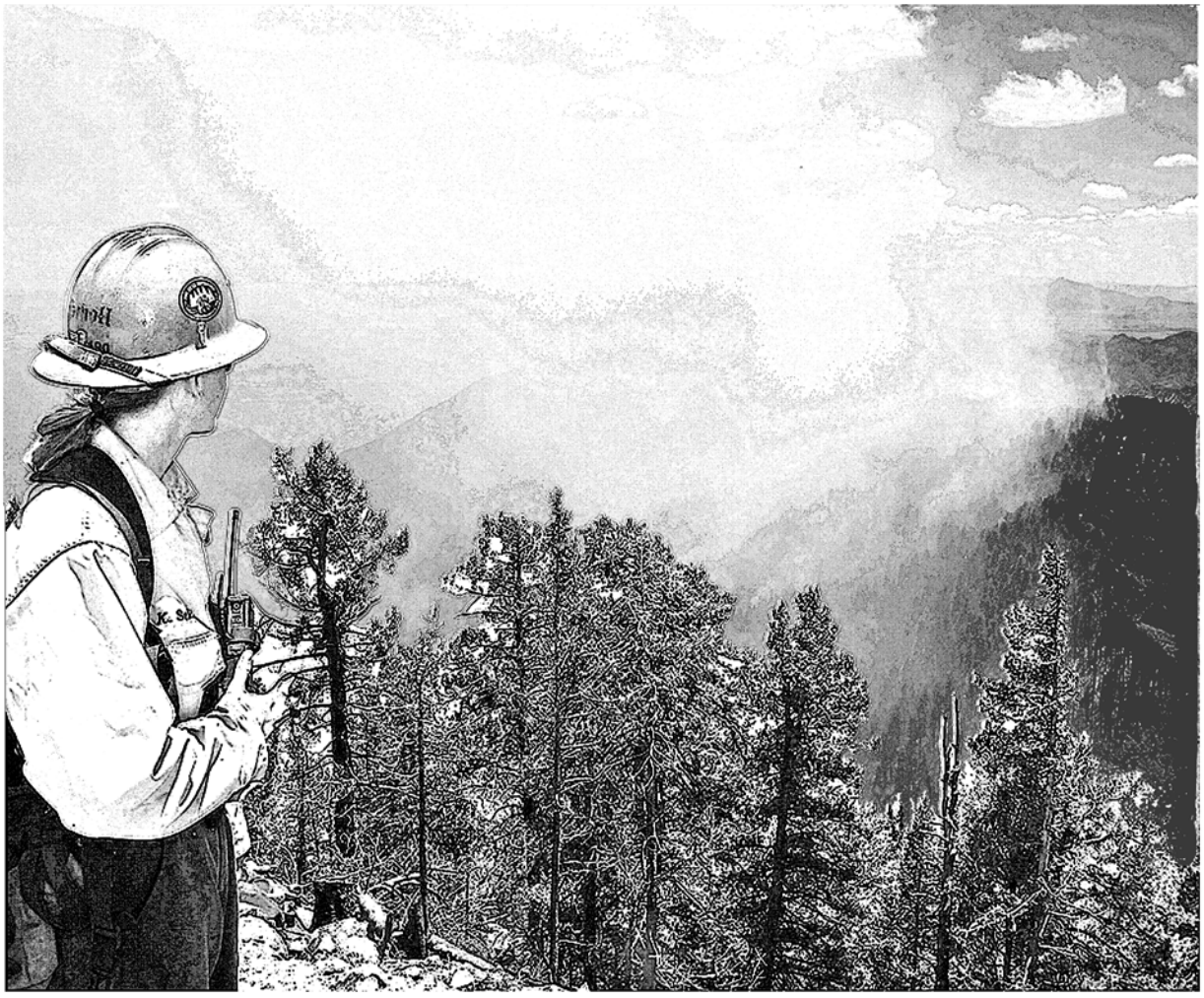
Field Observer
S-244



NFES 2960

Instructor Guide
JULY 2007

CERTIFICATION STATEMENT

on behalf of the

NATIONAL WILDFIRE COORDINATING GROUP

The following training material attains the standards prescribed for courses developed under the interagency curriculum established and coordinated by the National Wildfire Coordinating Group. The instruction is certified for interagency use and is known as:

Field Observer, S-244
Certified at Level I

This product is part of an established NWCG curriculum. It meets the COURSE DEVELOPMENT AND FORMAT STANDARDS – Sixth Edition, 2003 and has received a technical review and a professional edit.

Member NWCG and Training Working Team Liaison

Date 7-15-07

Chairperson, Training Working Team

Date 7/12/07

Field Observer
S-244

Student Workbook
JULY 2007
NFES 2961

Sponsored for NWCG publication by the NWCG Training Working Team.

Comments regarding the content of this publication should be directed to:
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PREFACE

Field Observer, S-244, is a suggested training course in the National Wildfire Coordinating Group (NWCG), wildland and prescribed fire curriculum. It was developed by an interagency group of experts with guidance from NWCG Training under authority of the NWCG. The primary participants in this development effort were:

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NWCG Development Unit
NWCG Standards Unit
NWCG Instructional Media Unit

NWCG appreciates the efforts of these personnel and all those who have contributed to the development of this training product.

CONTENTS

Field Observer, S-244

Unit 0 – Introduction

OBJECTIVES:

During this unit the instructor will:

1. Facilitate the introduction of course instructors and students.
2. Discuss administrative information.
3. Present overview of course.
4. Review pre-course work.

0.2

I. INTRODUCTIONS

- Have you ever worked in the Planning Section or fire use organization?
- Do you want to become a Field Observer (FOBS) or a Fire Effects Monitor (FEMO)? Why?
- What type of GPS receiver did you bring? How comfortable are you with using the receiver?

II. ADMINISTRATIVE INFORMATION

A. General Announcements

B. Course Materials

- Student Workbook
- Basic Land Navigation
- Fireline Handbook
- Incident Response Pocket Guide
- Field clothes with PPE
- Supplies
  - Compass with adjustment for magnetic declination
  - Clinometer (if not in compass)
  - GPS receiver and download cable
  - Belt weather kit
  - Colored pencils and markers
  - Engineer's ruler
  - UTM grid
  - Day pack for field exercise

III. COURSE OVERVIEW

This course was developed based on the tasks in the FOBS and FEMO position task books (PTBs).

- FEMO has several other tasks that are not related to FOBS, and those tasks are addressed in other courses.
- FOBS and FEMO have different qualifications.

A. Course Objective

Students will demonstrate skills and knowledge to gather and report information for incident planning.

