Air & Ground Operations

Developed as part of the National Emergency Services Curriculum Project

Overview

- Air Operations – ICS Module 10
- Air Search Methodologies
- Ground Operations
- Ground Search Methodologies

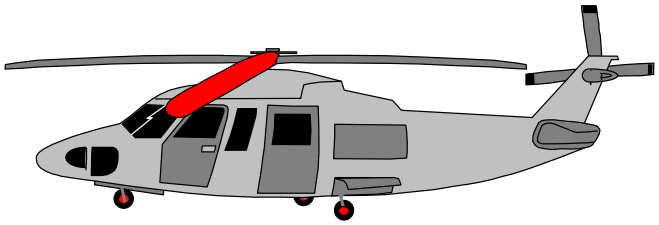
Air Operations

AIR OPERATIONS PRIMARY USES

- TACTICAL SUPPORT
- LOGISTICAL SUPPORT

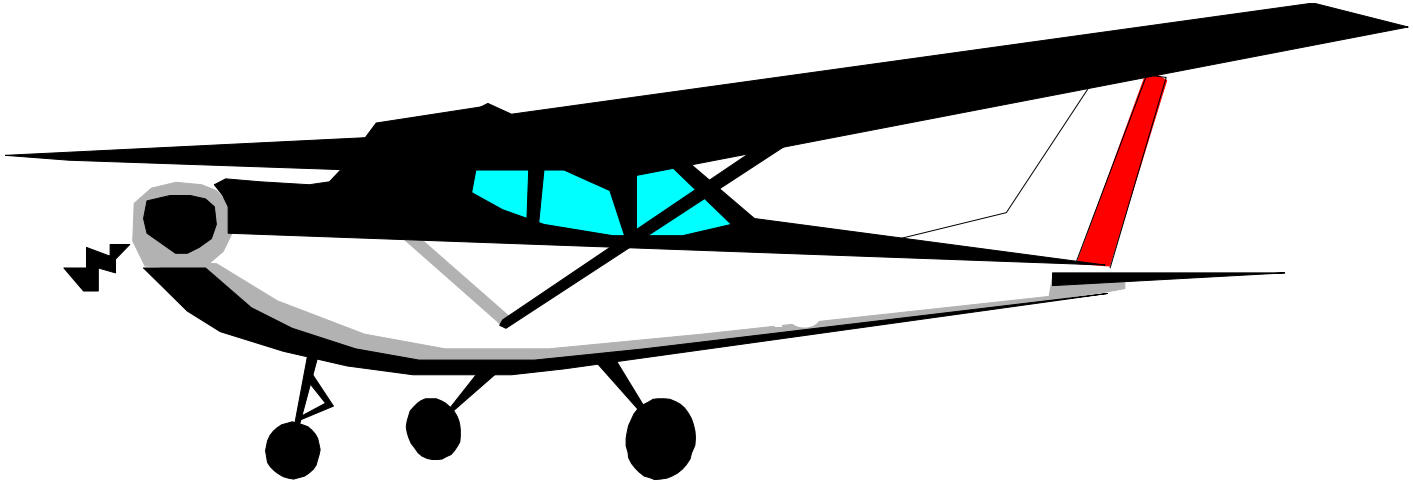
USES OF AIRCRAFT ON INCIDENTS

- SEARCH AND RESCUE
- EARTHQUAKES, FLOODS, ETC.
- LAW ENFORCEMENT
- FIRE CONTROL
- LAND MANAGEMENT PROGRAMS
- MARITIME INCIDENTS



