# Introducing crucial elements of Ground Search and Rescue for first responding field searchers

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Harvard Fire Department
Massachusetts Rescue And Recovery K9 Unit


SEARCH
RESCUE

**Jesstin "Manny" Pagan**, 5 years old.

**Anibal "Juni" Cruz**, 11 years old.

**Daniel "Danny" Agosto**, 6 years old.

# Boys alive amid search, coroner says

The three children found in a car trunk in Camden may have lived as long as 33 hours.

"*Thus* [within 5 hours] *the Toyota had been checked twice, once by family members, once by police officers. Neither check involved entering the car or opening its trunk.*"

The car was checked again by police at about 10 hours, and again at about 20 hours. The bodies of the boys were found by a relative at 49 hours.

# Missing Person Response

- Preplanning
- Notification
- Initial Response (Reflex Tasks) ~3 hours
- First operational period
- Subsequent operational periods
- Suspension
- Critique

# Search Crucials

- Search is an Emergency
- Search is a classic mystery
- Search for clues not just the subject
- Know if the subject leaves the search area
- Grid search as a last resort
- Manage by objectives
- (Search management is information management)

# Search is an Emergency

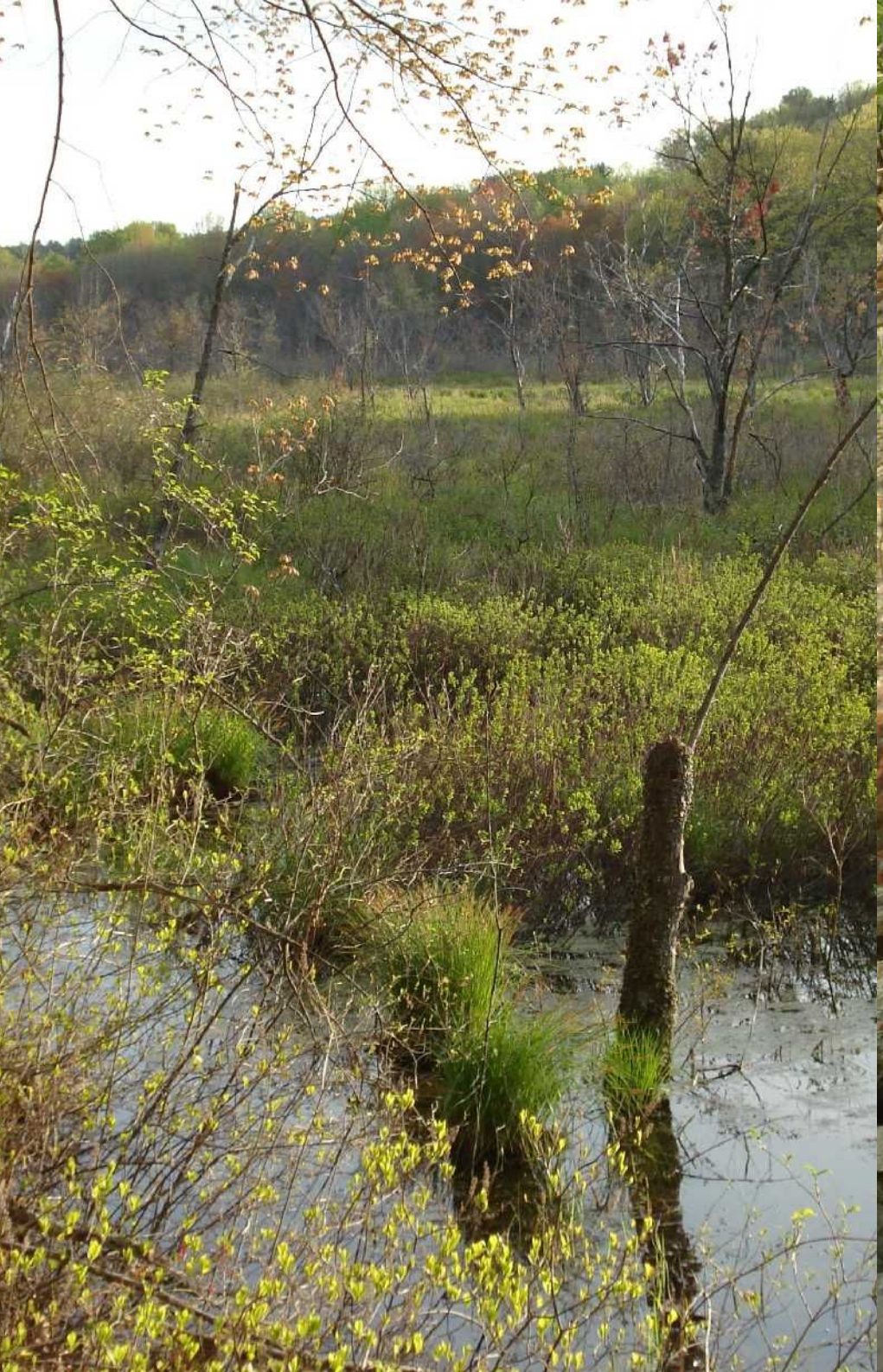
- Respond urgently
- Contain the search area
- Don't Stop at Night
- Mobilize trained search resources
- Search areas of high risk and high probability (hasty tasks) first

High Probability

High Risk

Trails

Hasty Tasks



# Search is a classic mystery

- Investigation
  - Interviews
  - Timeline of events
  - Subject Profile
- What clues to look for (search data)?
  - Clothing, equipment, litter (candy, gum, etc.)
  - Name, Description, footprint, scent articles
- What places to look (planning data)?
  - Where was the subject last?
  - What were they doing?

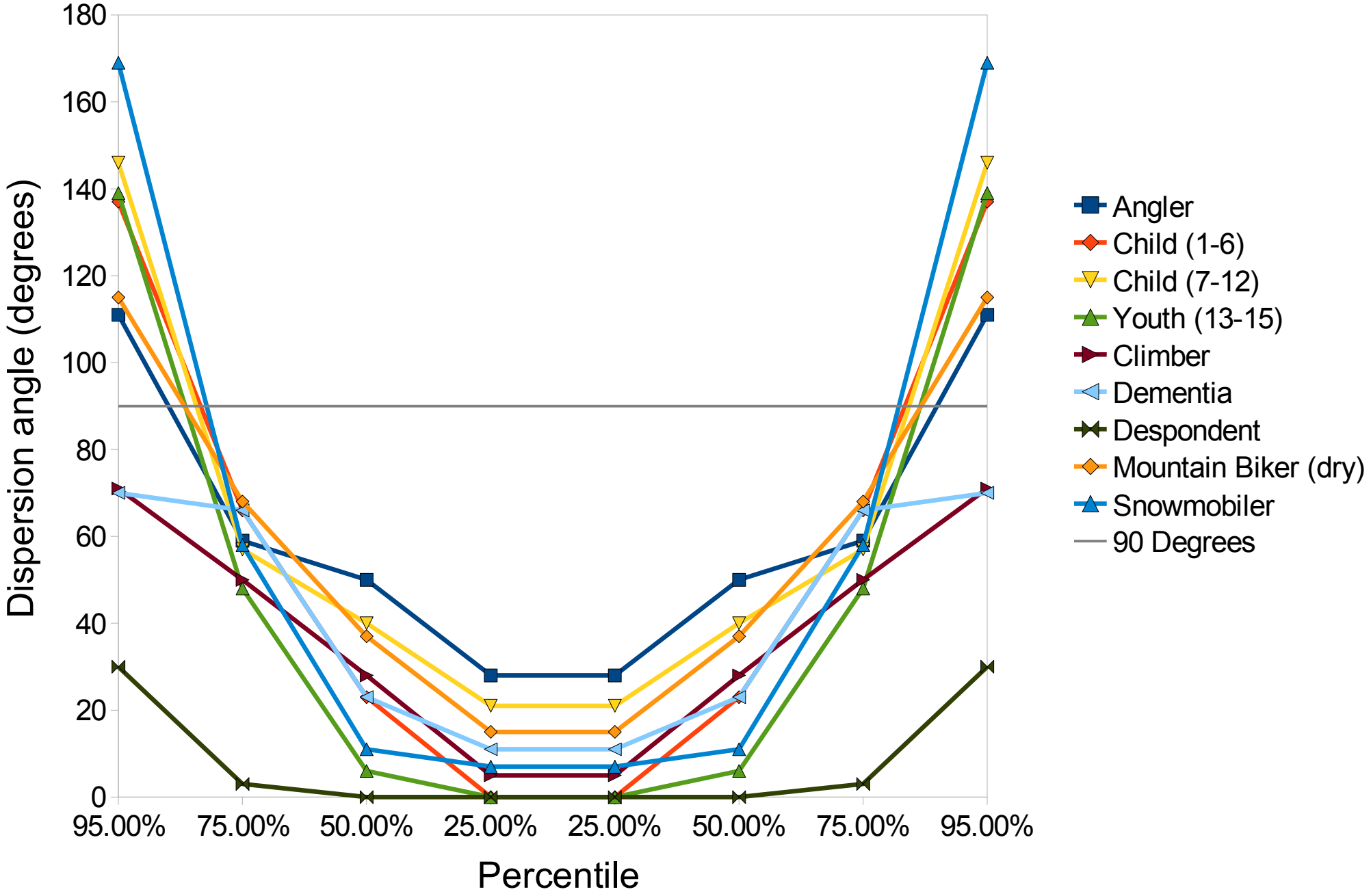
# Search for Clues not just the Subject

- One subject, many  clues
  - Around 3000 clues per mile when walking [Mantrackers]
  - Scent plumes [Air scent dogs, Tracking Dogs]
  - Dropped articles [Clue aware searchers]
- Clues can give:
  - Direction of travel
  - New last known points
  - Shift of priorities of areas to search

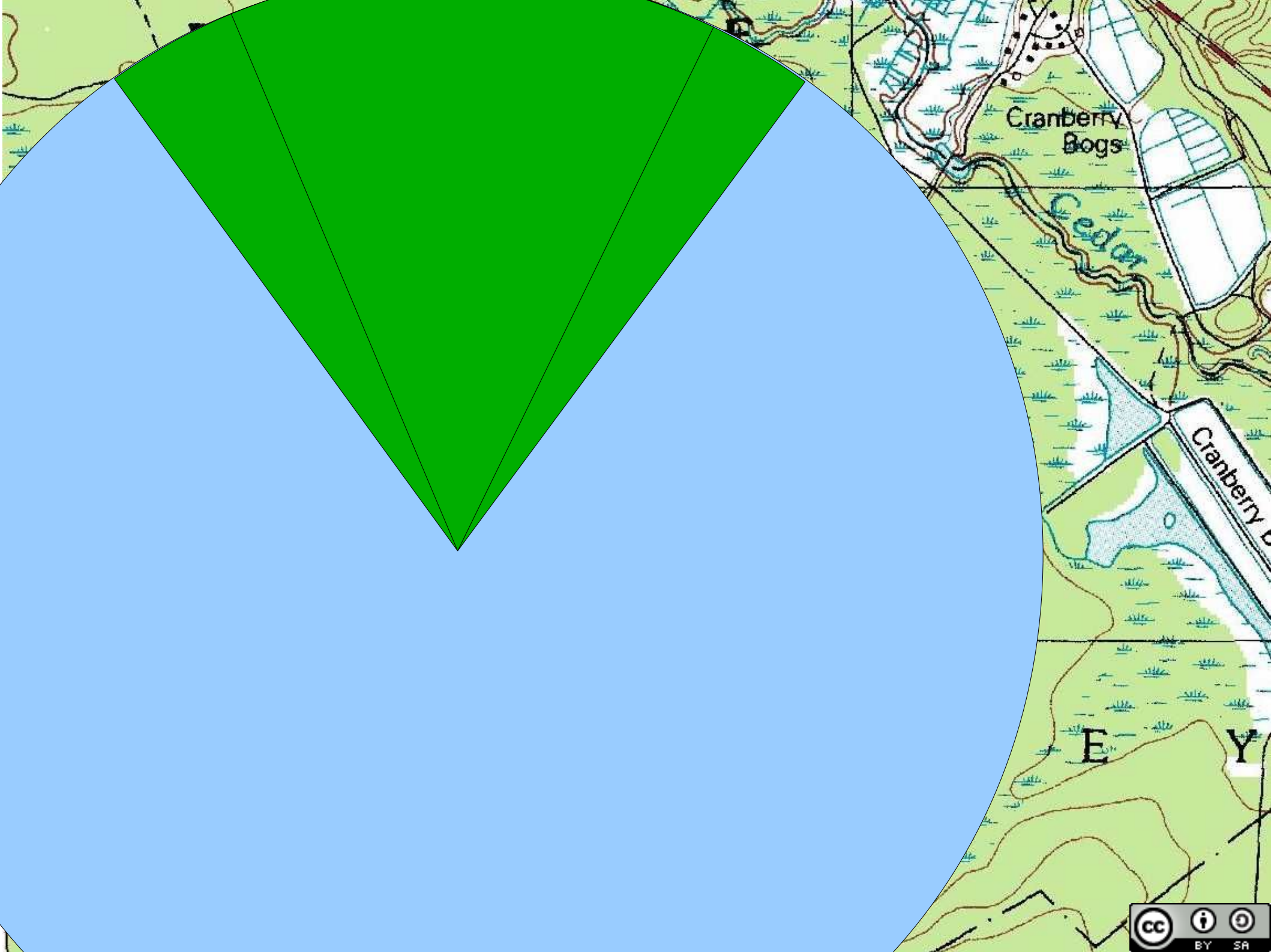
**Timmy's Hat found here by hasty task checking powerline**

**PLS**

**Timmy last seen here**




Data from ISRID (Koester, 2008)


Cranberry
Bogs
Cedar
Cranberry
E
Y

# Is this a Clue?

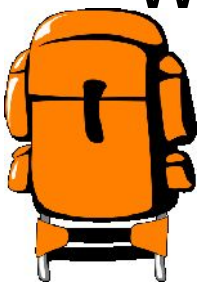
# Search for Clues not just the Subject

- Use Clue aware search resources
- Secure the PLS
- Secure scent articles


- Investigation and Interviews

  Search Data: What clues do we look for?