B. Unit Overview

- Unit 0 – Introduction
- Unit 1 – Roles and Responsibilities
- Unit 2 – Observing and Documenting
- Unit 3 – Mapping
- Unit 4 – Navigation
- Final Field Exercise

C. Instructional Methods

- Short lectures/facilitation with digital presentations
- Discussion and brainstorming
- Several exercises – classroom and in the field

D. Measuring Student Performance

- No unit quizzes
- Final exercise

  Eight hour field exercise where students will produce a field map, notes and GPS data, and take a written exam.

- Criteria for passing the course

  Students must achieve 70% or higher on the final exercise.

0.6

Field Observer, S-244

Unit 1 – Roles and Responsibilities

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Define the roles of the Field Observer or Fire Effects Monitor within the Incident Command System (ICS).

2. Demonstrate the responsibilities of the Field Observer or Fire Effects Monitor.

I. FIELD OBSERVER'S ROLE IN THE INCIDENT COMMAND SYSTEM

A. Gathers Intelligence

1. Collects incident status information (such as weather and fire behavior) from personal observations and provides this information to the situation unit leader (SITL), operations section chief, or other personnel as appropriate.

2. Tasks may change as incident progresses.

   For example, as incident is ramping up FOBS is providing field maps and then as incident is winding down task changes to gathering intelligence for rehabilitation.

3. "Observer" role – not fighting fire.

   - Working as a FOBS is very different from working in the Operations Section.

   - When in the field, FOBS either work alone or in pairs.

B. Works in the Planning Section

1. Responsibilities and organizational chart

   - Planning Section
   - Situation Unit
     – Situation unit leader is FOBS supervisor.
     – FOBS works with other positions in the Situation Unit, Operations Section and Logistics Section.

2. FOBS gathers intelligence to assist the Situation Unit with developing:

   - Incident maps
   - Incident Status Summary (ICS-209)
   - Other products

3. Planning cycle

   The planning cycle is a general guideline; deadlines vary on every incident.

II. FIRE EFFECTS MONITOR'S ROLE IN THE INCIDENT COMMAND SYSTEM

A. Gathers Intelligence

Collects on-site weather, fire behavior, and fire effects information to assess whether the fire is achieving established resource management objectives.

B. Works in Fire Use Organization

- Responsibilities and organizational chart.
- Burn boss or fire use manager is FEMO's supervisor.

III. FOBS/FEMO RESPONSIBILITIES

This section is an overview of general responsibilities. Some of these responsibilities are discussed in more detail in the following units.

A. Assemble Kit

1. Required items

- Fireline Handbook (FHB)
- Incident Response Pocket Guide (IRPG)
- Belt weather kit
- Ruler/scale
- Calculator
- GPS receiver with download cable
- Compass/clinometer
- Flagging (including hazard)
- Colored pencils, pens, or highlighters

2. Nice to have items

- Binoculars
- Digital camera
- Phone
- Extra batteries
- Clipboard
- Paper
- Forms
  - Unit Logs (ICS-214)
  - General Message (ICS-213)
- Mylar (maps)
- Rain gear
- Extra food and water
- First aid kit
- Templates (for drawing maps)

B. Review Documents

1. Incident Action Plan - Field Observer

2. Burn Plan - Fire Effects Monitor

C. Receive Initial Briefing and Specific Assignment from Supervisor

1. IRPG Briefing Checklist

- Refer to IRPG Briefing Checklist when receiving initial briefing.
- Ask questions if you don't understand something.
- May need to get a briefing from division supervisor.

2. Assignment instructions

- Assignment location
- Expectations for products (field maps and notes), observations needed, and other tasks
- Priorities
- Schedule and deadlines
  - Find out when your supervisor expects you back in camp from the field.
  - Don't be late.

D. Maintain Personal Safety

Working alone increases reliance on knowledge, experience, and situational awareness to maintain personal safety.

1. PPE – ground and flight

2. Risk management process

3. Check in/out and obtain briefing with various operational personnel during shift (division/group, branch, burn boss).

E. Obtain Transportation, Equipment, and Supplies Using Standard Ordering Process

Consult with supervisor on ordering process for transportation, equipment and supplies.

1. Transportation

Different types of transportation methods that you may use include:

- Foot
- Vehicular
- Aerial (fixed-wing, rotary)
- Boat

2. Equipment and supplies

Determine what equipment and supplies are needed.

F. Gather and Provide Intelligence to Supervisor or Others as Appropriate

1. Provide field maps, field notes, GPS data, digital photos and other information.

2. Debrief via face-to-face, radio, phone, or other method.

3. Immediately report hazardous conditions.

G. Documentation

Consult with supervisor on documentation requirements for the following:

- Field maps and notes
- Forms such as Unit Log (ICS-214) and weather observation form
- Digital photos
- GPS data

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Unit 2 – Observing and Documenting

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Demonstrate the ability to observe and document fire behavior factors.

2. Demonstrate the ability to observe, document, and immediately report extreme fire behavior.

3. Demonstrate the ability to observe and document operational and logistical factors.

I. INTRODUCTION

A. Types of Observations

This unit discusses types of observations and tasks that a FOBS or FEMO may be assigned, for example:

What types of observations would a FOBS or FEMO be making?

B. Document Observations

There are different methods for documenting observations, for example:

1. Draw field maps (this is discussed in Unit 3)

2. Take notes

    - It is essential to take notes – do not rely on your memory.

- Notes should include:
  - Descriptions of observations, such as fuel types, spread rates, weather, and safety zones.
  - Designations/names used on field map and in GPS receiver, for example DP#1 = drop point #1.
  - Description of items mapped, such as capabilities and limitations of a potential water source.
  - Description of digital photos, including location of where photo was taken.
  - Name of person who wrote the notes and when it was collected (date and hours).
- Use one of the following for recording notes:
  - Unit Log (ICS-214)
  - Form designed specifically for taking field notes.
  - Anything that you can write on.
- Notes should be legible.

3. Use a GPS receiver (this is discussed in Unit 3)

4. Take digital photos of observations, for example:

   - Structures at risk
   - Hazards
   - Resources
   - People
   - Fuels

   Record date and time photo was taken.

C. Debrief

1. When you come in from the field you will debrief with your supervisor. Operations personnel may also be part of the debriefing.

2. Work with geographic information system specialist (GISS) to download GPS data.

D. Common Terminology

1. It is critical that you use common terminology so everyone understands what is being said.

2. Refer to the NWCG Glossary of Wildland Fire Terminology (http://www.nwcg.gov).

II. FUEL CONDITIONS

As a FOBS or FEMO you must be familiar with fuel models.