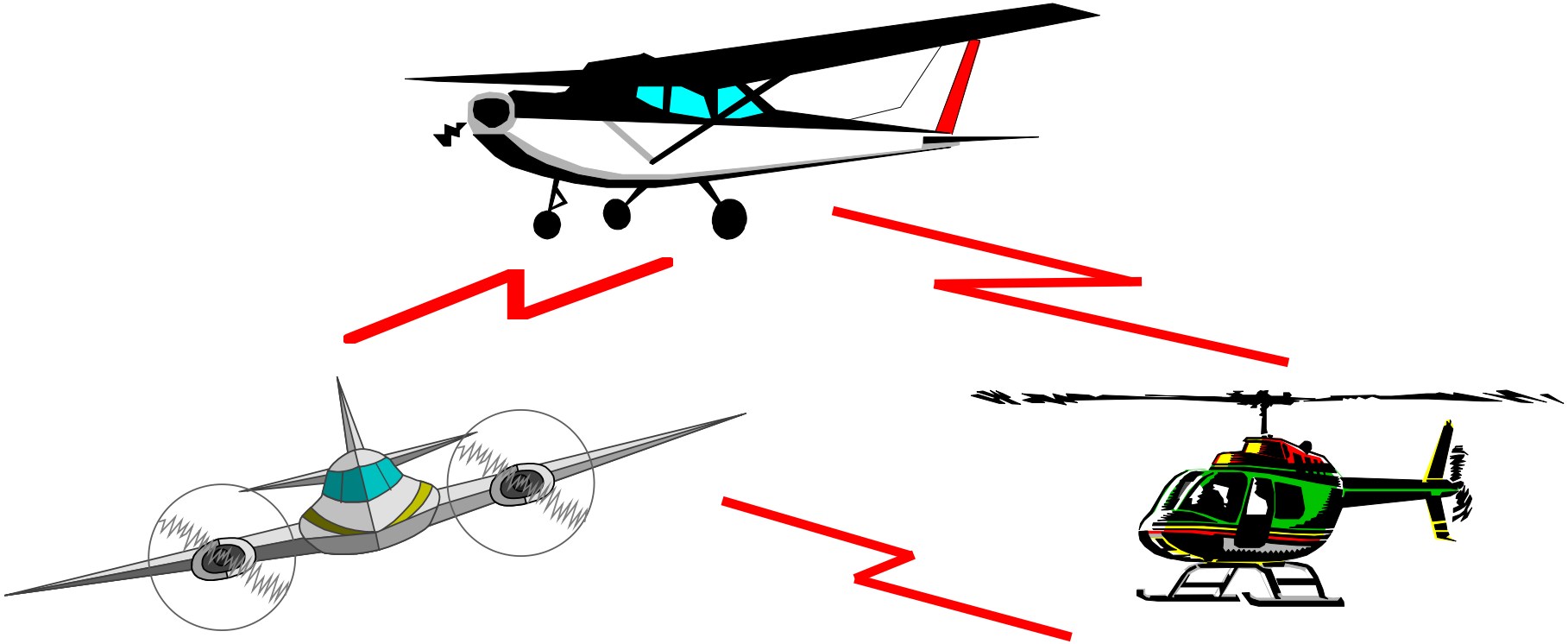
TEMPORARY FLIGHT RESTRICTIONS

AIR TACTICAL GROUP SUPERVISOR



IS AIRBORNE AND COORDINATES ALL AIRBORNE AIRCRAFT

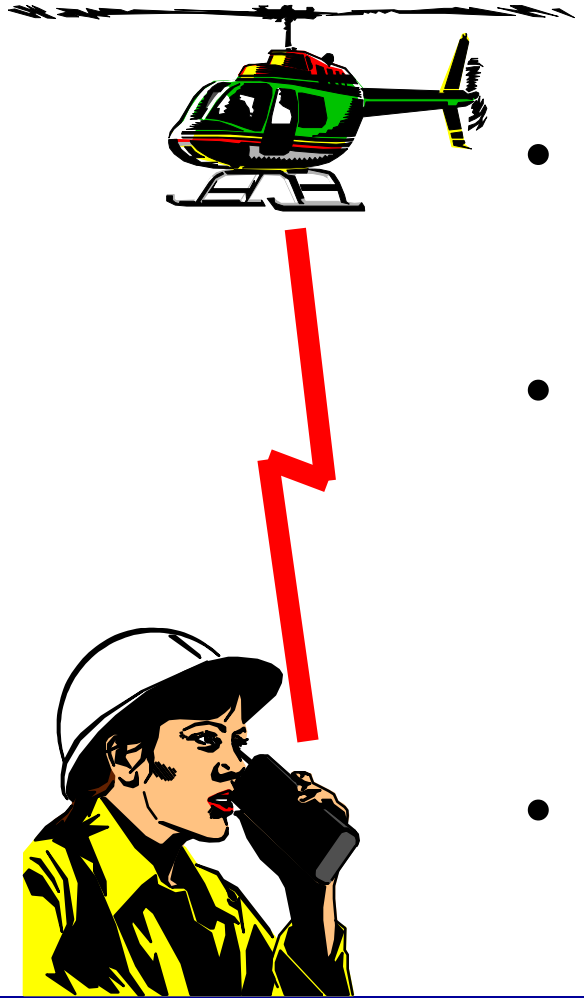
AIR TACTICAL GROUP SUPERVISOR



AIR TANKER / FIXED WING COORDINATOR

HELICOPTER COORDINATOR

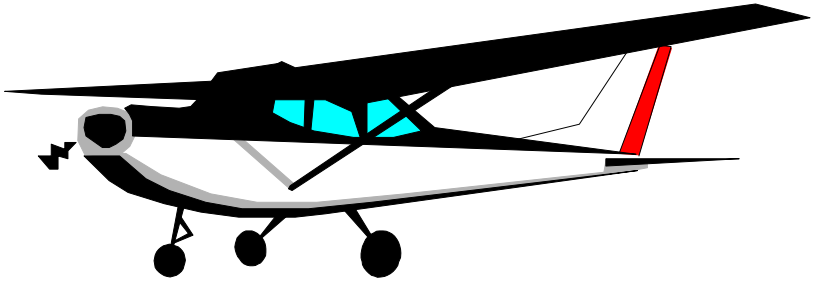
HELICOPTER COORDINATION



- CAN BE IN AIR OR ON GROUND
- COORDINATES ALL AIRBORNE HELICOPTERS (TACTICAL OR LOGISTICAL MISSIONS)
- REPORTS TO AIR TACTICAL GROUP SUPERVISOR

AIR TANKER / FIXED-WING COORDINATOR

- AIRBORNE POSITION
- COORDINATES AIRBORNE FIXED-WING AIRCRAFT
- REPORTS TO AIR TACTICAL GROUP SUPERVISOR



COORDINATION OF AIR OPERATIONS

AIR SUPPORT FUNCTIONS:

- PROVIDE FUEL & SUPPLIES
- MAINTAIN HELICOPTERS
- LOAD EQUIPMENT & RESOURCES
- MAINTAIN RECORDS
- ENFORCE SAFETY REGULATIONS
- AIRCRAFT PARKING

SELECTING HELIBASES & HELISPOTS

- SAFETY - MINIMUM OBSTRUCTIONS
- AWAY FROM RESIDENTIAL AREAS
- EXPANSION AND 24-HOUR OPERATION
- EASY GROUND ACCESS FOR FUEL & SUPPLIES

POSITIONS REPORTING TO A HELIBASE MANAGER

- DECK COORDINATOR
- LOADMASTER
- PARKING TENDER
- TAKEOFF/LANDING CONTROLLER
- RADIO OPERATOR
- TIMEKEEPER
- HELISPOTS

BREAK

Air Search Methodologies

Search Planning Guidance for use in General Aviation Missing Aircraft Searches in the Continental United States

Overview

- History and Purpose of the Study
- Current Methods
- Research Results
- Recommendations

History & Purpose of the Study

- 1000s of searches are conducted in the CONUS annually under the control of the AFRCC using a variety of resources, the majority of the time being CAP assets
- False alarms verses Actual Missions
- Proper use of valuable mission resources