  What things t es?

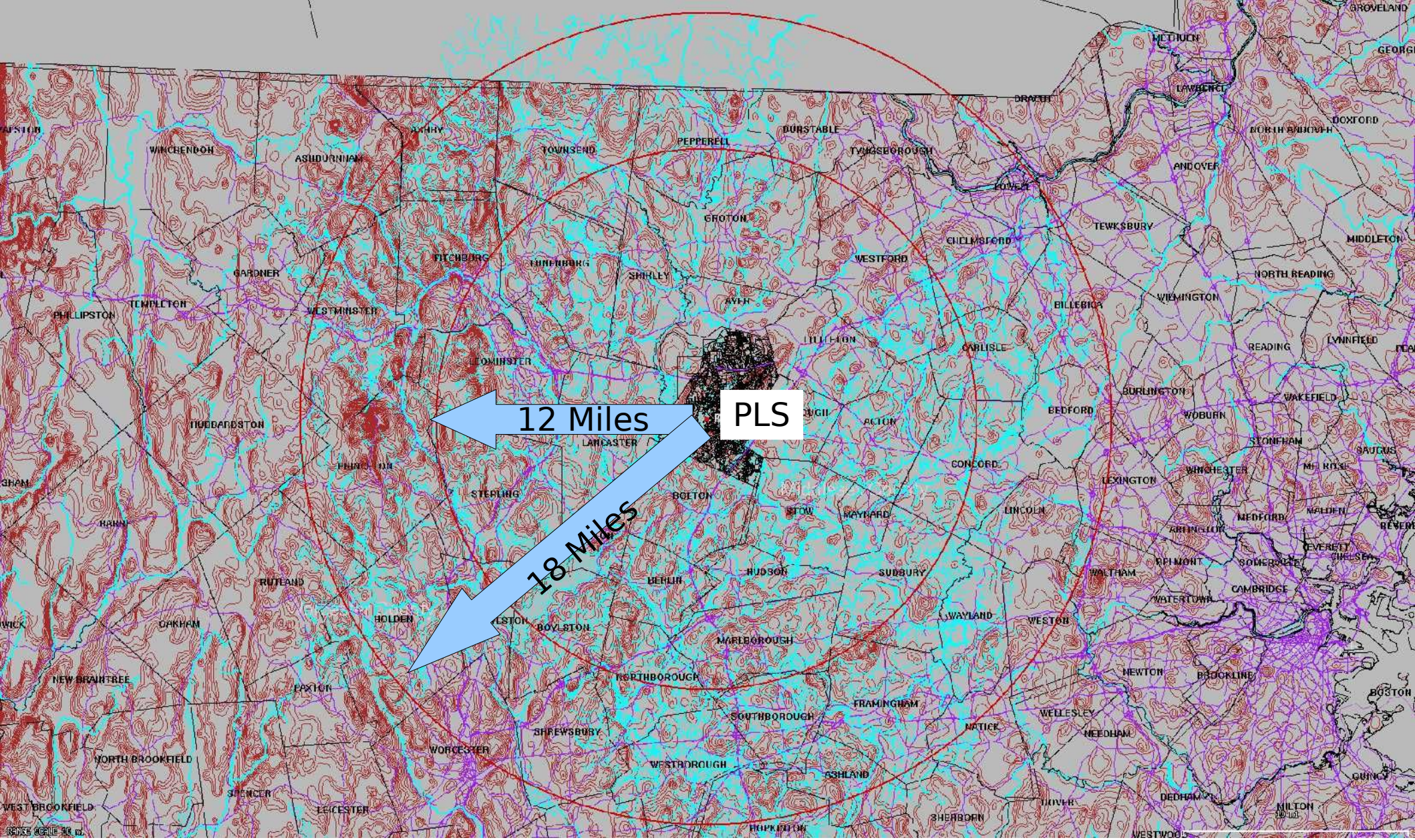




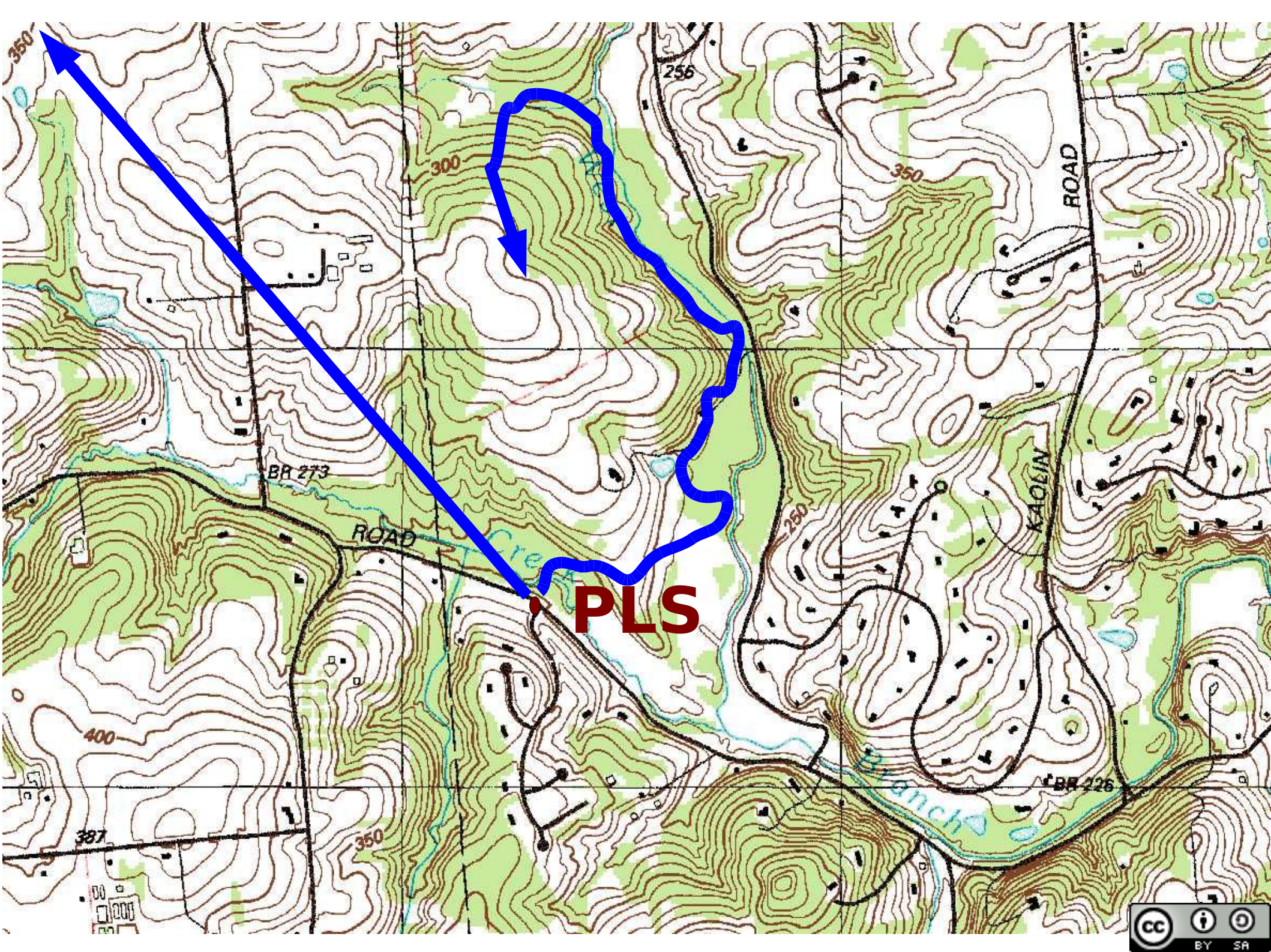



# Know if the Subject leaves the search area

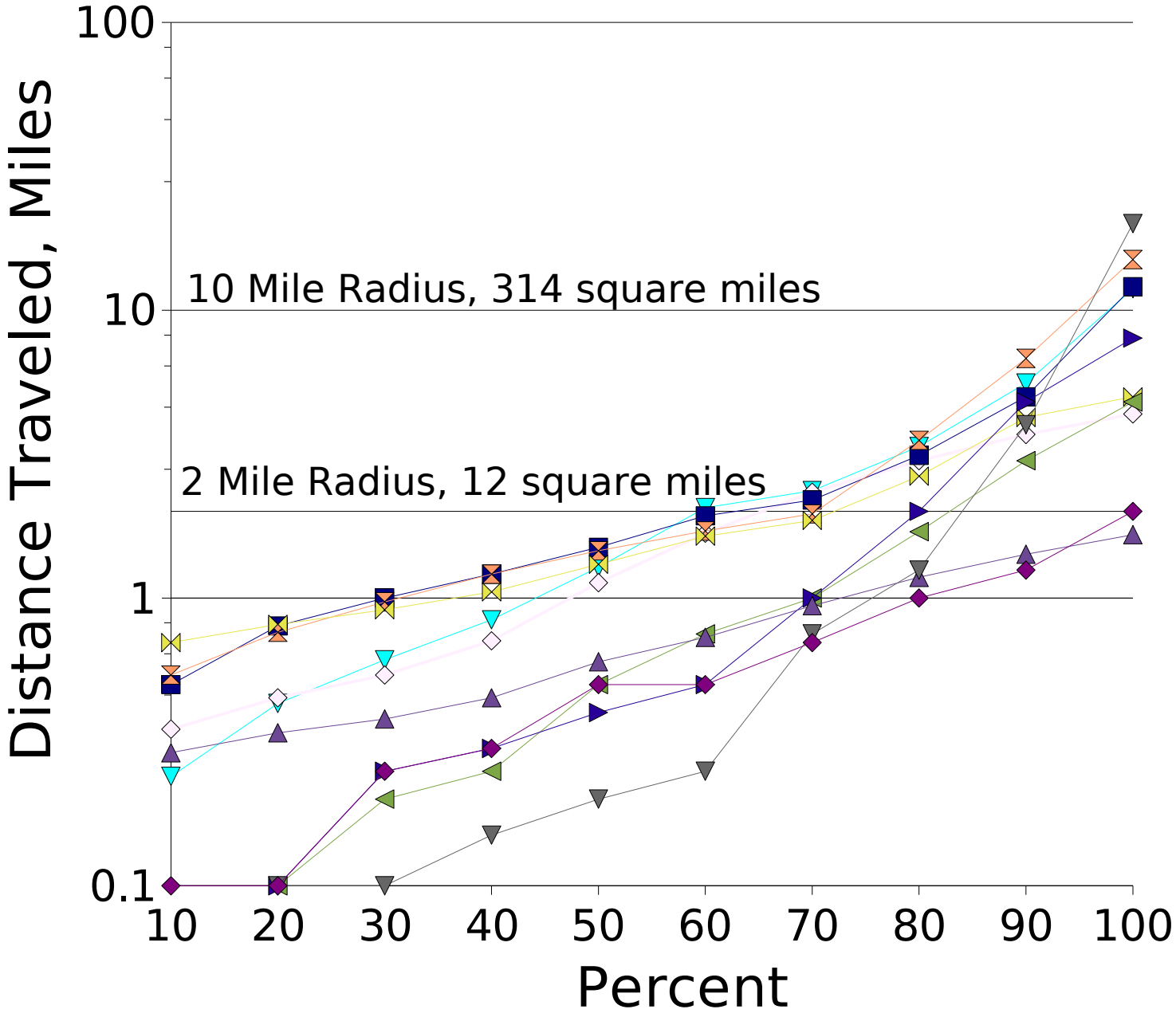
# Confinement

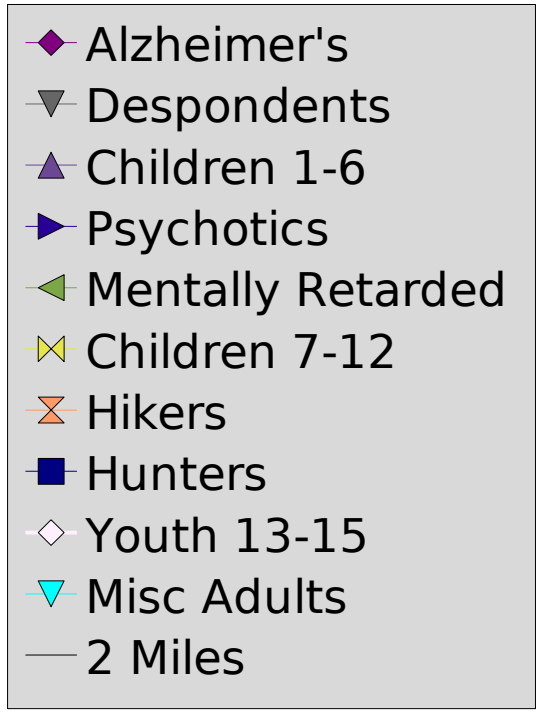



Last seen: About 3AM. Time now: 9AM.
Theoretical search radius: 12-18 miles
Theoretical search area: 500-1000 square miles