A. Fire Behavior Prediction System

1. Fuels are classified according to type of fuel carrying the fire.

2. Fuel models.

B. References

References you can use to determine fuel models include:

1. Fireline Handbook, Appendix B (Fire Behavior).

2. Other references, as appropriate.

III. TOPOGRAPHIC CONDITIONS

Some of the topographic conditions you may need to document include:

A. Slope

Percent slope = rise/run x 100

1. Topographic map

   To estimate the percent slope between two points on a topographic map:

   - Determine elevation of the two points and subtract one from the other – this is the rise.
   - Use a ruler to measure the run between the two points – be careful of units (inches, feet).
   - Plug numbers into formula.

2. Clinometer (refer to Unit 4 for information on how to use a clinometer to determine slope)

B. Aspect

On a topographic map, use index contour lines and the north arrow to determine which direction the slope is facing.

C. Elevation

Use a topographic map or GPS receiver to determine elevation.

D. Terrain Features

Examples of terrain features to pay attention to include:

- Chutes and box canyons
- Saddles
- Narrow canyons
- Ridges
- Intersecting drainages

EXERCISE: Topography

Overview: Students will estimate slope and identify aspect, elevation, and other topographic features on a topographic map.

Instructions:

Use the topographic map 02-01-S244-HO to answer the following questions:

1. Calculate slope between A and B.

2. What is the aspect at A?

Use the topographic map 02-02-S244-HO to answer the following questions:

3. Name the topographic feature at C:_____

4. Name the topographic feature at D:_____

5. Name the topographic feature at E:_____

IV. WEATHER CONDITIONS

Weather is constantly changing and it needs to be constantly monitored and documented.

A. Taking and Recording Weather Conditions

1. Use the belt weather kit or other equipment as appropriate.

2. Select a location to take weather conditions.

   – Location needs to be representative of the terrain and fuel types of the incident.

   – If you change location use a new observation form.

3. Determine how often to take recordings.

   – Consult with supervisor.

   – If weather is changing, take readings more often.

4. Record weather observations on a form or in your notes.

5. Immediately report weather conditions that could be hazardous.

6. If you use a radio or phone to transmit weather conditions record the time in your notes.

B. Monitor Weather Conditions

These are examples of weather conditions that need to be monitored:

1. Temperature

2. Relative humidity

3. Wind

4. Unstable atmospheric indicators

   - An unstable atmosphere enhances or encourages the vertical movement of air and is most often associated with critical or extreme wildland fire behavior.

   - Indicators of an unstable atmosphere include:

V. FIRE BEHAVIOR CONDITIONS

A. Fire Behavior Characteristics

A fire builds toward problem fire behavior in observable stages.

1. Smoldering

   Fire with no flame and barely spreading.

2. Creeping

   Fire burning with a low flame and spreading slowly.

3. Running

   Behavior of a fire spreading rapidly with a well defined head.

4. Torching

   The burning of the foliage of a single tree or small group of trees, from the bottom up.

5. Crowning

   A fire that advances from top to top of trees or shrubs more or less independent of a surface fire.

B. Fire Spread

1. Types

- Head fire

  The most rapidly spreading portion of a fire's perimeter, usually to the leeward or up slope.

- Flanking or lateral fire

  Rate of spread and intensity of a fire usually falling somewhere in between advancing and backing with spread lateral to the main direction of fire travel.

- Backing fire

  Fire spreading, or ignited to spread, into (against) the wind or down slopes. A fire spreading on level ground in the absence of wind.

2. Rate of Spread (ROS)

FOBS and FEMOS often have to calculate the rate of spread, which is the relative activity of a fire in extending its horizontal dimensions.

- Usually measured at head and on flanks using chains per hours or acres per hour for a specific period in the fire's history.

- Common methods for calculating rate of spread.

  – Rate of spread tables
  – Nomograms
  – Behave Plus software
  – Other new methods

C. Flame Length

- Determining flame length, which is an indicator of fire intensity, is also something FOBS and FEMOs may need to do.

- Flame length is the distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface).

D. Smoke Characteristics

Smoke characteristics that should be monitored include:

1. Plume-dominated fire

   - A plume dominated fire occurs when the power of the fire becomes stronger than the power of the local winds.

   - Such fires are extremely unpredictable, spread in various directions simultaneously, and exhibit extreme fire behavior.

2. Vertical development

3. Sheared column

4. Leaning column

   A leaning column is typical of a wind-driven fire.

5. Changing column

   When the color of the column changes from light to dark or when the column starts to rotate faster, it means the fire intensity is building.

6. Color

E. Extreme Fire Behavior

Immediately report extreme fire behavior conditions to operations section and supervisor.

1. Spotting

Behavior of a fire producing sparks or embers that are carried by the wind and which start new fires beyond the zone of direct ignition by the main fire.

2. Passive crown fire

A fire in the crowns of trees in which trees or groups of trees torch, ignited by the passing front of the fire.

3. Active crown fire

A fire in which a solid flame develops in the crowns of trees, but the surface and crown phases advances as a linked unit dependent on each other.

4. Fire whirl

Spinning vortex column of ascending hot air and gasses rising from a fire and carrying aloft smoke, debris, and flame.

Fire whirls range in size from less than one foot to over 500 feet in diameter; and large fire whirls have the intensity of a tornado.

VI. OTHER OBSERVATIONS

The Operations, Logistics and other sections may ask the Situation Unit for non-fire behavior information, such as road conditions, water sources, and threatened resources.

EXERCISE: Other Observations

Overview: Students will work in groups to brainstorm other types of observations the FOBS or FEMO may be asked to make based on given scenarios.

Instructions: Each group will receive a scenario(s) with a question. In all the scenarios you are either a FOBS or a FEMO. Answer the question(s) and then report your answers back to the large group.

Scenarios:

Group 1: The current transportation map is poor quality. The SITL wants you to find out more about the access routes. What are examples of the types of things you would be looking for?

Group 2: The Operations Section is trying to identify some escape routes and safety zones. The SITL has asked you to check out some potential sites. What should you be looking for?

Group 3: The SITL asked you to identify potential fireline locations. What should you be looking for?

Group 4: Operations Section has asked for information on potential water sources. Your supervisor asks you to check it out. What should you be looking for?

Group 5: Logistics Section has contacted SITL because they need to set up a new camp. SITL asks you to visit the potential sites. What should you be looking for?

Group 6: SITL has asked you to locate threatened resources in an area where they fire may be headed. What are some examples of what you should be looking for?

This section discusses “other” observations, such as operational, logistical and all hazard observations, you may need to make.

A. Operational Observations

1. Travel access

Examples of factors to look for related to travel access include:

- Road conditions
- Ingress and egress
- Bridge and culvert limitations
- Parking
- Turn arounds (best turnarounds are spur roads) and switchbacks
- Grade
- Gates, livestock, ownership, speed limits, and so on.