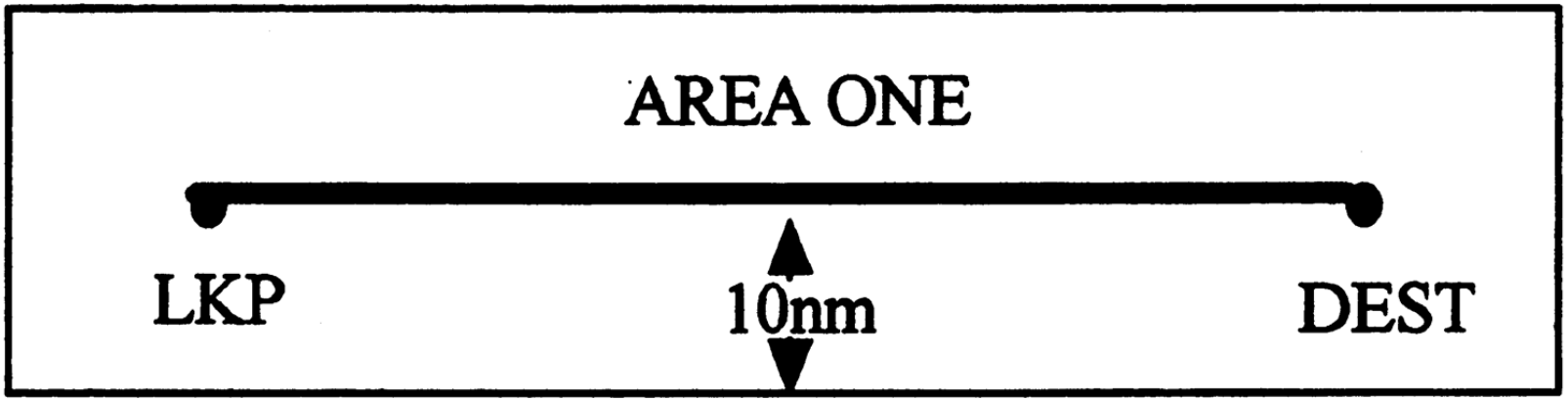
Current Methods

- Search planners are predominantly using the New Two-Area Method (NTAM) developed by the Canadian Department of National Defence's Directorate of Air Operational Research (DAOR)
- The NTAM is based on research of 76 missing aircraft missions conducted in Canada from 1981 to 1986

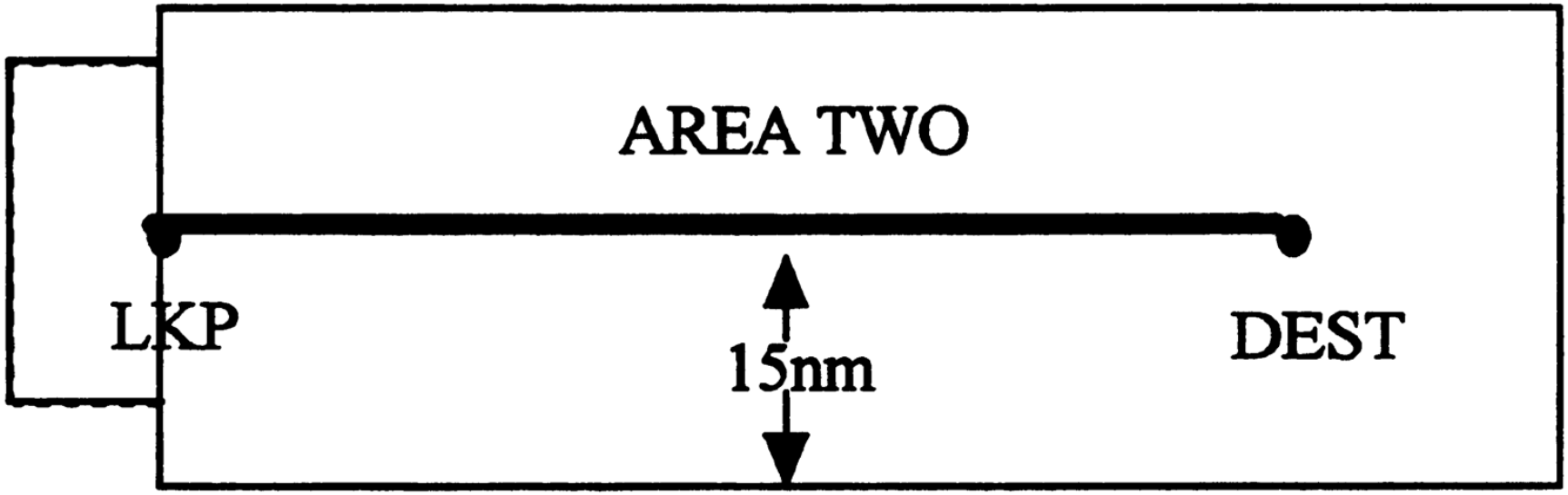
Current Methods Continued

- NTAM requires search planners to have the Last Known Position (LKP), the intended route of flight, and the intended destination of the missing aircraft
- Utilizing the above, two areas are defined for prioritizing the search
  - Area One – 10 Nautical Miles
  - Area Two – 15 Nautical Miles