PLS
BR 273
ROAD
KAOLIN
ROAD
BR 226
Branch
Creek
256
300
350
400
387
250

# Lost Person Behavior

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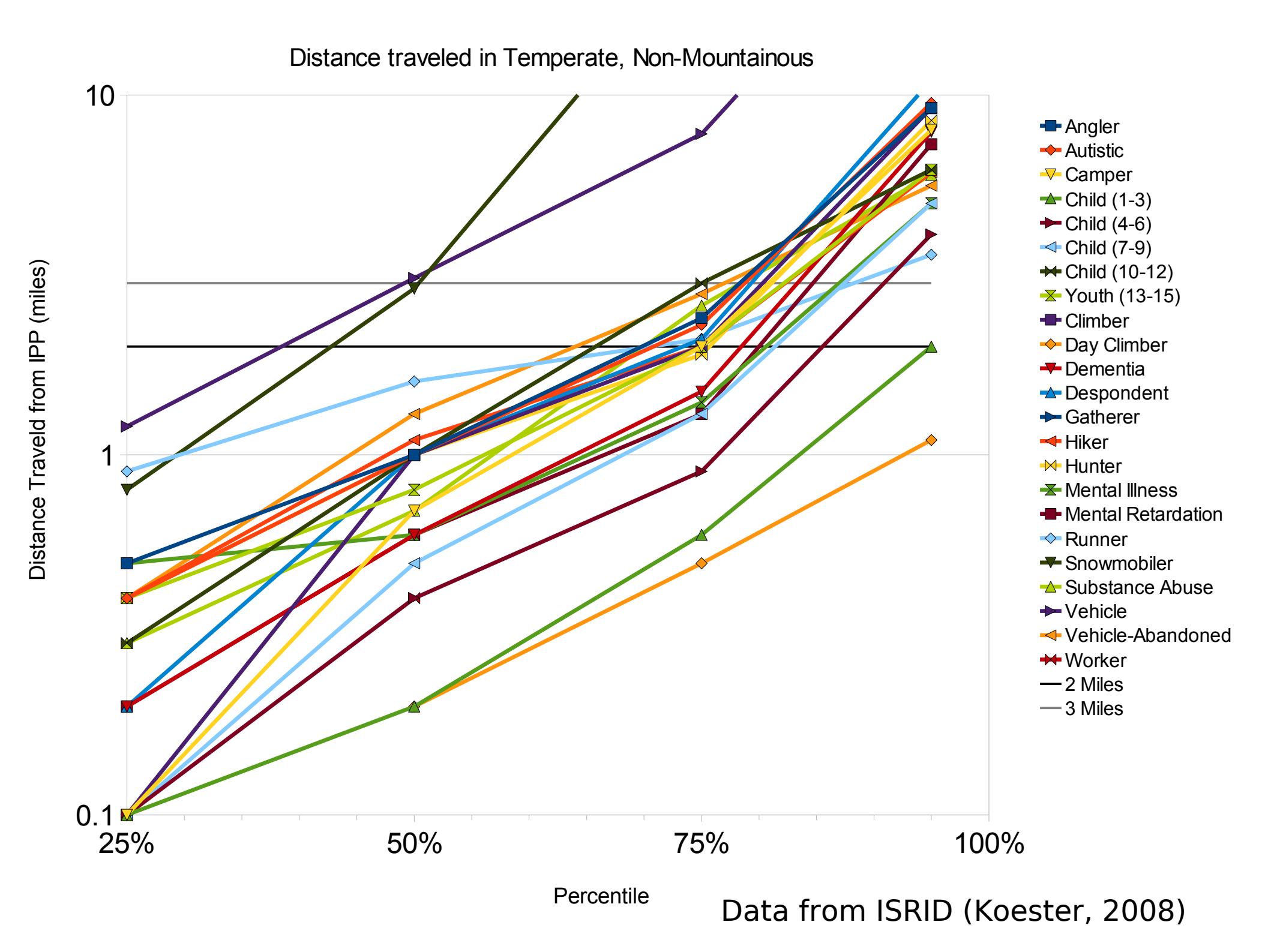

Distance traveled in Temperate, Non-Mountainous
10
1
0.1
Distance Traveld from IPP (miles)
25%
50%
75%
100%
Percentile
Angler
Autistic
Camper
Child (1-3)
Child (4-6)
Child (7-9)
Child (10-12)
Youth (13-15)
Climber
Day Climber
Dementia
Despondent
Gatherer
Hiker
Hunter
Mental Illness
Mental Retardation
Runner
Snowmobiler
Substance Abuse
Vehicle
Vehicle-Abandoned
Worker
2 Miles
3 Miles
Data from ISRID (Koester, 2008)

# Confinement

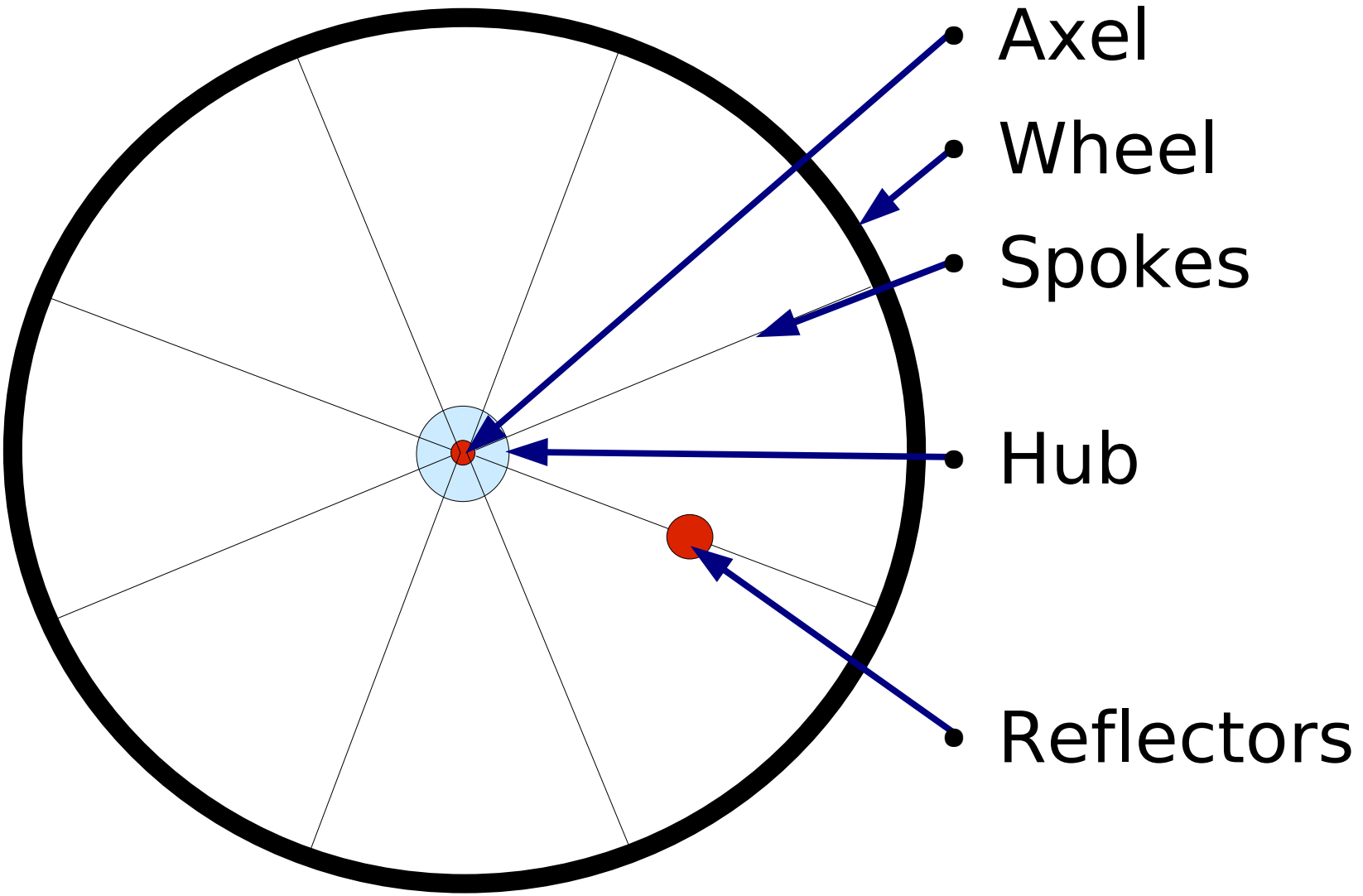
- Roadblocks / Trailblocks / Camp-ins
- Lookouts
- Road Patrols / Trail Patrols
- Create Track Traps

# Initial Actions

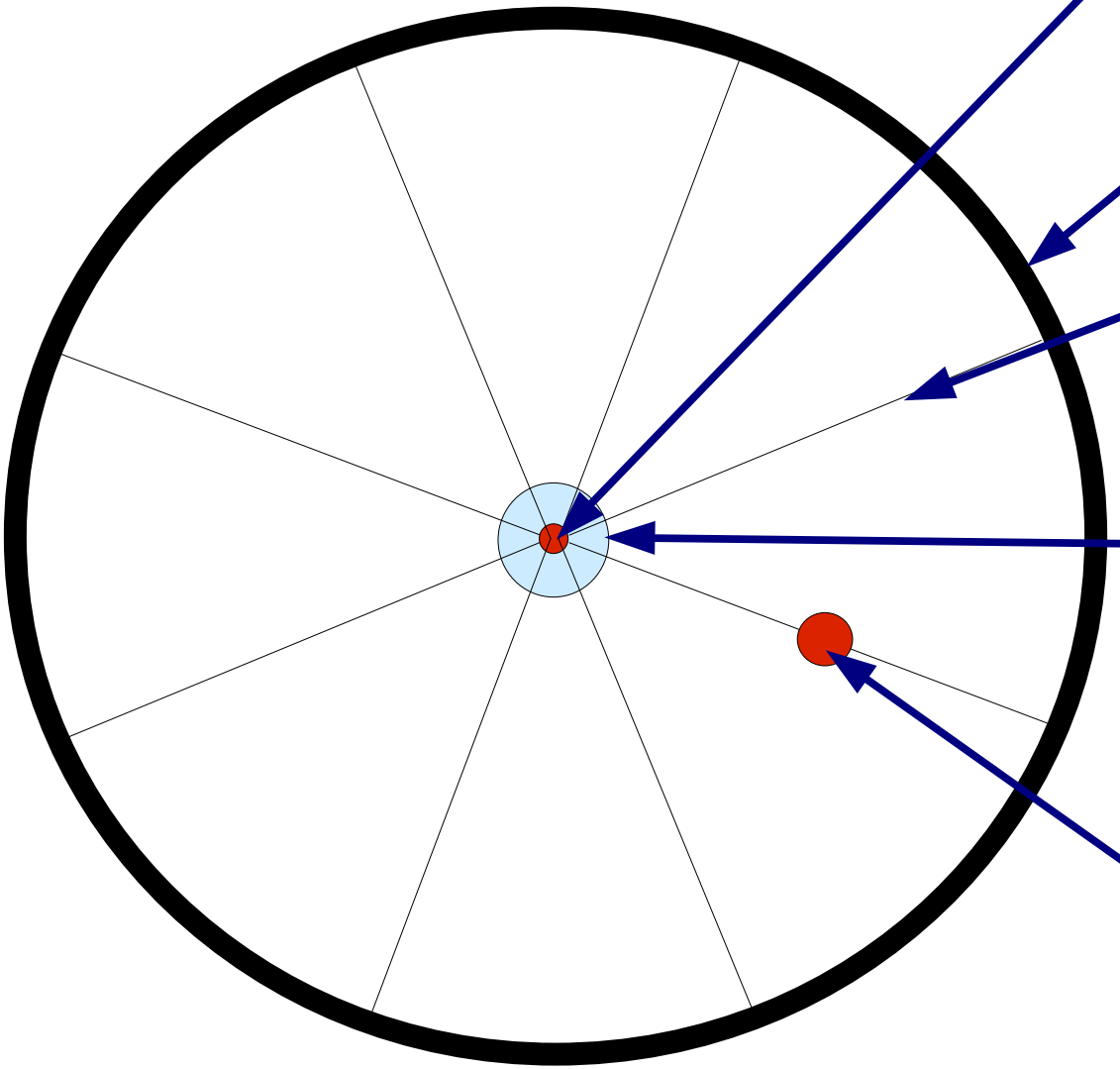
- Classic mystery → Investigate
- Subject in search area → Confinement
- Emergency → Hasty Tasks
  - Areas of high risk
  - Areas of high probability
- Clues and the subject → Get Help