2. Escape routes and safety zones

Factors that should be considered when looking for escape routes and safety zones include:

- Topography – such as slope and uneven terrain
- Access
- Proximity (fire edge and control lines)
- Size (large enough to support resources)
- Hazards

3. Fireline locations

You may be asked to make observations about line placement or even recommendations on where to place lines.

- Types
  - Completed / open line
  - Dozer line / hand line
  - Direct / indirect
  - Contingency lines
- Placement
  - Topography (ridgetop, midslope)
  - Barriers (natural or created)
  - Fire history (old fires, prescribed)
  - Fuel type changes

4. Water sources

- Types (hydrants, swimming pools, wells, lakes, rivers, swamps, streams)
- Ownership
- Operable
  - Volume/recharge ability
  - Deep enough
  - Free of obstruction
- Accessible (portable pumps, engines, water tenders, helicopters)
- Other considerations (threatened and endangered species, recreational users)

5. Helispots

- For specific information on helispots refer to:
  - Fireline Handbook
  - Incident Response Pocket Guide
  - Interagency Helicopter Operations Guide (IHOG)
- Factors to consider include:
  - Size and location
  - Approach and departure (prevailing wind, one-way, two-way)
  - Hazards (tall trees, power lines, slope)

6. Location of resources

   You may be given the assignment to find the location of certain resources (equipment, crews, and overhead).

7. Threatened resources

   You may be asked to find out if there are any threatened resources.

   - Natural and cultural
     - Timber
     - Watershed
     - Threatened/endangered species
     - Historical/archaeological sites
     - Native American sacred sites
   - Improvements
     - Home, cabins, campsites, and other structures
     - Fences
     - Communication sites
     - Power lines

8. Estimating acreage

   - Area = length x width
   - Dot grid
   - Comparing it to areas of known size (football field is 1 acre)

B. Logistical Observations

You may be asked to scout possible locations for incident facilities such as potential incident command post, spike camp, staging area and helibase. Factors to consider include:

1. Size – is it large enough to accommodate all the resources?

2. Access for vehicles and helicopters

3. Water availability

4. Communications (radios and phone)

5. Property ownership

6. Hazards

7. Avoid sensitive areas (riparian areas, wetlands)

8. Drop points (size, access)

C. All Hazards Observations

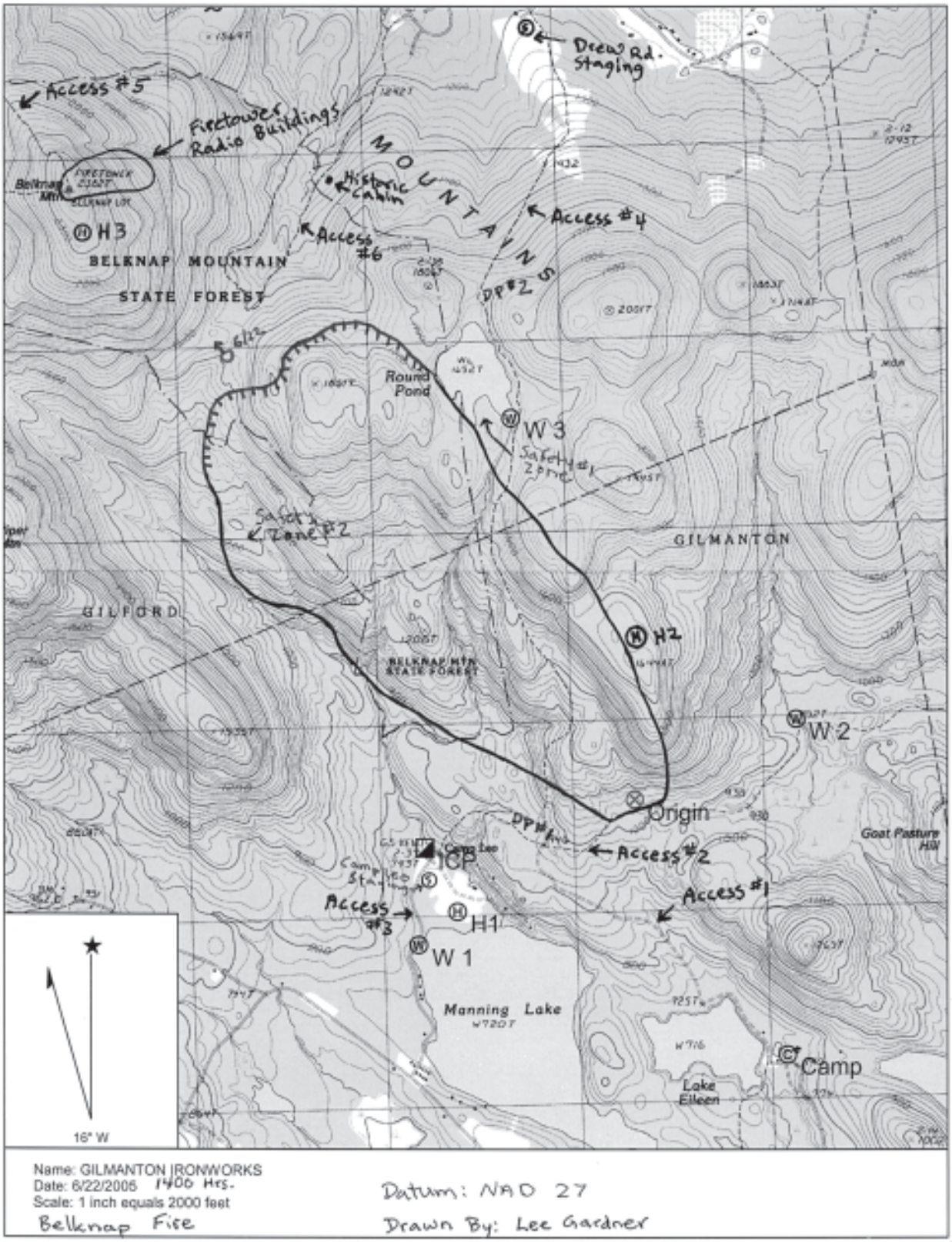
1. Types of all hazards incidents

   - Natural disasters (hurricanes, earthquakes, volcanoes, floods)

   - National emergencies (terrorism, hazmat)

2. Examples of possible observations

   - Damage assessment
   - Medical needs
   - Other


Drew Rd. Staging
Access #5
Firetower Radio Buildings
Historic Cabin
MOUNTAINS
Access #4
Access #6
H3
BELKNAP MOUNTAIN
STATE FOREST
DP#2
Round Pond
W3
Safety Zone #1
Safety Zone #2
GILMANTON
GILFORD
H2
W2
Origin
DP#1
Access #2
ICP
Goat Pasture Hill
Access #1
Access #3
H1
W1
Manning Lake
Camp
Lake Eileen
16° W
Name: GILMANTON IRONWORKS
Date: 6/22/2006 1400 Hrs.
Scale: 1 inch equals 2000 feet
Belknap Fire
Datum: NAD 27
Drawn By: Lee Gardner