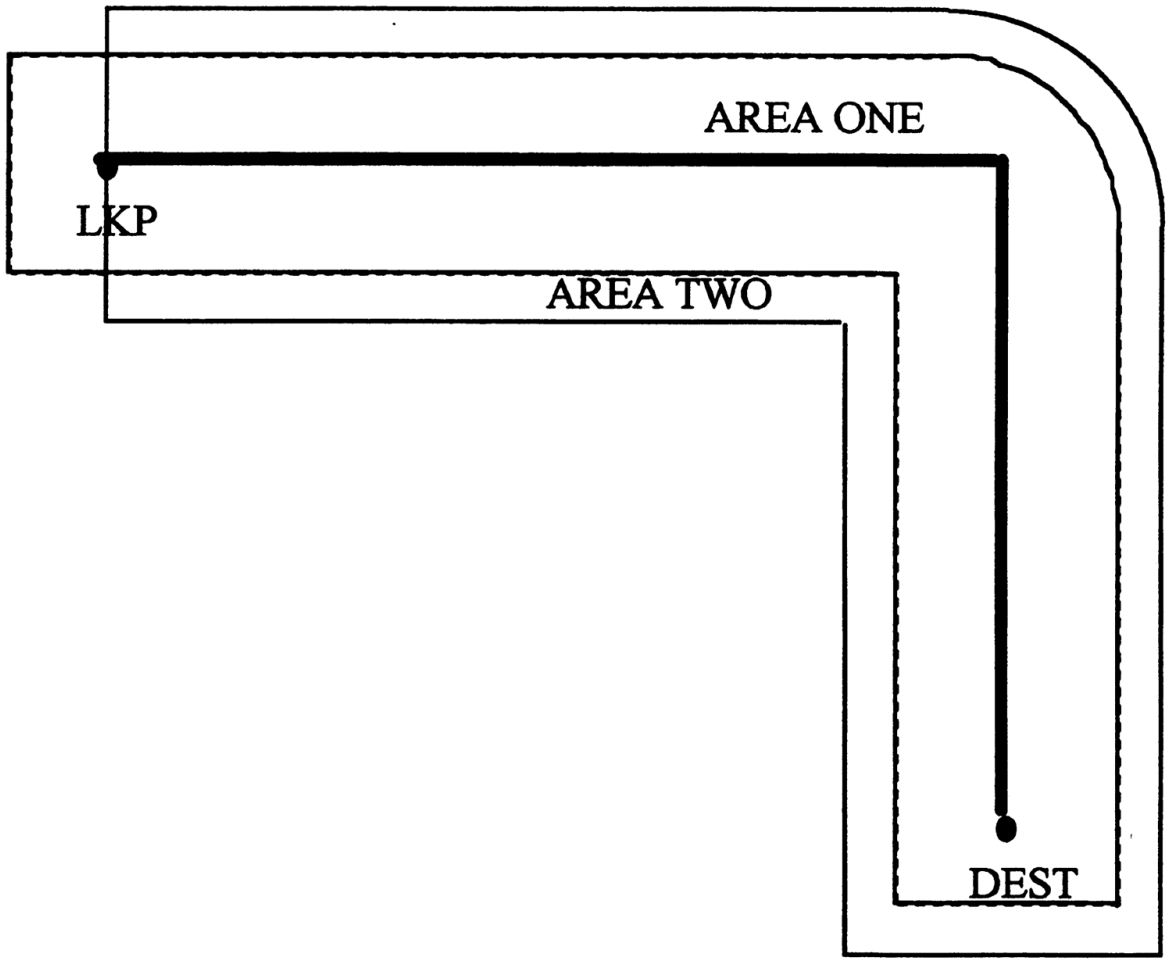
NTAM Area One



NTAM Area Two



En Route Turning Points



Recommended Search Sequence when using NTAM

- First, conduct track crawls along the missing aircraft's intended track, being especially thorough near the LKP and destination
- Second, Conduct electronic searches and cooperating target/survivor searches covering the entire high probability areas

Recommended Search Sequence when using NTAM Continued

- Search Area One in the following order
  - The last quarter of the track from the track outward with equal priority along the track
  - The third quarter from the track from the track outward with equal priority along the track
  - The first quarter of the track outwards commencing at the LKP
  - The second quarter from the track outward with equal priority along the track
  - The over-fly area followed by the under-fly area commencing at the destination and LKP respectively

Recommended Search Sequence when using NTAM Continued

- Search Area Two in the following order
  - The last quarter of the track from the track outward with equal priority along the track
  - The third quarter from the track from the track outward with equal priority along the track
  - The first quarter of the track outwards commencing at the LKP
  - The second quarter from the track outward with equal priority along the track
  - The over-fly area followed by the under-fly area commencing at the destination and LKP respectively

DAOR Study
NTAM Results

- 79% of the missing aircraft were located in Area One
- 83% of the missing aircraft were located in Area Two
- High Concentrations of aircraft were found in the first and last tenth of the track
- More aircraft were found in the second half of the track than the first

What's the problem?

Should the Canadian NTAM be utilized by search planners in the CONUS or not, and if not, what better alternatives are readily available?

Guiding Questions

- How many missing aircraft searches were coordinated in 1999 by the AFRCC, and what information is available for each search?
- What relevant information is normally available to mission planners that could further impact planning efforts?
- Where were the missing aircraft actually located?

Guiding Questions Continued

- Will changes to the structure of the areas to be searched in CONUS yield better results than if search planners continued to use the NTAM?
- Does the available information justify search planners changing their current methods?

Study Subjects

- 115 missing aircraft searches were conducted in CONUS in 1999
- 78 missions were determined to be valid for the study
  - 37 missions were eliminated from the study for lack of data (no known route or destination or the aircraft was not located
  - False missions were included in the study

General Results

- The mean distance off of track that aircraft in the study were located was 12.74 nautical miles
- The mean distance that the aircraft in the study were found along the track was 64% of the intended track length
- After removing false missions the mean distance off of track was 15.57 nautical miles while the mean distance that the aircraft were found along the track was 57% of the intended track length

Results of Using NTAM Area One

- 55 of the 78 aircraft were located in area one, which is approximately 71% of ,all aircraft in the study
- 40 of the 62 actual missions were located in area one using the NTAM, which is approximately 65% of the aircraft located on actual missions

Results of Using NTAM Area Two

- 59 of the 78 aircraft were located in area two, which is approximately 76% of ,all aircraft in the study
- 43 of the 62 actual missions were located in area two using the NTAM, which is approximately 69% of the aircraft located on actual missions

Negative Results using the NTAM

- 19 of the 78 aircraft in the study were not located in Areas One or Two of the NTAM, approximately 24% of the aircraft in the study
- 19 of the 62 aircraft located on actual missions were found outside of Areas One or Two of the NTAM, approximately 31% of the aircraft located in the study

Alternatives to the NTAM

- We found that Area One of the NTAM was the best place to start, and should thus be left alone
  - Many of the missing aircraft were located within this window in this study
  - Route searches along this area when limited information is available is the only logical alternative to doing nothing

Alternatives to the NTAM Continued

- Option One
  - 20 nautical miles around the LKP, destination and known turning points
  - 73% of aircraft located on actual missions were found in this area which is better than the 69% NTAM rate
- Option Two
  - 10% of the intended track length around the LKP, turning points and intended destination
  - 68% of aircraft located on actual missions were found in this area, which compared to the NTAM was worse, but not significantly