  Protect Clues
  - Secure the PLS
  - Scent Articles
  - Tracks

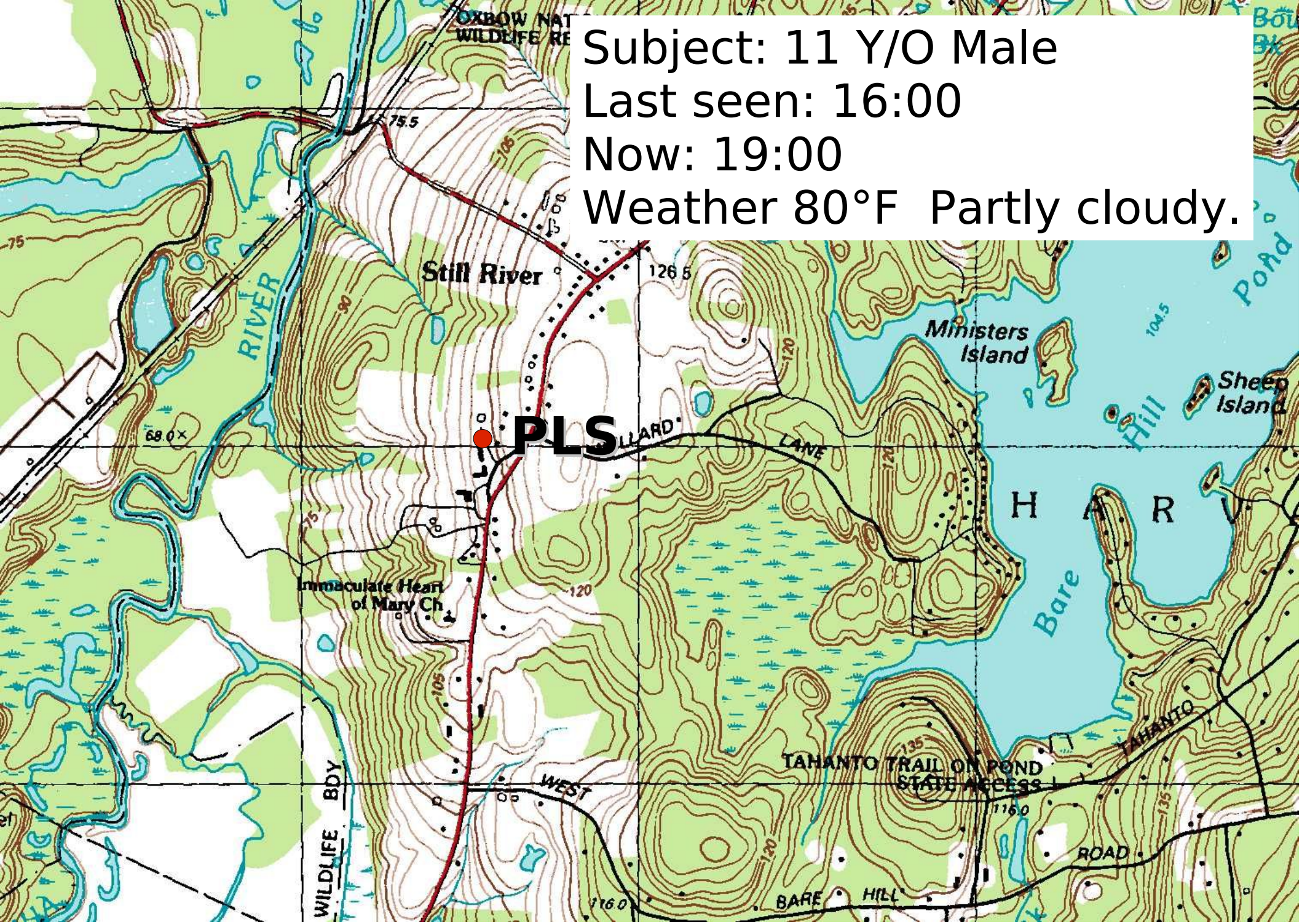
# Reflex actions: The Bicycle Wheel

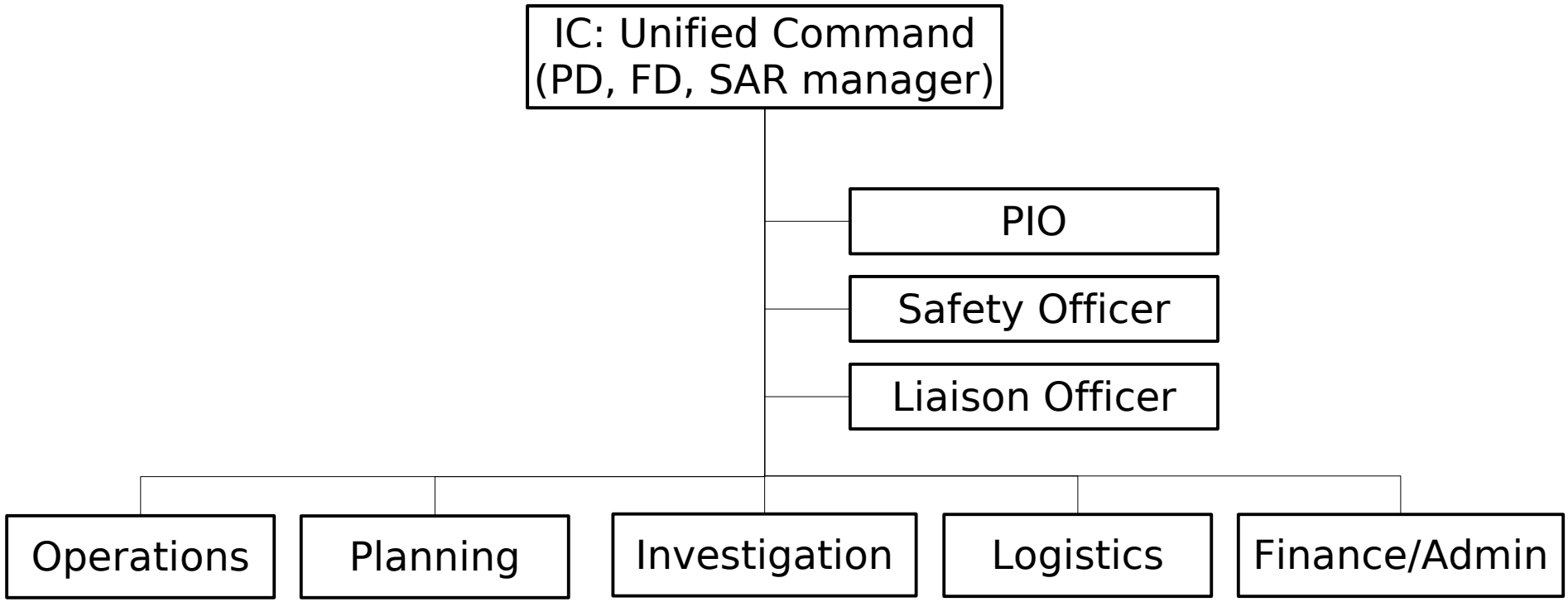


# Reflex actions: The Bicycle Wheel



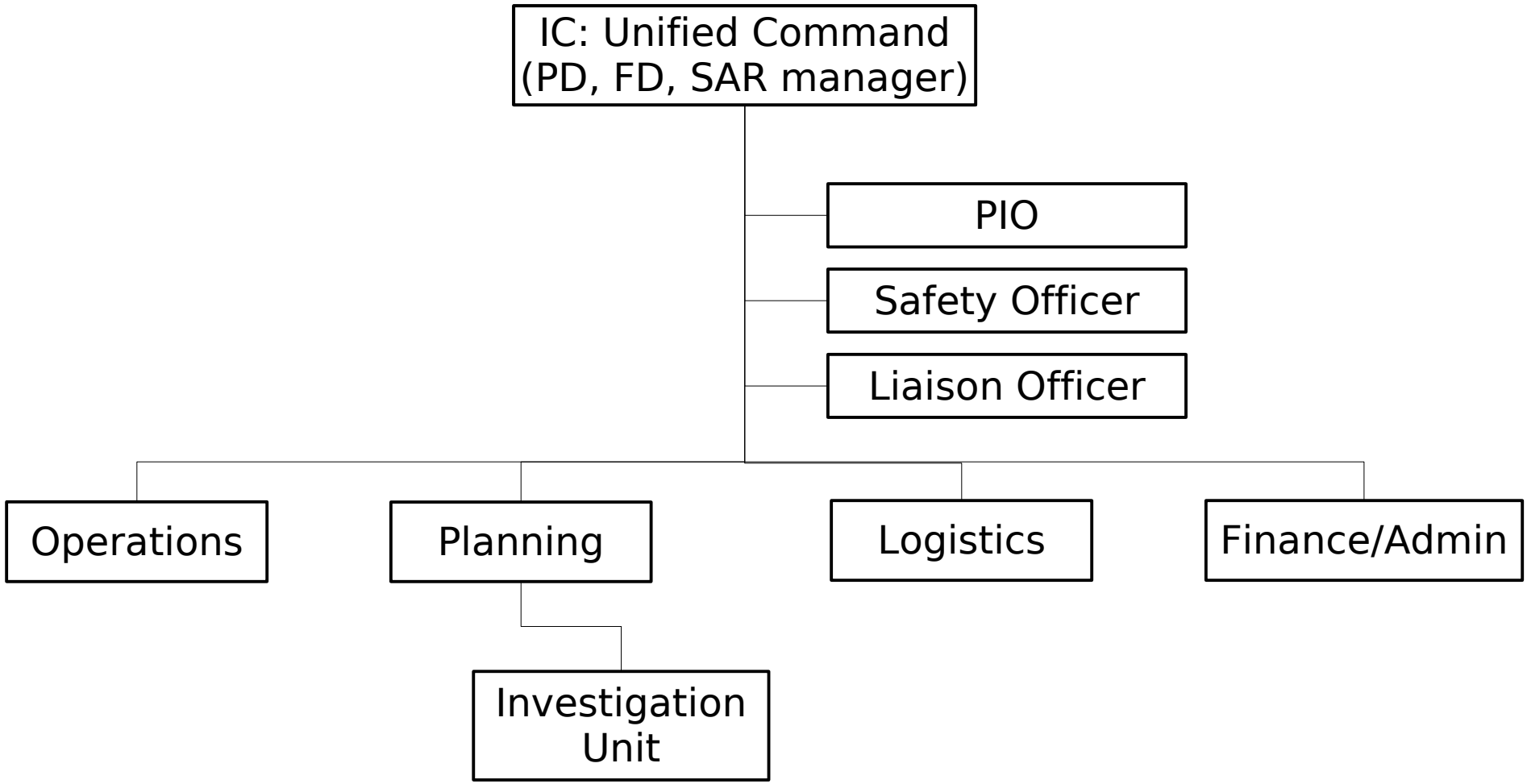
- Secure PLS, Investigation
- Confinement
- Hasty Tasks on likely routes
- Mantrackers and Tracking dogs to area around PLS
- Hasty Tasks to points of high risk and high probability


Subject: 11 Y/O Male
Last seen: 16:00
Now: 19:00
Weather 80°F  Partly cloudy.
PLS
Still River
RIVER
Ministers Island
Sheep Island
Bare Hill
Pond
Immaculate Heart of Mary Ch
WILDLIFE BDY
WEST
TAHANTO TRAIL ON POND STATE ACCESS
TAHANTO
ROAD
BARE HILL
LLARD
LANE
H A R V
75.5
126.5
68.0
116.0
104.5