FIRE NAME: Belknap Fire

MAP/GPS DESIGNATION	DESCRIPTION
Access #1 / A 1	Access capability for all Wildland Engines (T3-7)
Access #2 / A 2	Access capability for AWD Wildland Engines
Access #3 / A 3	Access capability for all Engines
Access #4 / A 4	Access capability for Types 5,6 & 7 Engines - AWD
Access #5 / A 5	Access capability by foot or ATV's only
Access #6 / A 6	Access by Types 5,6 & 7 Engines - AWD
◪ / ICP	Building (1500 sq. ft.) Restroom facilities
Ⓢ / S 1	Staging Area - Camp Leo - Flat open field
Ⓢ / S 2	Staging Area - End of Drew Rd. - Flat open field
Ⓦ / W 1	Manning Lake water source available to all Engines (Draft) Helicopter Dip Site.
Ⓦ / W 2	Water source available to all wildland engines and portable pumps
Ⓦ / W 3	Water Source available to Type 5,6 and 7 engines, port. pumps, Round Pond Dip site
Ⓗ / H 1	Helibase - Large open field
Ⓗ / H 2	Helispot - Good Landing area, Poor ground access
Ⓗ / H 3	Helispot - Landing area on rock outcrop (Type 3)
DP #1 / DP 1	At intersection of A1 and A2
DP #2 / DP 2	On Access #4 off Drew Road - Turnaround
Safety Zone #1 / Safe 1	Area of sparse fuels and Beach next to Round Pond. 1 crew capability Escape Route on fireline along pond
Safety Zone #2 / Safe 2	Burned over area. 2 crew capability. Best access from North of Safety Zone.
Fire Tower & Radio buildings	Fire Tower and communications site with many outbuildings
Historic Cabin	Designated historic site - 20x30 Cabin
⊗ / Origin	Area under investigation flagged off

DATA COLLECTED BY: Lee Gardner FOBS ON 06/22/05 AT 0900 - 1400 hrs.

FIRE NAME: Belknap Fire

MAP/GPS DESIGNATION	DESCRIPTION
5 / SF1	Spot Fire 10x20 @ 1300 hrs, spead rate 2 ch/hr. but near steep slope.
----- / FL 1	Start of Uncontroled fireline
----- / FL 2	End of Uncontroled fireline.
	General Observations:
	Fuel Types: Fuel Model 9 in valleys and lower slopes. Fuel Model 5 on higher slopes
	Spread Rates range from 2 ch/hr. with little slope to 5 ch./hr. on steep slopes. Very little spread in rocky areas with sparse fuels
	Safety / Hazards Many steep slopes with loose and rolling rocks and debris are a big concern.
	Fire Weather: See attached observation records

DATA COLLECTED BY: Lee Gardner FOBS ON 06/22/05 AT 1400 hrs.

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Unit 3 – Mapping

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Describe process to produce accurate, legible field maps and notes.

2. Demonstrate the ability to map from an aerial platform.

I. FIELD MAPS

Producing field maps (hand drawn and GPS) is one of the responsibilities of Field Observers and Fire Effects Monitors.

- The Situation Unit uses field maps to produce the Incident Action Plan map, Situation Unit map, and other incident maps.

- Communicate with supervisor to find out their expectations.

A. Standards

Standards help ensure field maps are of consistent quality and meet the needs of those who use them.

1. S.T.A.N.D.D.

- **S**cale
- **T**itle
- **A**uthor
- **N**orth arrow
- **D**ate and time
- **D**atum

2. Symbology

- The symbology standard helps ensure that maps are consistent and readable.

- Symbols must be defined in the legend.

3. Accuracy

This standard helps ensure information on the map is accurate.

4. Utility

This standard helps ensure that field maps:

- Contain the information needed
- Are legible
- Meet the needs of the Situation Unit, Operations, and other incident personnel as appropriate.

B. Locate Start Point

1. It is imperative that the first point you plot on the field map is accurate.

2. Examples of different ways to do this include:

- Plot your own position location. For example, use two known points to determine your location.
- Use a known point (such as a landmark) that is on the map and measure from this point.
- Use a GPS receiver.

C. Draw Features

Examples of features to draw on field maps often include:

- Perimeter
- Fireline types
- Hazards
- Roads
- Water sources
- Spot fires
- Escape routes, safety zone
- Natural barriers
- Hotspots
- Facilities/improvements
- Structures

Remember to write descriptions of items mapped in field notes.

D. Map Management

1. Keep maps small, dry and protected.

2. Systematically fold maps.

3. Take adjoining maps in case of unexpected fire growth or spot fires.

4. Map management is imperative when mapping from an aircraft. This is discussed in more detail in a later section.

II. MAPPING WITH GPS

There are numerous types of GPS receivers and they all work differently; however, some general guidelines to follow include:

A. Start-up Checklist

Each time you use a GPS receiver, you need to input information such as:

1. Position format units
2. Map datum
3. Distance units
4. Elevation units
5. North reference
6. Time format and time zone

B. Determine Memory Capacity

C. Clear Track Log

D. Set the Record Mode

1. Set record mode to distance, time, or auto and set interval values (for example .10 miles and .01 miles every 20 seconds or a normal setting).

2. If interval is set to **time**, the GPS receiver will continue to record even if you have stopped moving which can cause problems later on.

3. Do not set record mode to wrap because if the memory exceeds capacity the GPS receiver will overwrite existing track points.

E. Start and Record New Track

1. Do not back track where you have already recorded data. This will cause problems when the data is downloaded.

2. Do not turn GPS off to stop recording a track; go to Track setup and switch the Record Mode to off. This will help avoid collection of unnecessary track points when the GPS is turned back on.

3. Start new track logs for different areas.

F. Name and Save Track Log

If you have exceeded the memory capacity of the GPS receiver do not save the active track to the track log; this will average the points down to the GPS units' capacity and ruin the accuracy.

G. Name and Save Waypoints

1. Use short descriptive designations because long names can be hard to read when they are downloaded.

2. Examples of names include:

   - D1, D2, D3 for different dozer lines
   - HL1, HL2, HL3 for different hand lines
   - DP1, DP2, DP3 for different drop points
   - H1, H2, H3 for different helispots
   - A1, A2, A3 for different access points

3. Include a description of each waypoint in your notes.

H. Check Datum

Make sure the datum set in the GPS unit matches the datum of the map you are using.