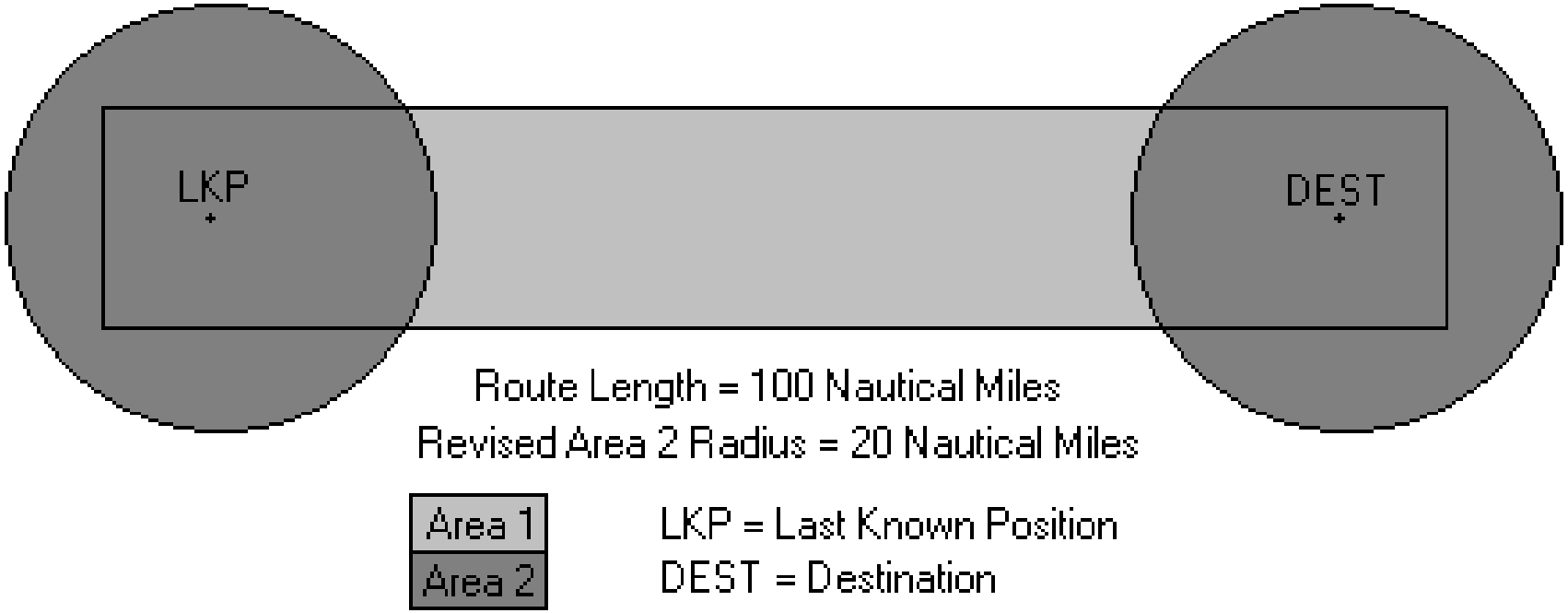
Alternatives to the NTAM Continued

- Option Three
  - 20% of the intended track length around the LKP, turning points and intended destination
  - 77% of aircraft located on actual missions were found in this area, which compared to the NTAM was better, and was also better than the results of Option One

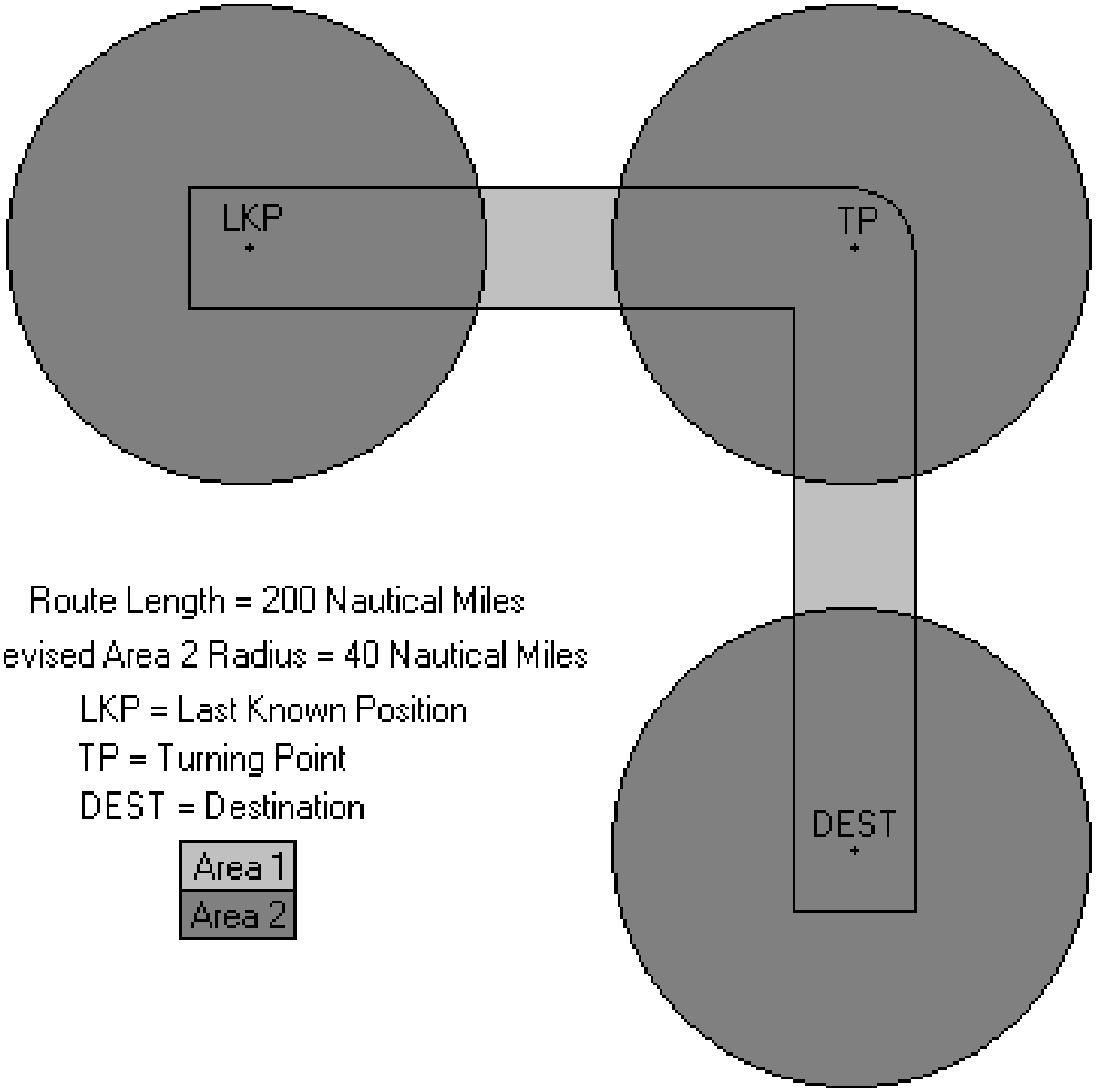
Alternatives to the NTAM Continued

- Option Four
  - 20 nautical miles or 20% of the intended track length around the LKP, turning points and intended destination, whichever was greater
  - 82% of aircraft located on actual missions were found in this area, which compared to the all other options and the NTAM yielded the best results