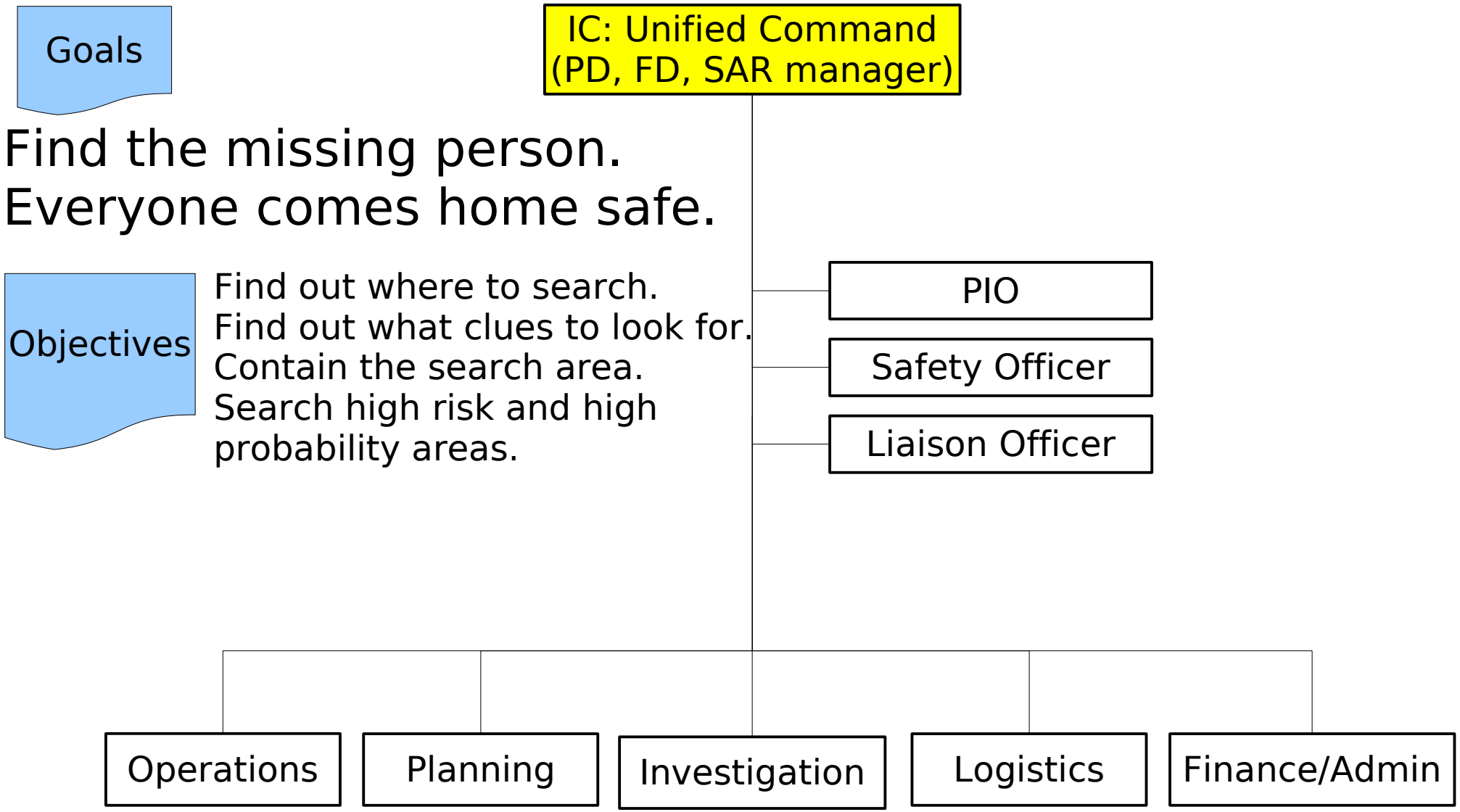



NIMS – 2007
Option of Investigation
as an additional Section

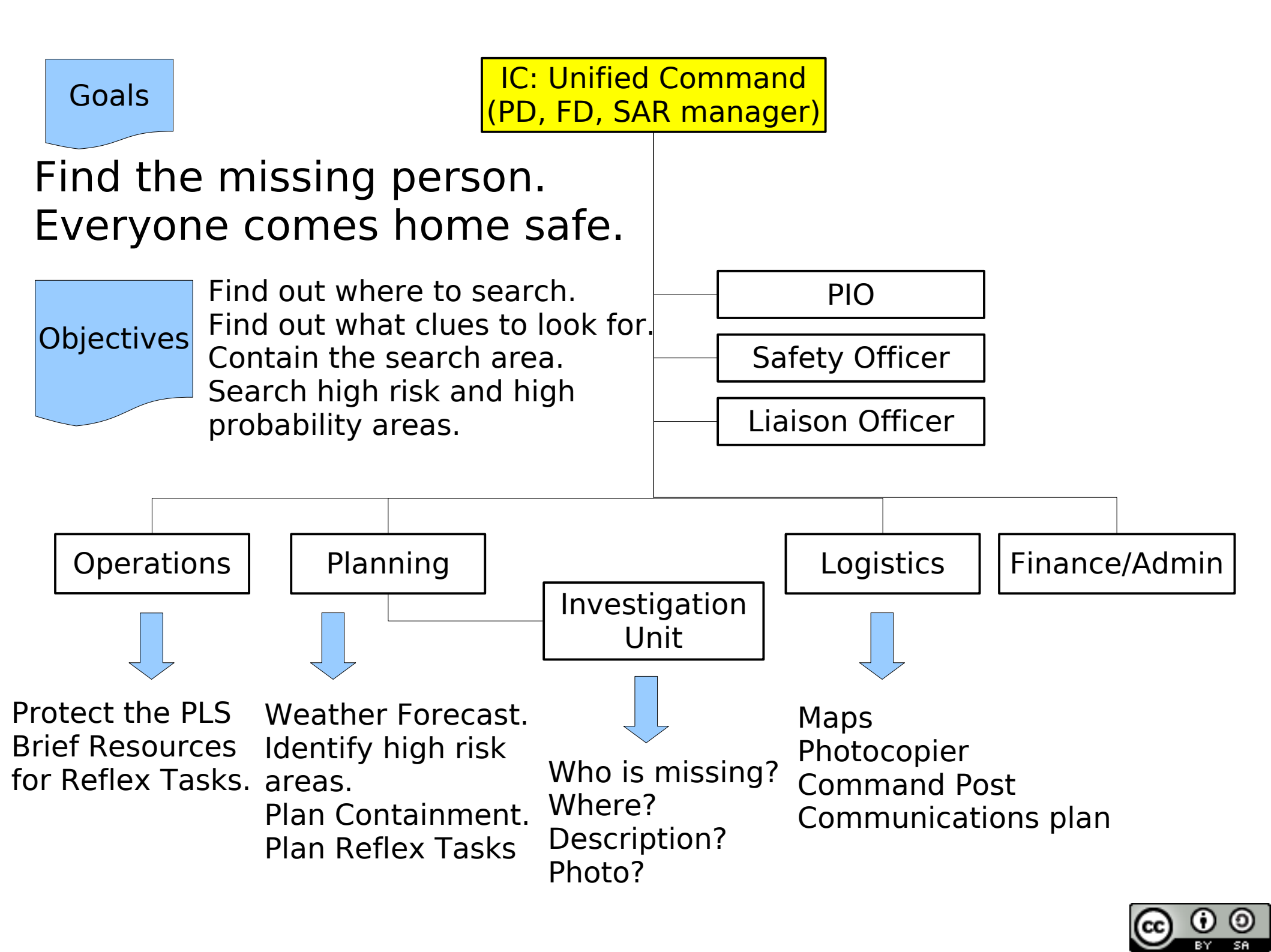
If all Section Chief and Command Staff positions
are occupied, an Investigation section
exceeds the span of control for the IC.




More Usual case: Investigation Unit
within the Planning Section




# Manage by Objectives


Goals
IC: Unified Command
(PD, FD, SAR manager)
Find the missing person.
Everyone comes home safe.
Objectives
Find out where to search.
Find out what clues to look for.
Contain the search area.
Search high risk and high probability areas.
PIO
Safety Officer
Liaison Officer
Operations
Planning
Investigation Unit
Logistics
Finance/Admin
Protect the PLS
Brief Resources for Reflex Tasks.
Weather Forecast.
Identify high risk areas.
Plan Containment.
Plan Reflex Tasks
Who is missing?
Where?
Description?
Photo?
Maps
Photocopier
Command Post
Communications plan

Goals

Find the missing person.

Everyone comes home safe.

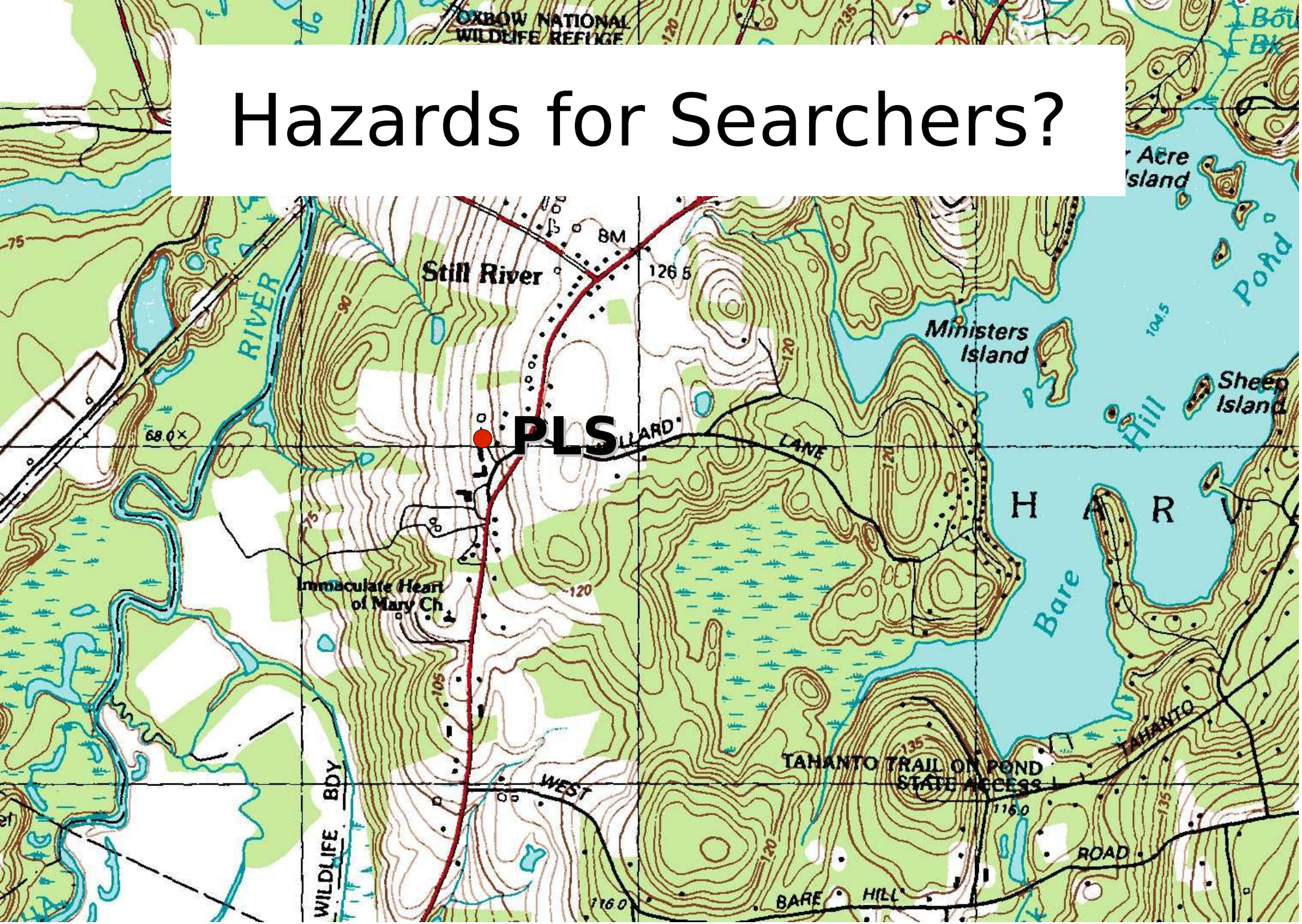
IC: Unified Command
(PD, FD, SAR manager)

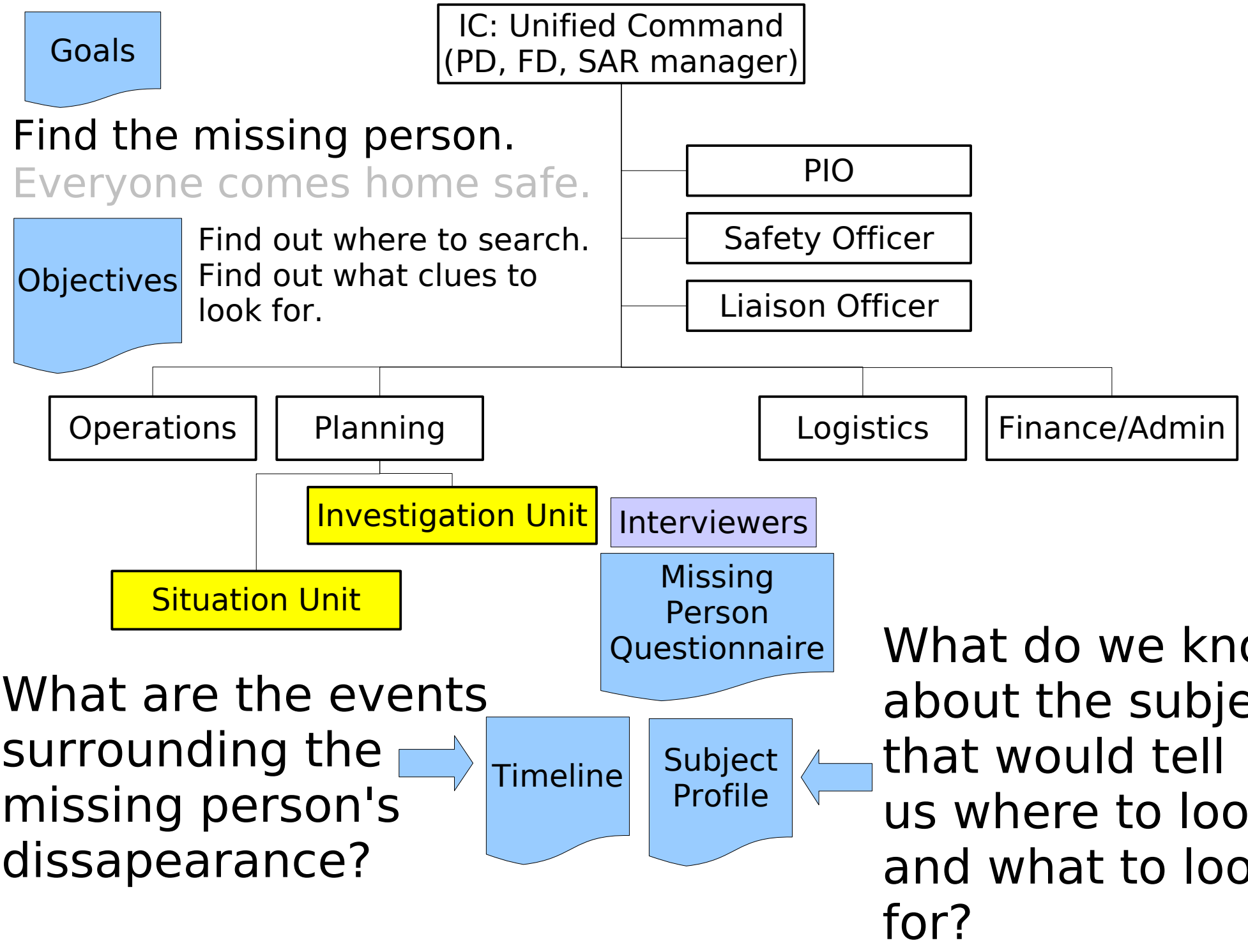
- PIO
- Safety Officer
- Liaison Officer

Hazard Assess.