I. Download Data

Work with supervisor or geographic information system specialist (GISS) to download data.

J. Take Notes

Remember to explain designations or names in your notes; also any other helpful information.

III. PLOTTING POINTS USING LATITUDE/ LONGITUDE

There are many ways to plot points on a map using latitude/longitude. This section describes one of those methods. You can use this same method to determine the coordinates of a point.

To plot latitude/longitude it is important to know:

- How to count minutes and seconds on a topographic map.
- How to use a 20 scale engineer's ruler.

In this course we use an engineer's ruler with 20 graduations per inch. Each graduation is equal to 1 second on 1:24,000 scale map.

This section will describe how to plot the following latitude/longitude coordinate: 43º – 08' – 23" N 71º – 42' – 46" W

A. Plotting Latitude 43º – 08' – 23" N

Note: The term “given coordinate” means the coordinate that is being plotted.

1. Step 1

   On the right or left margin of the map find the latitude lines that are identified with tick marks.

2. Step 2

   - Identify the first latitude tick-mark that is south of the given latitude coordinate.
   - Determine how many minutes and/or seconds the southern latitude line is from the given latitude coordinate (subtract the southern latitude line coordinate from the given coordinate). This is called the “difference.”

3. Step 3

   - Verify that the scale on the ruler matches the map scale.
   - When measuring latitude orient the ruler north to south; place the ruler with the “0” on the southern latitude line.
   - Measure the “difference” (as determined in step 2) on the ruler and mark this point.
   - Repeat this on the other side of the map.

4. Step 4

   - Draw a line connecting the latitude marks.
   - This line represents the latitude line 43º – 08' – 23" N.

B. Plotting Longitude 71º – 42' – 46" W

1. Step 1

   - On the bottom of the map find the longitude lines that are identified with tick marks.

2. Step 2

   - Identify the first longitude line that is east of the given longitude coordinate.

   - You may want to draw this line on the map.

   - Determine how many minutes and/or sections the eastern longitude line is from the given longitude coordinate; subtract the eastern longitude line coordinate from the given coordinate. This is referred to as the "difference."

3. Step 3

   - Verify that the scale on the ruler matches the map scale.

   - Orient the ruler on a diagonal because longitude lines may not be 1 minute apart.

   - Place the ruler with the "0" on the eastern longitude line and place the "15" (which represents 150 seconds = 2.5 minutes) on the western longitude line that is 2.5 minutes from the eastern longitude line.

   - Slide ruler vertically (keeping the "0" and the "15" graduation marks on their respective longitude line until the "difference (as measure on the ruler) lines up with the previously drawn latitude line.

   - Mark this point – it represents the latitude and longitude coordinate.

IV. PLOTTING POINTS USING UNIVERSAL TRANSVERSE MERCATOR (UTM)

There are different methods for plotting points on a map using UTM coordinates. This section describes one of those methods. This method can also be used to determine the coordinates of a point.

A. Use a UTM Grid Reader to Plot Points

1. There are many different types of grid readers and they all work differently.

2. This course uses a 1:24,000 UTM grid; each mark is 100 meters.

    - Numbers on the right are used to determine the northing coordinate location.

    - Numbers on the top are used to determine the easting coordinate location.

    - The point is plotted in the top right corner.

3. Make sure scale on grid reader matches scale on map.

4. If UTM grid lines are not on the topographic map, you will need to draw them to use the grid reader.

B. Plot UTM Coordinate: 19 3**26**470 E 48**19**800 N

1. Step 1

   - Find the northing and easting tick marks on the map.
   - Identify the UTM grid square where the given coordinate is located.

2. Step 2

   Place the grid reader in this grid square and slide the reader until:

   - The last three numbers of the easting coordinate (470) align on the north-south UTM coordinate (^{3}**26**).
   - The last three numbers of the northing coordinate (800) align on the east-west UTM coordinate (^{38}**19**).

3. Step 3

   Plot point of UTM coordinate in upper right corner of grid reader.

V. AERIAL MAPPING

A FOBS and FEMO will often have to collect intelligence from an aircraft.

- Mapping from the air is difficult; it takes a lot of practice.
- Find out supervisor's expectations; you may not get another chance to fly over the incident.

A. Advantages of Mapping from Aircraft

1. Best vantage point to see terrain features.

2. Covers a large area in a short time.

3. GPS and infrared equipment may be combined to accurately locate hot spots and perimeter.

    - Do not attach antennas or other equipment outside aircraft without proper approval.

4. Types of aircraft

    - Fixed-wing aircraft are good for mapping a very large fire or several small fires.
    - Aircraft with high wings provide the best visibility.
    - Helicopters are good for mapping any fire, especially in rugged terrain.

B. Disadvantages of Mapping from Aircraft

1. Difficulty staying oriented. To help stay oriented compare terrain features to a base map.

2. Vegetation and smoke can reduce visibility.

3. Terrain appears flatter. Foot travel times are often underestimated by aerial observers.

4. Limited work space.

5. Air sickness.

C. Factors to Discuss with Supervisor

1. Flight mission/purpose.

2. Type of aircraft for the mission.

3. Best flight pattern to achieve mission.

   - Flying outside the perimeter generally provides the best view and avoids other air traffic.

   - Turns should be made on the side of the aircraft where the FOBS or FEMO has the best visibility.

   - Speed and turn rate should be slow, especially when using handheld GPS equipment.

4. Process to request flight.

D. Pre-Flight Briefing

Obtain safety briefing from the pilot or helitack personnel; follow helicopter passenger briefing in the IRPG.

E. Safe Flight Procedures

1. Do not talk to pilot during take-off and landing.

2. Monitor all radio traffic and assist the pilot as appropriate. Know the frequencies being used.

3. Request clearance from pilot to use radios.

4. Always watch for other aircraft and hazards and report to pilot.

EXERCISE: Aerial Mapping

Overview: To gain experience with aerial mapping, students will sketch a map and estimate acreage based on an aerial simulation.