Option Four Example # 1



Option Four Example # 2



Crash Location Segment Breakdown

Distance Along Track Location	Number of Aircraft Located in Section	Percentage of Aircraft Located in Section
Before the LKP	4	6.45
LKP to 10% of Track	10	16.13
10% to 20% of Track	4	6.45
20% to 30 % of Track	5	8.06
30% to 40% of Track	4	6.45
40% to 50% of Track	1	1.61
50% to 60% of Track	3	4.84
60% to 70% of Track	2	3.23
70% to 80% of Track	1	1.61
80% to 90% of Track	5	8.06
90% of Track to Destination	12	19.35
After the Destination	11	17.74
Total Number of Actual Searches	62	

Recommendations

- First, as early as possible in the search conduct ramp searches of the airports along the intended route of flight, especially the intended destination so as to eliminate those airports for false missions
  - This is a good task for early arriving search crews
  - Don’t forget to think about where your crews are coming from – they may be able to search en route

Recommendations Continued

- Second, assuming that you have no other available information other than the intended route of flight, establish area one to be searched with the following precedence:
  - The last 20% of the route, from the destination backwards searching from the track outwards with equal priority along the track
  - The area immediately surrounding the destination after the last 10% of the route searching from the track outwards with equal priority

Recommendations Continued

- The first 20% of the route, from the LKP forwards searching from the track outwards with equal priority along the track
- The area immediately surrounding the LKP before the first 10% of the route searching from the track outwards with equal priority along the track
- Search the remaining portions along the route from the LKP to the destination searching from the track outwards with equal priority along the track

Recommendations Continued

- If there is a more accurate updated LKP than the origin of the flight then the area immediately surrounding the updated LKP outwards to 10 nautical miles with equal priority should be searched prior to initiating the above sequence
- If this updated LKP suggests it, eliminate areas that are no longer necessary to search

Recommendations Continued

- Third, after completing a thorough search of area one, initiate a second stage search following the plan established in Option Four discussed earlier
  - 20 nautical miles or 20% of the original track length, whichever is greater, radius around the original LKP, turning points, and destination
  - Areas of overlap with area one should be searched again as those tend to be the highest areas of probability

Recommendations Continued

- The second stage search should be conducted with the following precedence:
  - First, the area immediately surrounding the final destination from the final destination outwards with equal priority
  - Second, turning points within the last 20 percent of the original track length from the turning point outwards with equal priority

Recommendations Continued

- Third, the area immediately surrounding the original or updated LKP searching outwards with equal priority
- Search the remaining turning points along the route from the original or updated LKP to the destination searching from each turning point outwards with equal priority

Recommendations Continued

- If there is a more accurate updated LKP than the origin of the flight then the area immediately surrounding the updated LKP outwards to 20 nautical miles or 20% of the original track length, whichever is greater, should be searched with equal priority prior to initiating the above search sequence
- If this updated LKP suggests it, eliminate areas that are no longer necessary to search

Recommendations Continued

- Fourth, plan for expansion and the need for additional resources
- Fifth, early on, set reasonable objectives for your personnel including when you plan to close or suspend your search efforts

Recommendations Continued

- Sixth, stay abreast of the current issues involved in this study
- Seventh, consider expanding upon this study at a later date
- Eighth, consider validating or invalidating my work at a later date

BREAK

Ground Operations

GROUND OPERATIONS PRIMARY USES

- TACTICAL SUPPORT
- LOGISTICAL SUPPORT

USES OF GROUND TEAMS ON INCIDENTS

- SEARCH AND RESCUE
- DISASTER RESPONSE
- CRASH SITE SECURITY
- SHELTER MANAGEMENT AND ASSISTANCE
- SUPPORT TO TECHNICAL TEAMS

COORDINATION OF GROUND OPERATIONS

GROUND SUPPORT FUNCTIONS:

- DETERMINE FUEL & SUPPLY NEEDS
- MAINTAIN VEHICLES
- LOAD EQUIPMENT & RESOURCES
- MAINTAIN RECORDS
  - CAPF 109 (CAP Vehicle Clearance)
  - ICSF 218 (Support Vehicle Inventory)

COORDINATION OF GROUND OPERATIONS CONT.

GROUND SUPPORT FUNCTIONS:

- ENFORCE SAFETY REGULATIONS
- PARKING & STAGING
- Remember that although ground teams are coordinated through the operations section, their vehicle resources and needs are coordinated through the logistics section, which is different than the air branch

BREAK

Ground Search Methodologies

Search Formations

- Hasty
- Line
- Wedge

Hasty Team

- Used to check critical points of interest on site
- No set layout
- Normally specific, very-experienced personnel assigned
  - Assistant Team Leader
  - Communications
  - Medic/First Aider
- A branch of a larger ground team in the field
- Usually sent out as the initial, quick search

Search Formations Continued

- Ground Team Members
  - Wilderness or Experienced Members (W)
  - General or Inexperienced Members (X)
  - Communications (C)
  - Medic/First Aider (+)
  - Navigator (N)
  - Assistant Team Leader (A)
- Ground Team Leader (L)

Line Search

- Last Resort
- Detailed but Slow Search

Option 1: W X X X C L + X X X W

Option 2: W X X X C A + X X X W

Wedge

- More Common
- Follows trails and paths typically
- Takes less time than line search

Wedge Continued

Option 1:

N

X X

X X X

W C L + W

Option 2:

N

X X

X X X

W C A + W

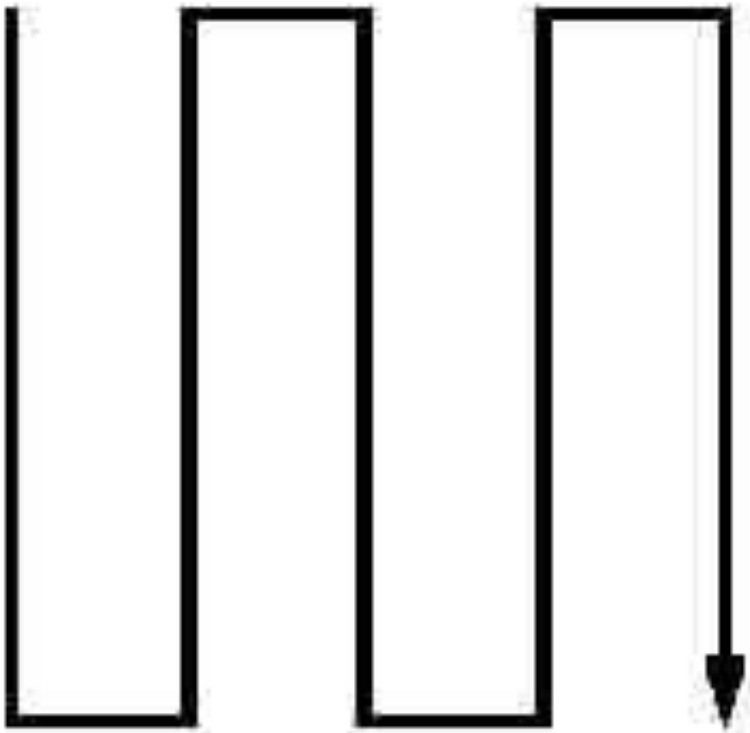
L

Search Patterns

- Parallel Sweep
- Expanding Square or Circle
- Contour

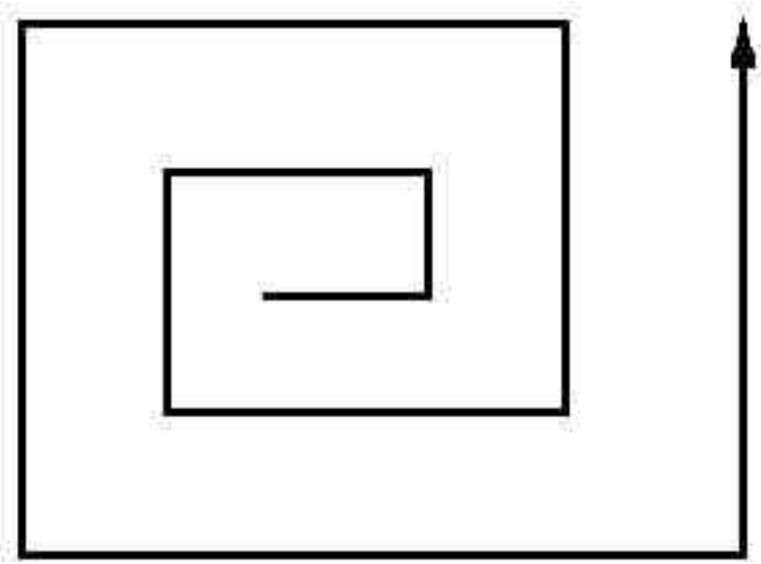
Parallel Sweep

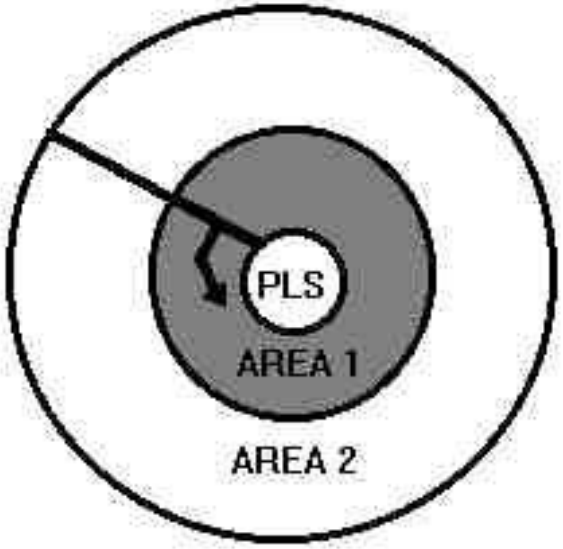
- Used to search specific gridded areas typically
- Normally use a Line Search formation



Expanding Square or Circle

- Search small areas for missing person or clue
- Normally use Hasty team





Contour Search

- Searching by elevation
  - top to bottom not normally very feasible
  - statistically people get hurt climbing, not on the way back down
- Normally looking for hikers along trails or on side of trails
  - Use the Wedge formation for this pattern

Missing Person Search Clues

- Physical clues
  - Clothing or equipment
  - Smoke, by sight or smell
  - Food wrappers, trash or cigarette butts
  - Broken or disturbed brush or other signs of humans passing through an area
  - Scavengers
  - Decomposition Odors

Missing Person Search Clues Continued

- Recorded Clues
  - Trail registers
  - Sign-in logs
- People
  - Witnesses
  - Trained personnel like other searchers or Forest Rangers
  - Family and Friends

Missing Aircraft Search Clues

- Terrain Changes
  - Broken or disturbed trees and underbrush
  - Landslides
  - Horsetails caused by windblown snow or sand
  - Breaks in terrain
  - Blackened or discolored areas
  - Smoke
  - Presence of Scavengers

Missing Aircraft Search Clues

- Smells
  - Smoke
  - Decomposition Odors
  - Fuel, oil or Brake Fluid
- Aircraft Signs
  - Pieces of wreckage (twisted metal, seats, etc.)
  - Fuel, oil, or brake fluid
  - Shiny metal in the distance

Missing Aircraft Search Clues

- Signs of the Pilot/Passengers
  - Bits of clothing or personal effects
  - Trail markings
  - Footprints
  - Campfires
  - Garbage
  - Signals (Flares, Mirrors, etc.)
- Unusual events (Voices, creaking metal)

What do you do when you find a clue or the target?

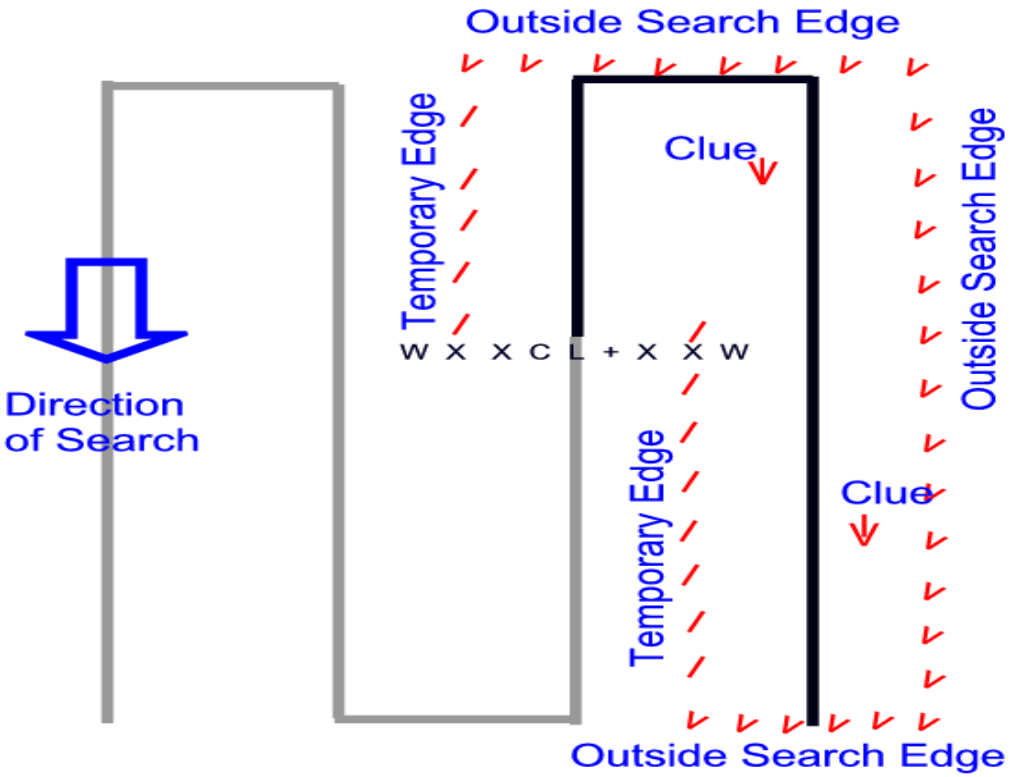
- Halt in Place
- Alert the Team Leader
- Look for hazards in your area
- Do not disturb anything
- Brief the Team Leader on what you found
- Mark the area if necessary to prevent damaging of this or other potential clues (covered in later slide)