- Operations
- Planning
- Logistics
- Finance/Admin

# Hazards for Searchers?




Goals
IC: Unified Command
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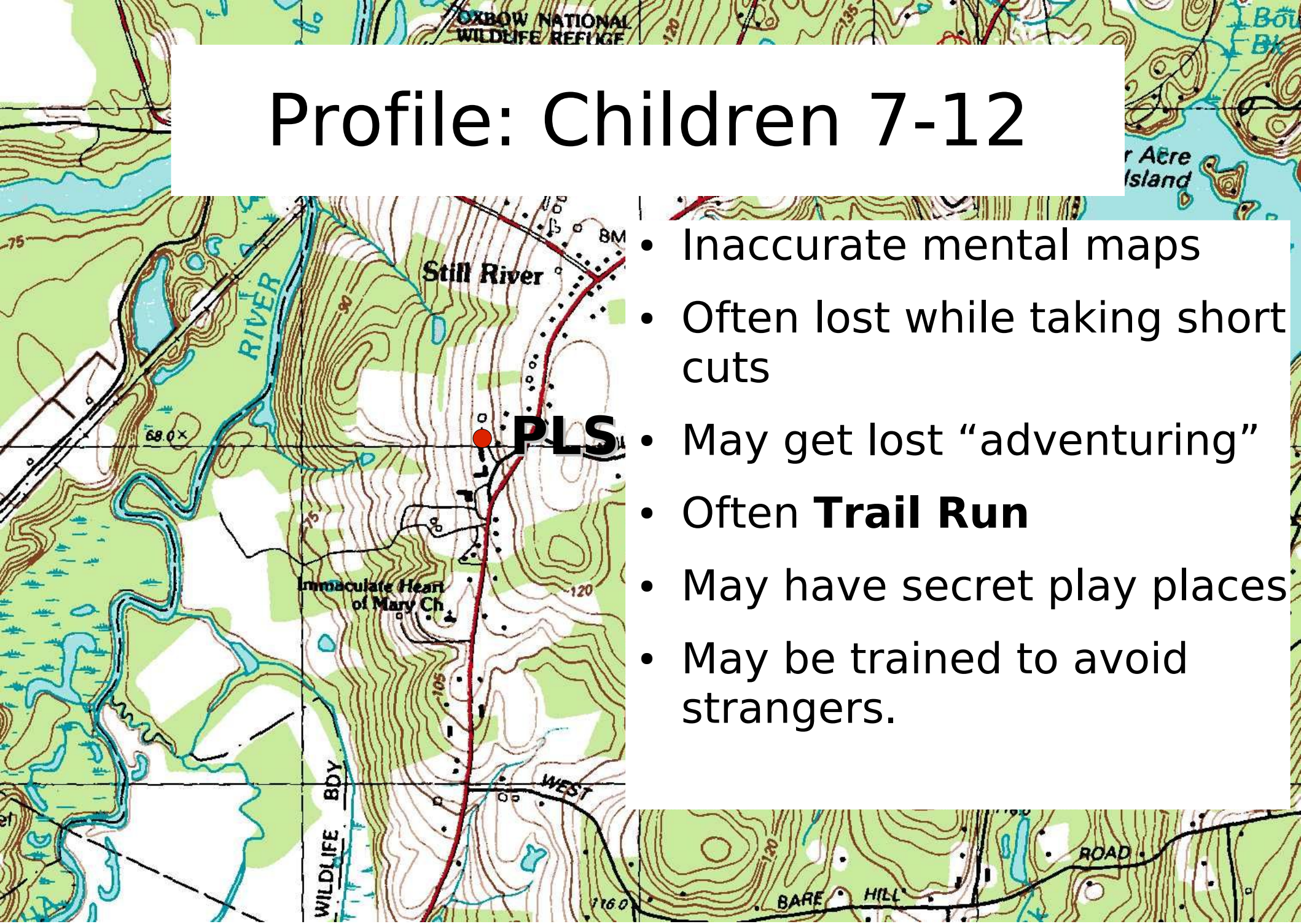
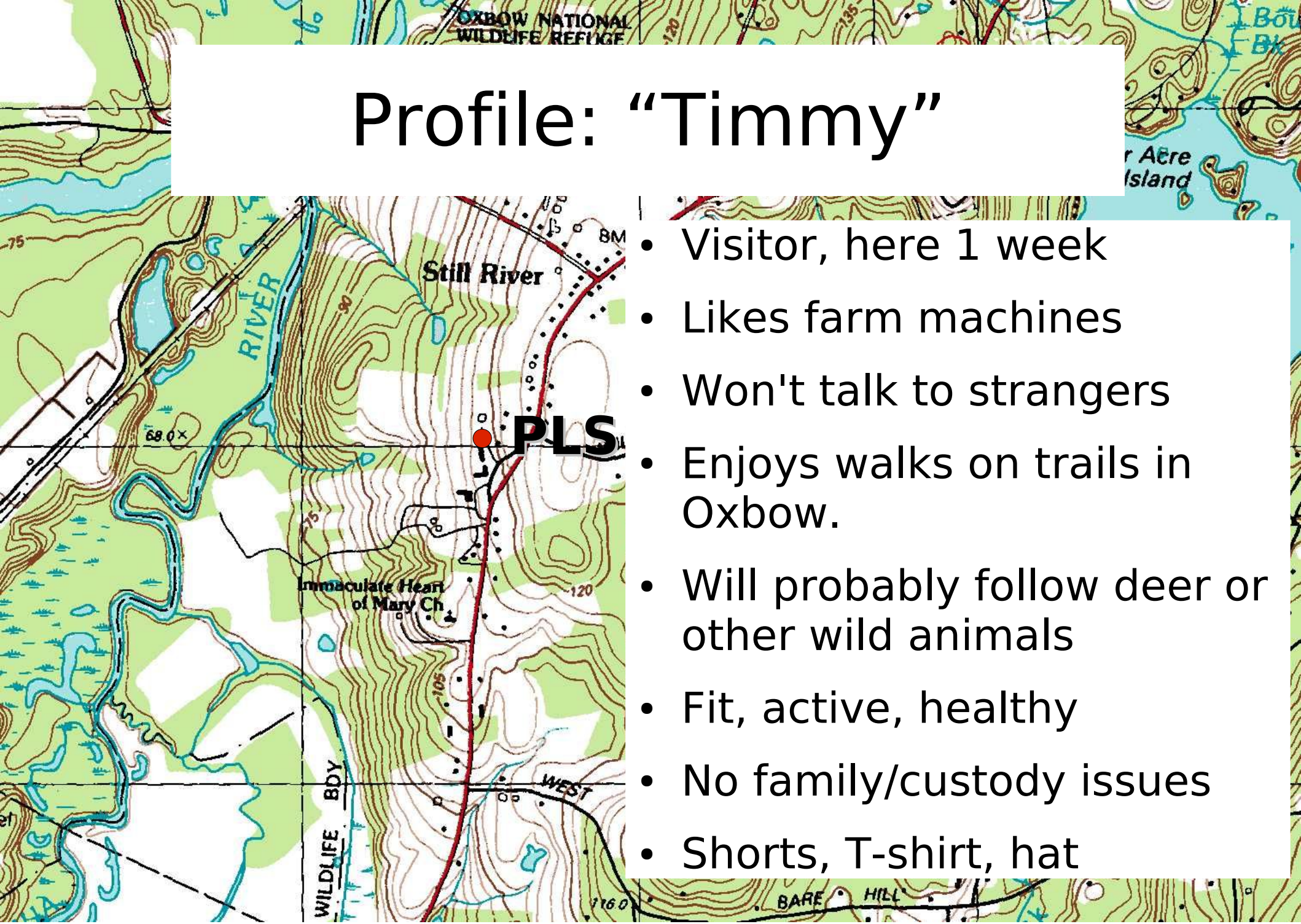
Everyone comes home safe.
PIO
Safety Officer
Liaison Officer
Objectives
Find out where to search.
Find out what clues to
look for.
Operations
Planning
Logistics
Finance/Admin
Investigation Unit
Interviewers
Situation Unit
Missing
Person
Questionnaire
What are the events
surrounding the
missing person's
dissapearance?
Timeline
Subject
Profile
What do we know
about the subject
that would tell
us where to look
and what to look
for?

# Profile: Children 7-12

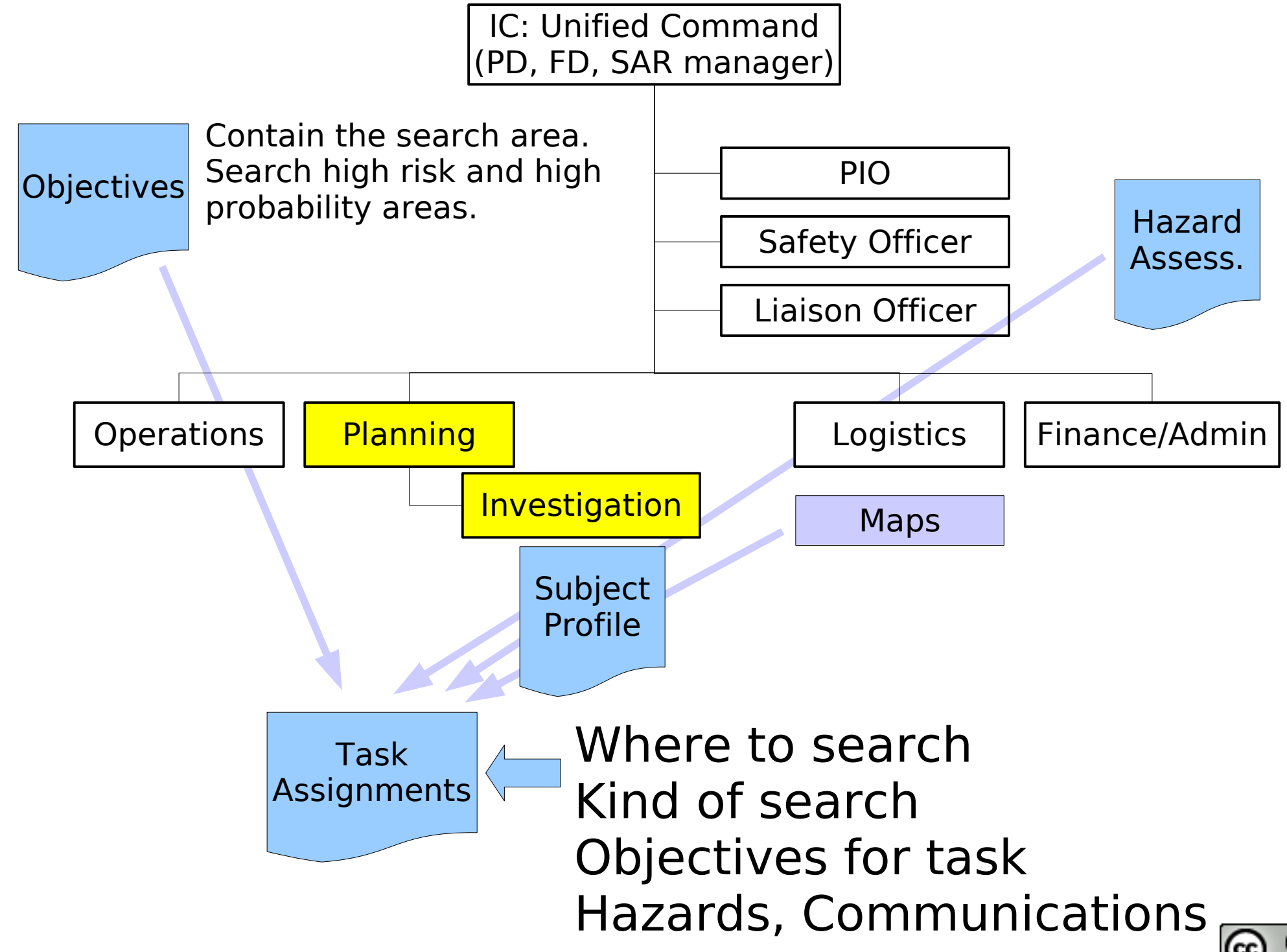



- Inaccurate mental maps
- Often lost while taking short cuts
- May get lost “adventuring”
- Often **Trail Run**
- May have secret play places
- May be trained to avoid strangers.