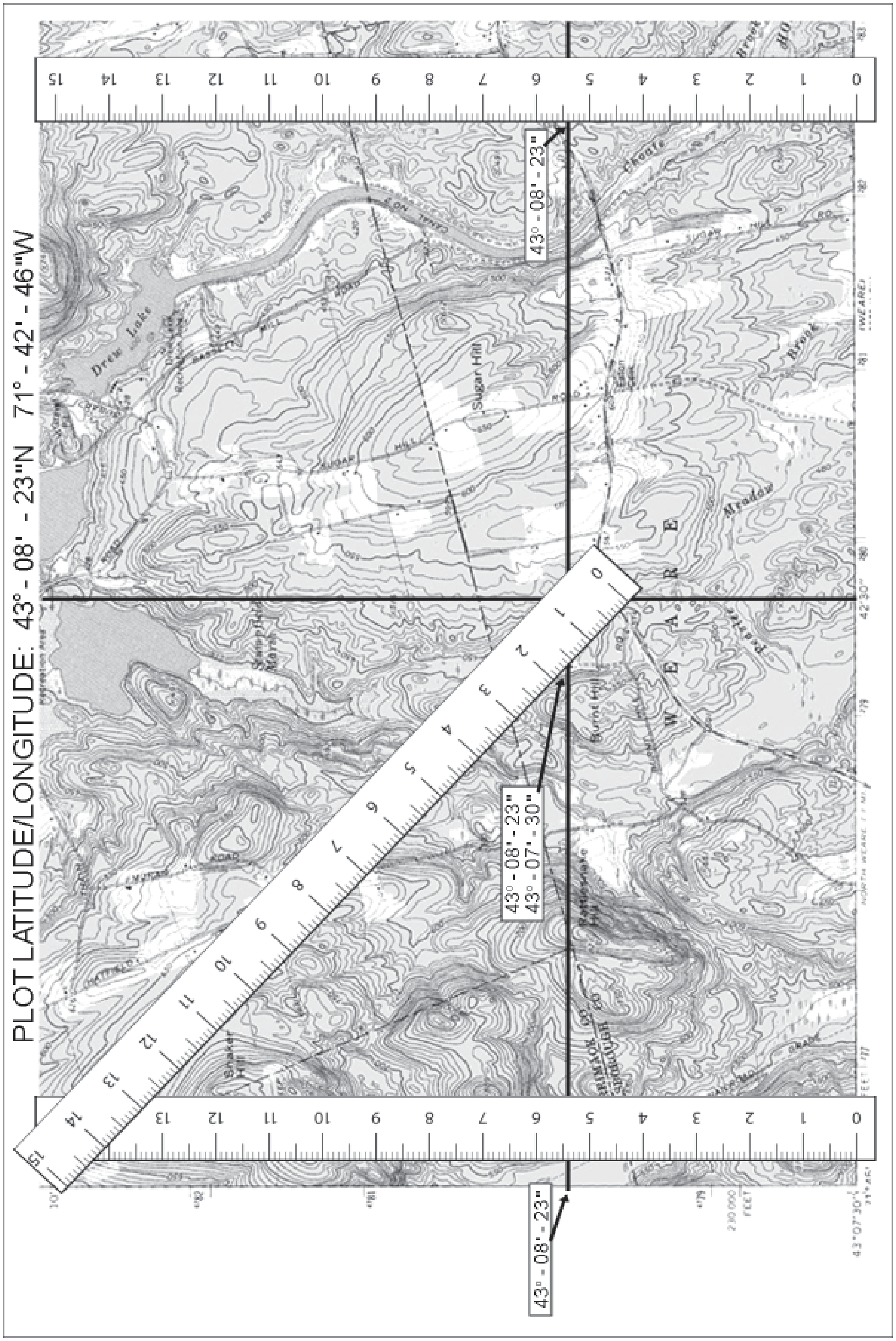
Instructions:

1. Read the following scenario:

   You arrive and check in at incident base camp in Idaho City, Idaho, at 1300 hours. There is a new fire about **one mile NW** of town. **The Situation Leader assigns you to fly the fire and bring back a field map of the fire perimeters and estimated acreage.** The field map will be used for the 1730 briefing. The SITL has arranged a flight. Flight is from an airstrip SW of Idaho City. You acquire the Idaho City quad map and go to the airfield SW of town and take the flight.

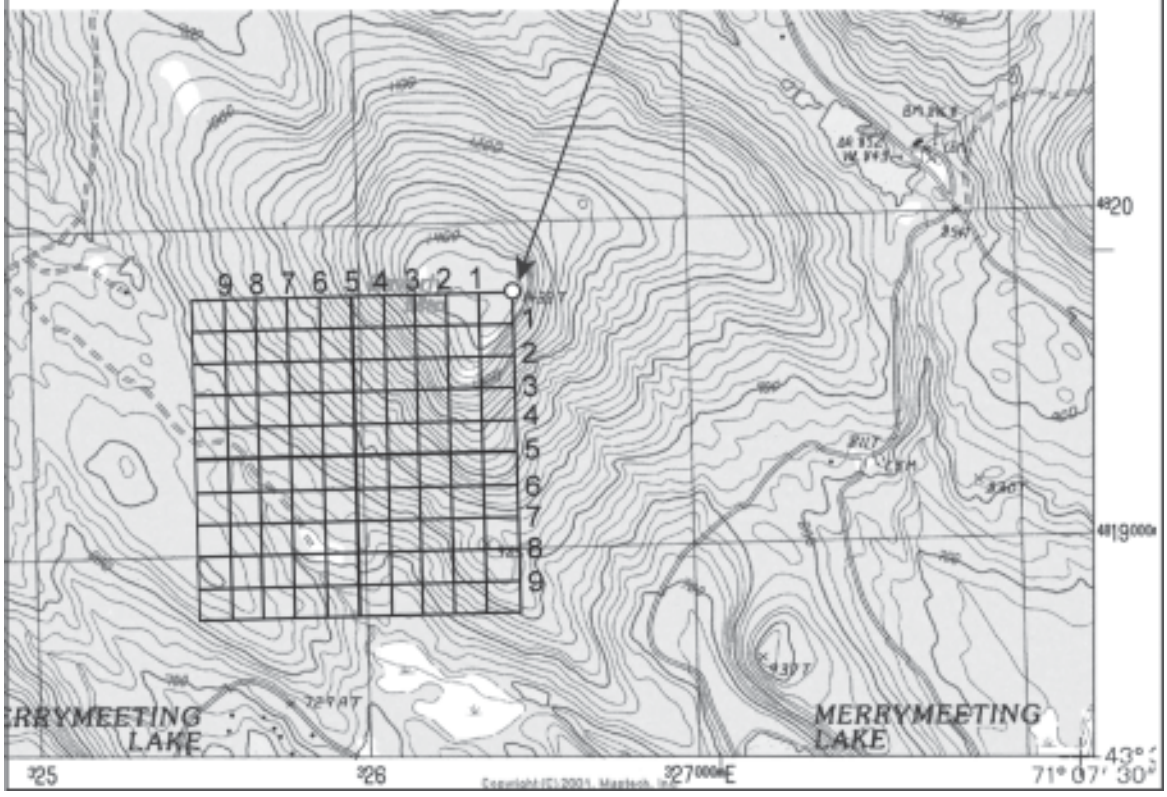
2. Take some time to review the scenario and map to get oriented before the simulation is played. Look for features on the map, such as ridges, road, rivers and airstrip.