Marking a Route

- Mark area searched for future teams or return leg
- Determine color and type to use
  - Surveyors tape (Recommended)
  - Crepe Paper Streamers (Party supplies)
- Place markings at eye level when possible
- Slow the team down as necessary to leave a good marking

Suggested Route Markings

- 1 Strand = temporary edge of search pattern
- 2 Strands = outside edge of search pattern
- 3 Strands = clue, marked with:
  - Time & date
  - Clue number
  - Team ID


Outside Search Edge
Temporary Edge
Clue
Outside Search Edge
W X X C L + X X W
Direction
of Search
Temporary Edge
Clue
Outside Search Edge

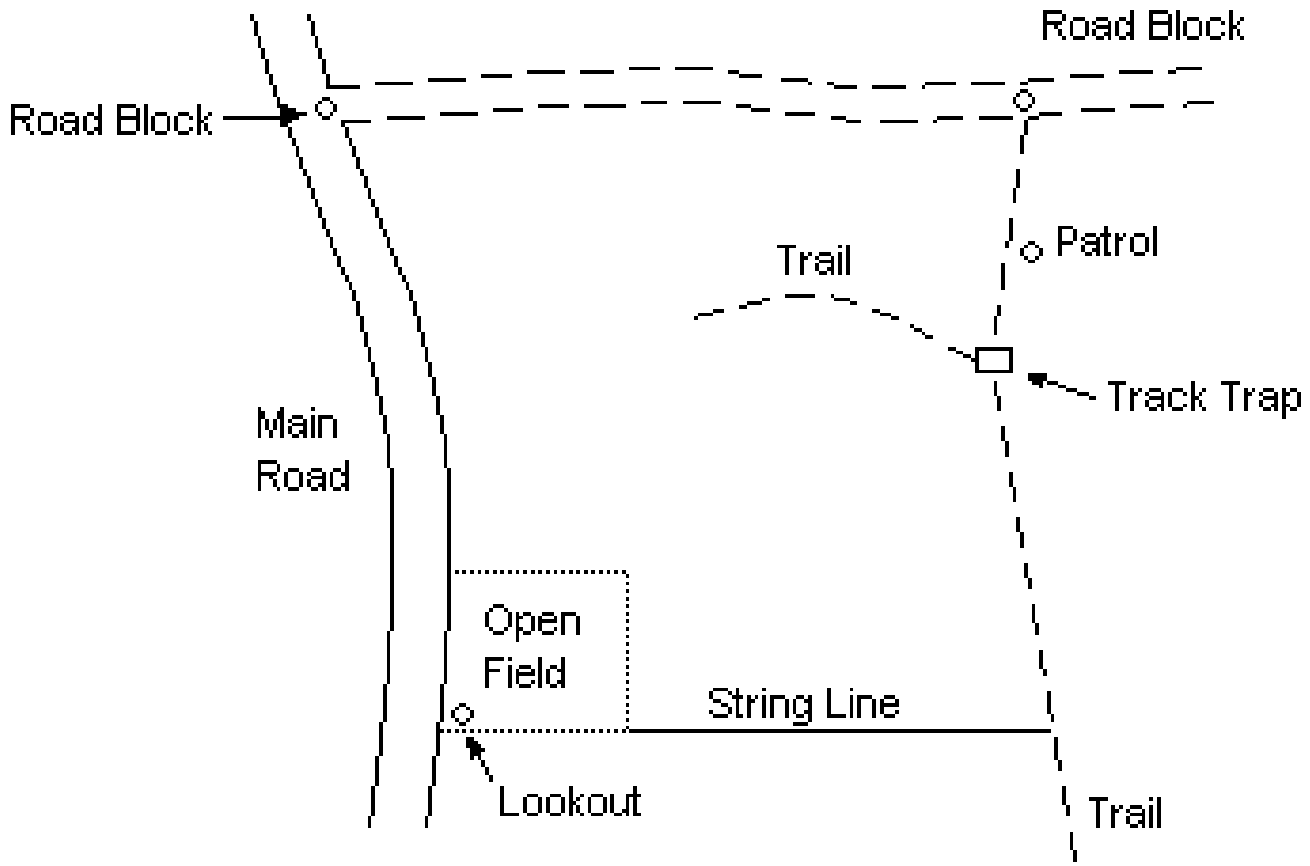
Attraction Techniques

- Sound
  - Shouting the victim's names
  - Honking vehicle horns
  - Using a Public Address System
- Light
  - Fires
  - Flashlights
  - Headlights

Confinement Methods

- Road or Trail Blocks
- Look Outs
- Track Traps
- String Lines
- Line Markings or Trail Blazing

Confinement Methods Continued



Pros & Cons

+ Hasty Search most successful initial search
+ Line Search useful for finding very small objects

- Destroys clues
- Man intensive
- Time intensive
- Can be difficult to manage

SUGGESTIONS

- Determine how well your local personnel search
  - PODs
  - Honest results, both successful and unsuccessful
- Offer more realistic training opportunities for your personnel
- Don’t wait to call in these assets – we are not an ambulance service with near immediate response times

QUESTIONS?

THINK SAFETY!