# Profile: “Timmy”




- Visitor, here 1 week
- Likes farm machines
- Won't talk to strangers
- Enjoys walks on trails in Oxbow.
- Will probably follow deer or other wild animals
- Fit, active, healthy
- No family/custody issues
- Shorts, T-shirt, hat

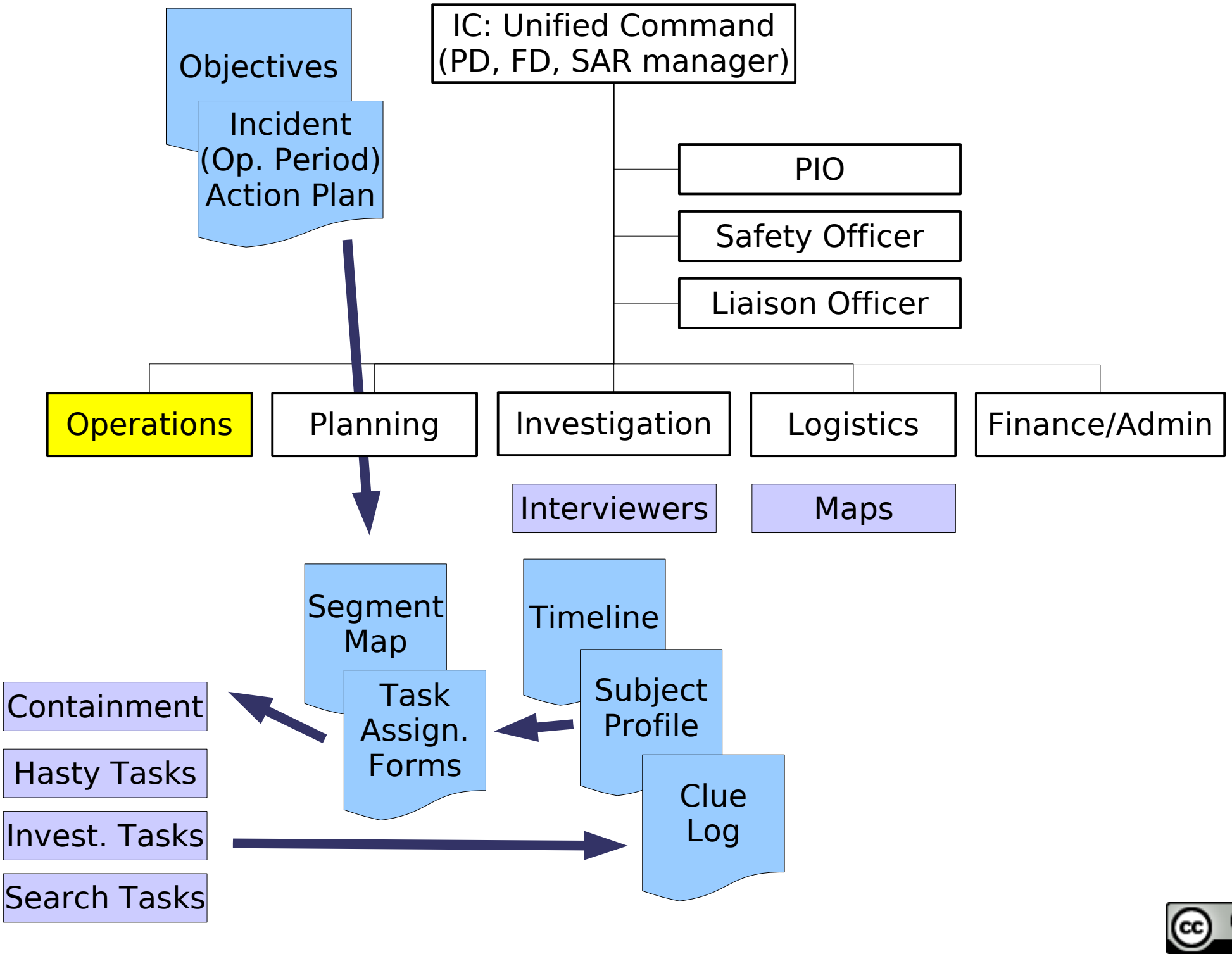

IC: Unified Command
(PD, FD, SAR manager)
Objectives
Contain the search area.
Search high risk and high probability areas.
PIO
Safety Officer
Liaison Officer
Hazard Assess.
Operations
Planning
Logistics
Finance/Admin
Investigation
Maps
Subject Profile
Task Assignments
Where to search
Kind of search
Objectives for task
Hazards, Communications


OXBOW NATIONAL WILDLIFE REFUGE
Camp Green Eyrie
Bellevue Cem
Four Acre Island
Pond
Still River
BM
126.5
RIVER
Ministers Island
Sheep Island
Hill
PLS
LAVE
H A R V
Immaculate Heart of Mary Ch
Bare
TAHANTO TRAIL ON POND
STATE ACCESS
TAHANTO
WEST
WILDLIFE BDY
ROAD
BARE HILL
75.5
68.0
116.0

# “Timmy”

- Visitor, here 1 week
- Likes farm machines
- Won't talk to strangers
- Enjoys walks on trails in Oxbow.
- Will probably follow deer or other wild animals
- Fit, active, healthy

- Inaccurate mental maps
- Often lost while taking short cuts
- May get lost “adventuring”
- Often **Trail Run**
- May have secret play places


Objectives
Incident (Op. Period) Action Plan
IC: Unified Command (PD, FD, SAR manager)
PIO
Safety Officer
Liaison Officer
Operations
Planning
Investigation
Logistics
Finance/Admin
Interviewers
Maps
Segment Map
Timeline
Task Assign. Forms
Subject Profile
Clue Log
Containment
Hasty Tasks
Invest. Tasks
Search Tasks

# Task Assignment Form Lifecycle

Operations

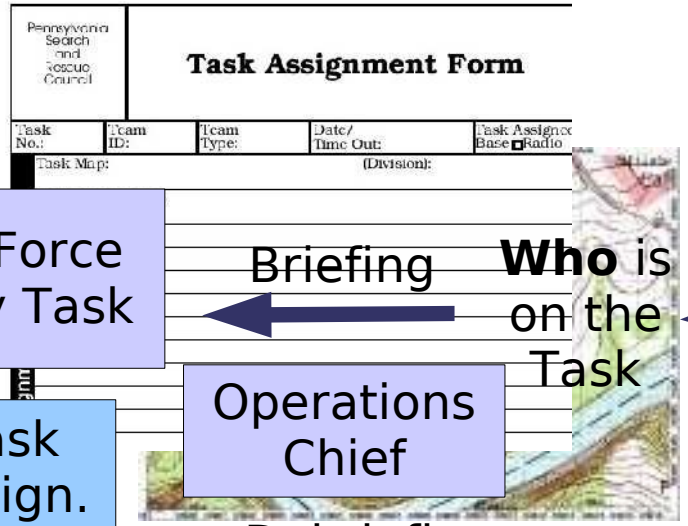
Planning

Investigation

**Where**
**Kind of Task**
**Objectives**
Hazards
Comms

SITSTAT

Clue Log




Task Force
Hasty Task

Briefing

**Who** is on the Task

Task Assign. Form

Operations Chief

Task Assign. Form

Debriefing

Safety Officer

Situation Unit Leader

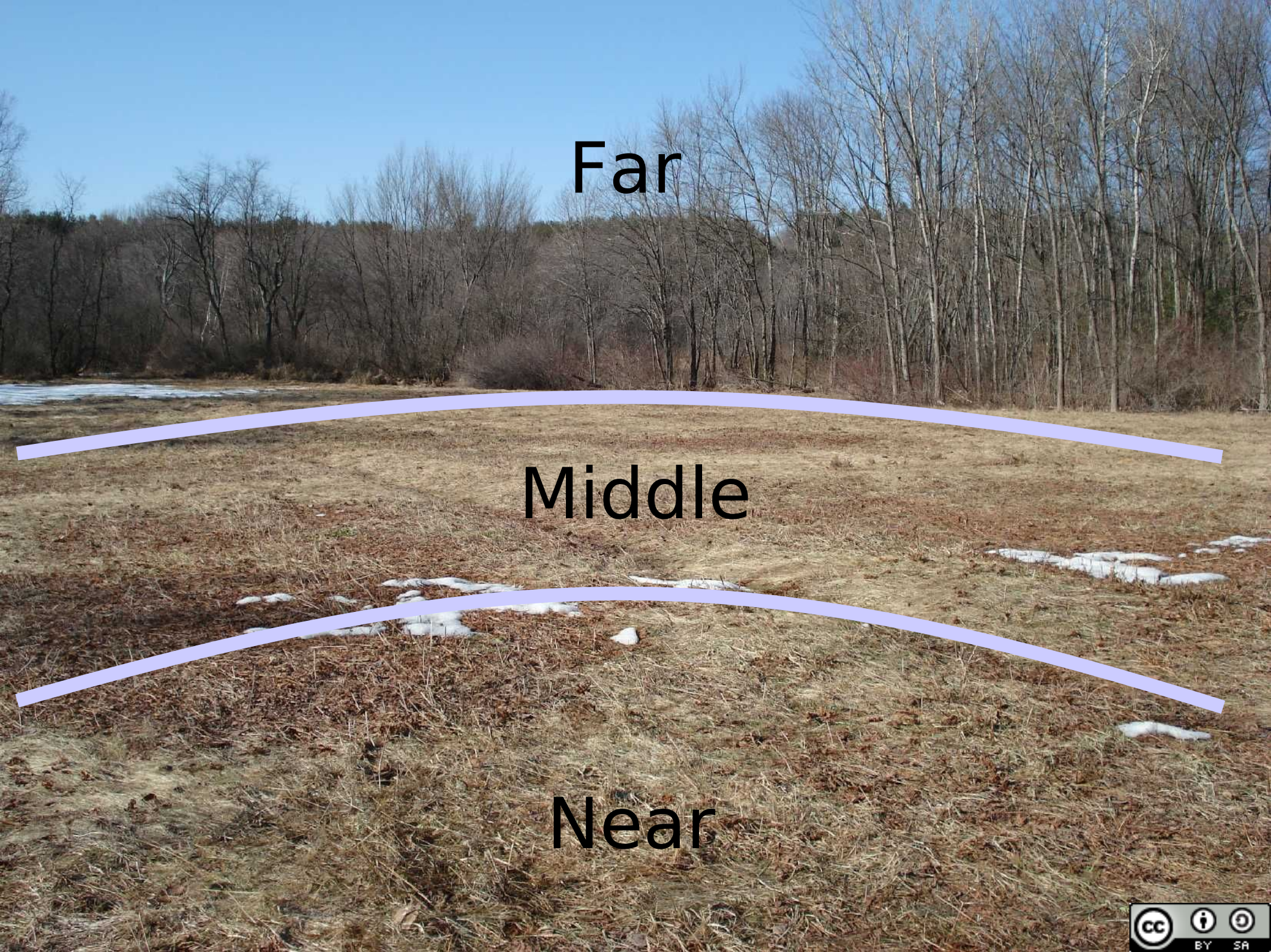
Task Assign. Form

Hazard Assess.

**Search Tactics**

**POD**


Task Force
1 Air Scent Canine + Handler
3 Clue Aware Searchers
(communications, navigation, medical)


Far
Middle
Near


Look Through Things


Look UP

Look Back

# Watch for Track Traps

# Clue Awareness

- Observe Clues
- Protect Clues: Flag, don't touch, call in.

# Grid search as a last resort

# Initial Search Tactics

- Active
  - Investigation
  - Hasty tasks
  - [Attraction]
- Passive
  - Confinement

# Progressing to:

- Active
  - Investigation
  - Efficient Tasks
  - [Attraction]
- Passive
  - Confinement

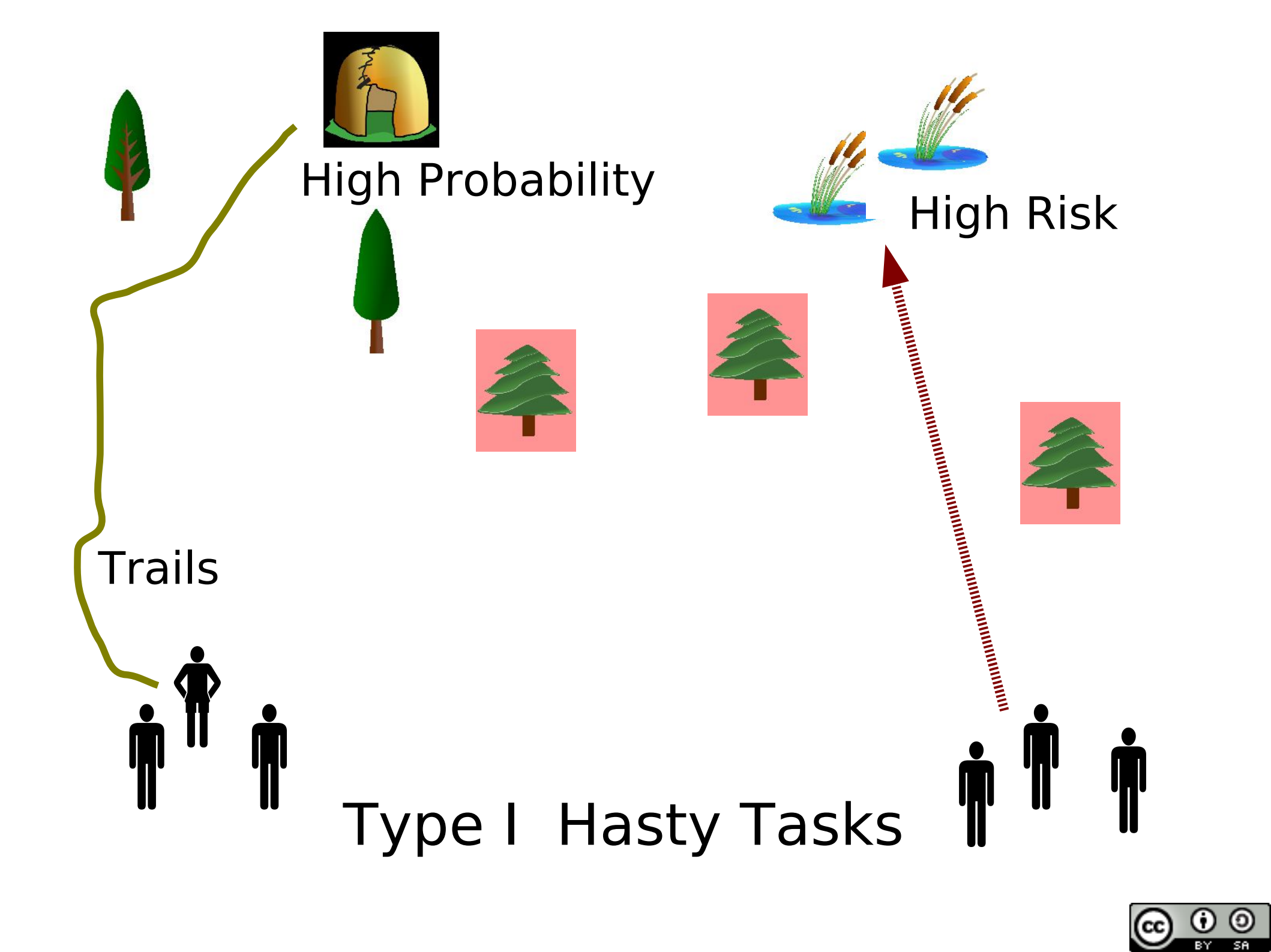
# Types of Ground Search

- **Type I**
  - Hasty tasks: speed – trails, high probability and high risk areas.
- **Type II**
  - Small teams, loose grid - efficiency
  - Clue finders with critical separation
- Type III
  - Grid search – Thorough, slow, **destructive**
- Type IV
  - Evidence Search