3. Use a couple different methods to estimate acreage to help make sure it is correct.


PLOT LATITUDE/LONGITUDE: 43° - 08' - 23"N 71° - 42' - 46"W
43° - 08' - 23"
43° - 08' - 23"
43° - 07' - 30"
43° - 08' - 23"
Drew Lake
Sugar Hill
Meadow
Brook
Choate
Burnt Hill
Shaker Hill
W E A R E

(not to scale)

Plot UTM Point: Zone 19 326470 E 4819800 N



Field Observer, S-244

Unit 4 – Navigation

OBJECTIVES:

Upon completion of this unit, students will be able to:

1. Demonstrate the ability to navigate by pacing and using a compass.
2. Demonstrate the ability to navigate using a GPS receiver.
3. Demonstrate the ability to orient and interpret maps.
4. Demonstrate the ability to produce accurate, legible field maps and notes.

I. INTRODUCTION

A. Field Exercises

This unit consists of six field exercises that will help you apply what you learned in the pre-course work and in Units 1, 2 and 3.

B. Logistics

- Directions to field exercise site
- Timeframes
- Wear PPE
- Bring the following:

II. USING A COMPASS AND CLINOMETER

This section is a review of how to use a compass and clinometer.

A. Tips on Getting Accurate Compass Readings

- Hold compass level and steady so needle swings freely.
- Hold compass about waist high in front of the body, except when using a compass with a sighting mirror or a sighting type compass.
- Raise and lower eyes when taking a bearing, do not move your head. Always use the same eye when taking bearings.
- Directly face the object being measured.
- Avoid taking readings near magnetic fields.
- Take bearing twice.
- Adjust for magnetic declination as appropriate.
- Follow the direction of travel arrow, not the compass needle, when walking a bearing.
- When navigating, use back bearings to ensure you are on track.

B. Adjust Compass for Magnetic Declination

C. Orient a Compass to Magnetic North or Geographic North

D. Take Bearing (Direct and Back)

E. Following a Bearing

F. Estimating Slope with a Clinometer

III. PACING DISTANCE

EXERCISE: Pacing

Overview: For students to determine their own pace and to give them experience with estimating distance (within +/- 10 feet) by pacing on level and sloped ground.

Instructions: In this exercise you will determine your own pace and estimate a given distance (within +/- 10 feet) by pacing on level and sloped ground.

1. Determine your own pace using a 100 foot pacing course. Record your answer below:

   My pace is _____.

   To be successful in the remaining exercises and on the final it is essential that your pace is accurate.

2. Pace the course and estimate the distance. Answers should be within +/- 10 feet of actual measured distance. Record your answer below:

   Distance: _____ feet _____ chains

IV. USING A COMPASS AND GPS RECEIVER

EXERCISE: Determine Bearings and Distance

Overview: For students to have experience with determining bearings and distance on a marked triangular course using a compass, GPS receiver, and pacing.

Instructions: In this exercise you will obtain experience with determining bearings and distances on a marked triangular course using a compass, GPS receiver, and pacing.

1. Set your compass to zero declination and set GPS receiver to magnetic.

2. Traverse the course and determine the compass bearing and pacing distance for each leg of the course. Bearings should be within +/- 2 degrees and pacing distance should be within +/- 5 feet. Record your answers in the table below.

3. Traverse the course again and determine GPS bearings and distance. Bearings should be within +/- 2 degrees and pacing distance should be within +/- 5 feet. Record your answers in the table below.

LEG	COMPASS BEARING	DISTANCE as determined by pacing	GPS BEARING	DISTANCE as determined by GPS
A – B				
B – C				
C – A				

EXERCISE: Following Bearings and Determining Distances (Navigation)

Overview: Students will obtain navigation experience by following set bearings and distances (using a compass and GPS receiver and by pacing) on a 6 leg navigation course.

Instructions:

1. Navigate the six leg course that is described in the table below (an instructor will give you the bearings and distances).

2. Mark start point in GPS receiver and record and name each waypoint.

3. Using only a compass, navigate the first five legs of the course.

4. When you reach point 6, use the GPS "GOTO function" to determine GPS bearing and distance back to point 1 and record in the table below. Then take a compass bearing and pace the distance, record answers in the table.

5. Compare your GPS results with compass/pacing results and be prepared to discuss. Answers should be within +/- 3 degrees and +/- 15 feet of the actual bearing and distance.

Leg	Compass Bearing	Distance (feet)
1 – 2		
2 – 3		
3 – 4		
4 – 5		
5 – 6		

Leg	Compass Bearing	Pacing Distance	GPS Bearing	GPS Distance
6 – 1				

V. ORIENT AND INTERPRET MAPS

EXERCISE: Orient and Interpret Maps

Overview: Students will obtain experience orienting a map (using a compass and topographic features) and interpreting maps (locating map attributes such as topographic features, legend, grid systems, etc.).

Instructions:

1. Find your approximate location on the map.

2. Select two prominent topographical features or landmarks that are visible to you and shown on the map. Turn the map until the features on the map are in proper relation to the actual features in the field.

3. Adjust compass for declination. Rotate compass housing so north or 360 degrees is at the index line or direction of travel line on the compass. Place one side of the compass base plate along the right or left edge of the map. The direction-of-travel line must be toward the top of the map. Carefully rotate the map and compass together until the needle is aligned with orienting arrow.

VI. ESTIMATING SLOPE WITH A CLINOMETER

EXERCISE: Slope (using a clinometer)

Overview: Students will obtain experience with using a clinometer to determine slope.

Instructions: In this exercise you will use a clinometer to determine slope of designated sites (instructor will tell you which sites).

1. Stand so you are facing directly up or down the slope.

2. Hold clinometer vertically.

3. 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.

4. Align the horizontal band with this object. Read the appropriate scale in percent or degrees as indicated by the horizontal band. The intent is to measure slope, not the height of the object.

5. Record your answers in the table below:

Designated Site	Slope (degrees)	Slope (percent)

VII. FIELD MAPPING AND TAKING NOTES

EXERCISE: Producing Field Maps and Taking Notes

Overview: Students will produce a field map and notes by using a compass, GPS receiver, and pacing; they will also debrief with a supervisor.

Instructions: In this exercise you will obtain experience with field mapping and taking notes.

1. Produce a hand drawn field map using the following standards: S.T.A.N.D.D., ICS symbology, accuracy and utility standards.

2. Calculate acreage of fire.

3. Use GPS receiver to mark waypoints and record track log.

4. Produce written notes that will accompany the map and GPS data that explain descriptions of items mapped, general observations, GPS designations/names, and other relevant information.

5. Debrief with instructor who will role play as your supervisor.