# Type I – Hasty Tasks

- Emphasis: Speed
- Check areas of:
  - high probability

    and
  - high risk
- Small, Fast moving, clue aware teams.
- Detect & Preserve Clues


High Probability
High Risk
Trails
Type I Hasty Tasks

# Type II search







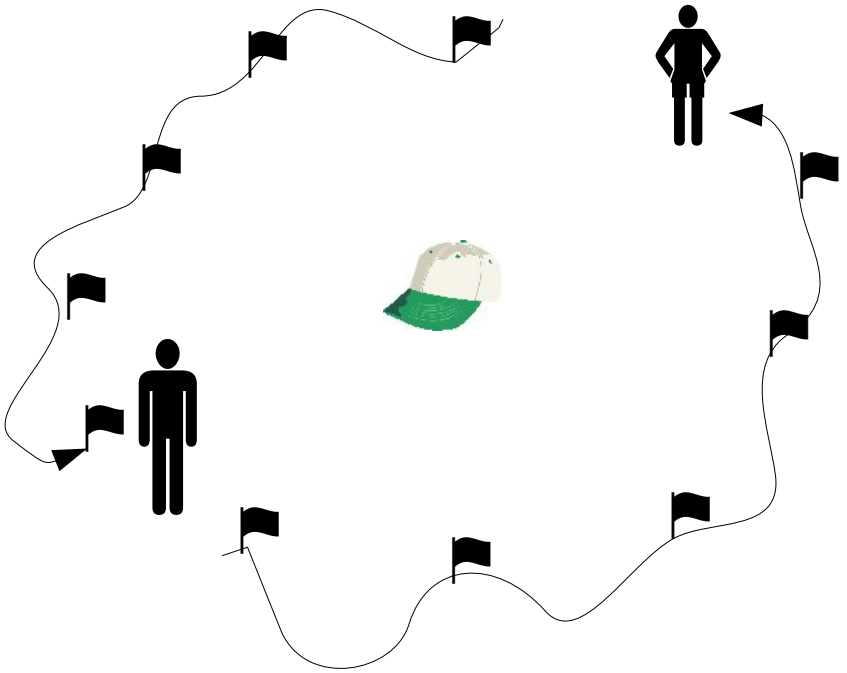
- Emphasis: Efficiency

Type II Grid

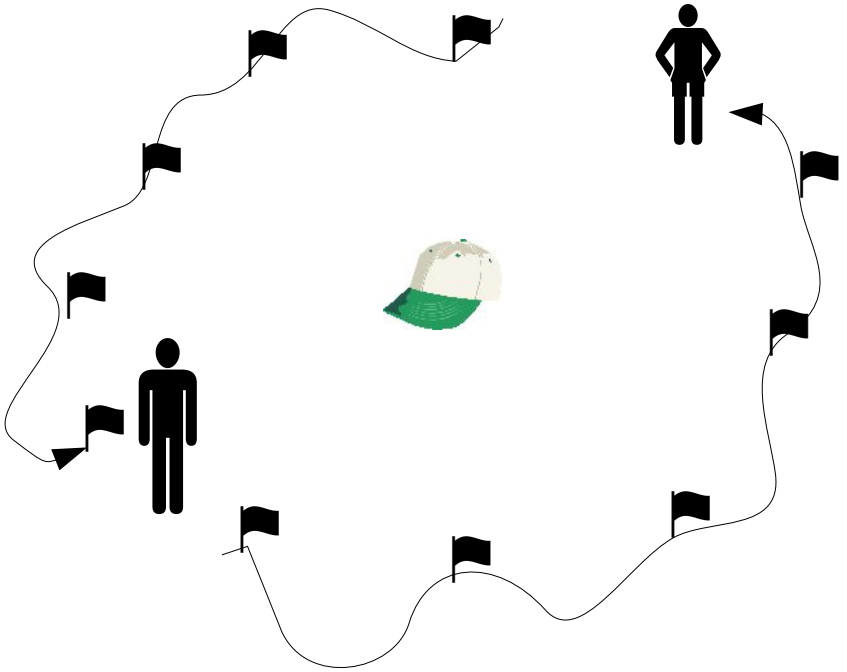
# Critical Separation Distance

- How far apart do you place searchers in a Type II search?

## Northumbrian Rain Dance

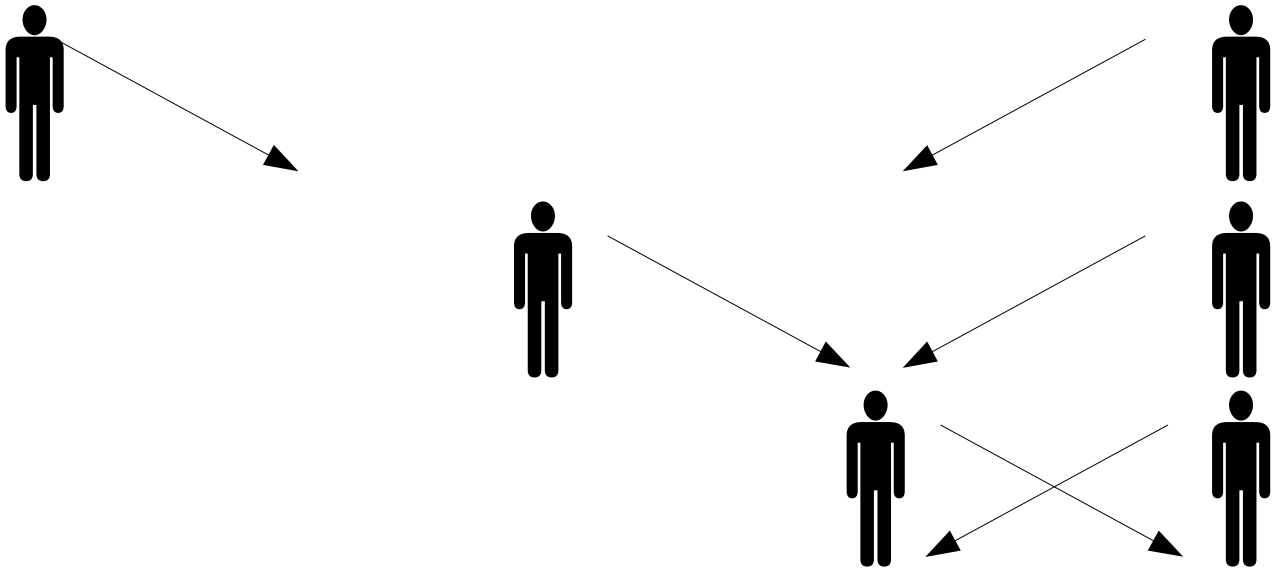


# Critical Separation Distance



POD

1 Critical Separation



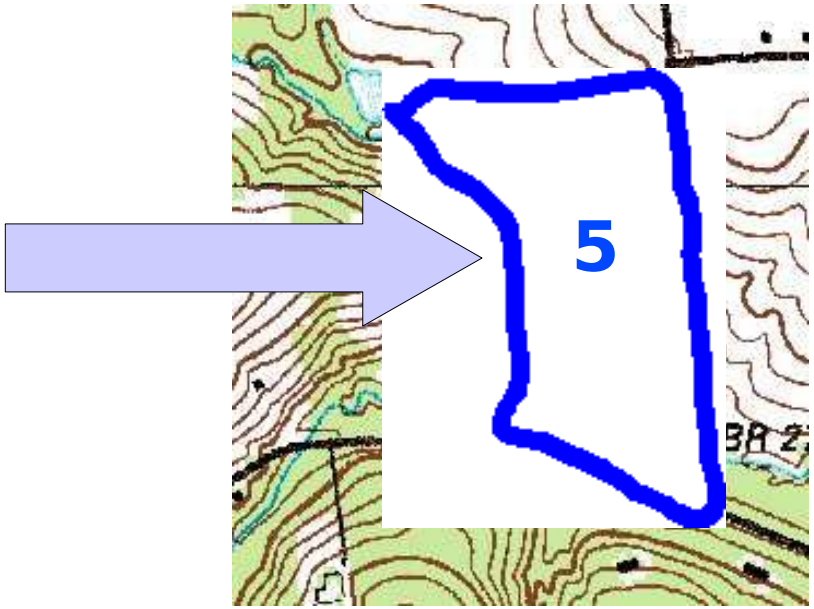
~25%

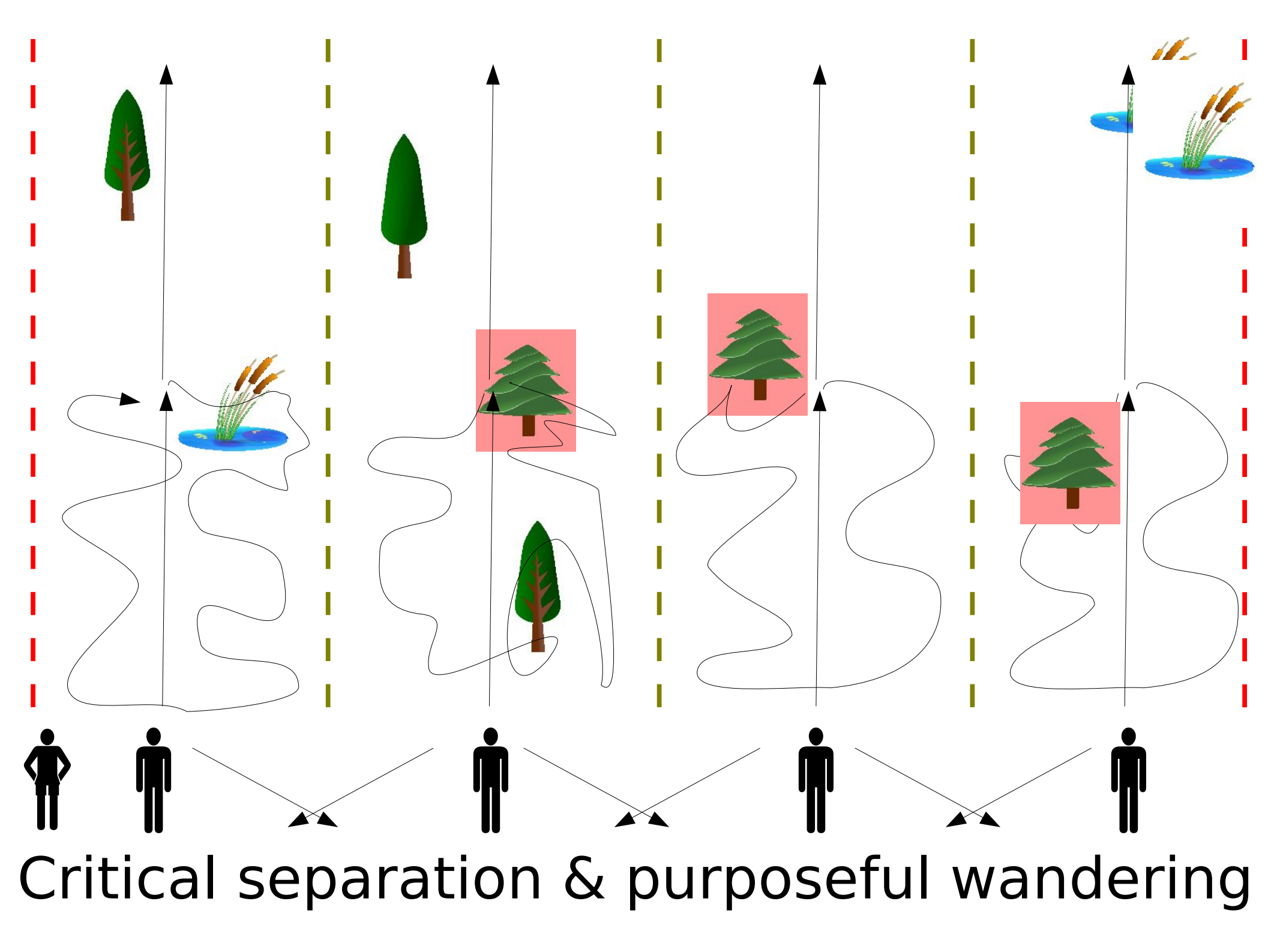
~50%

~80%

# POD

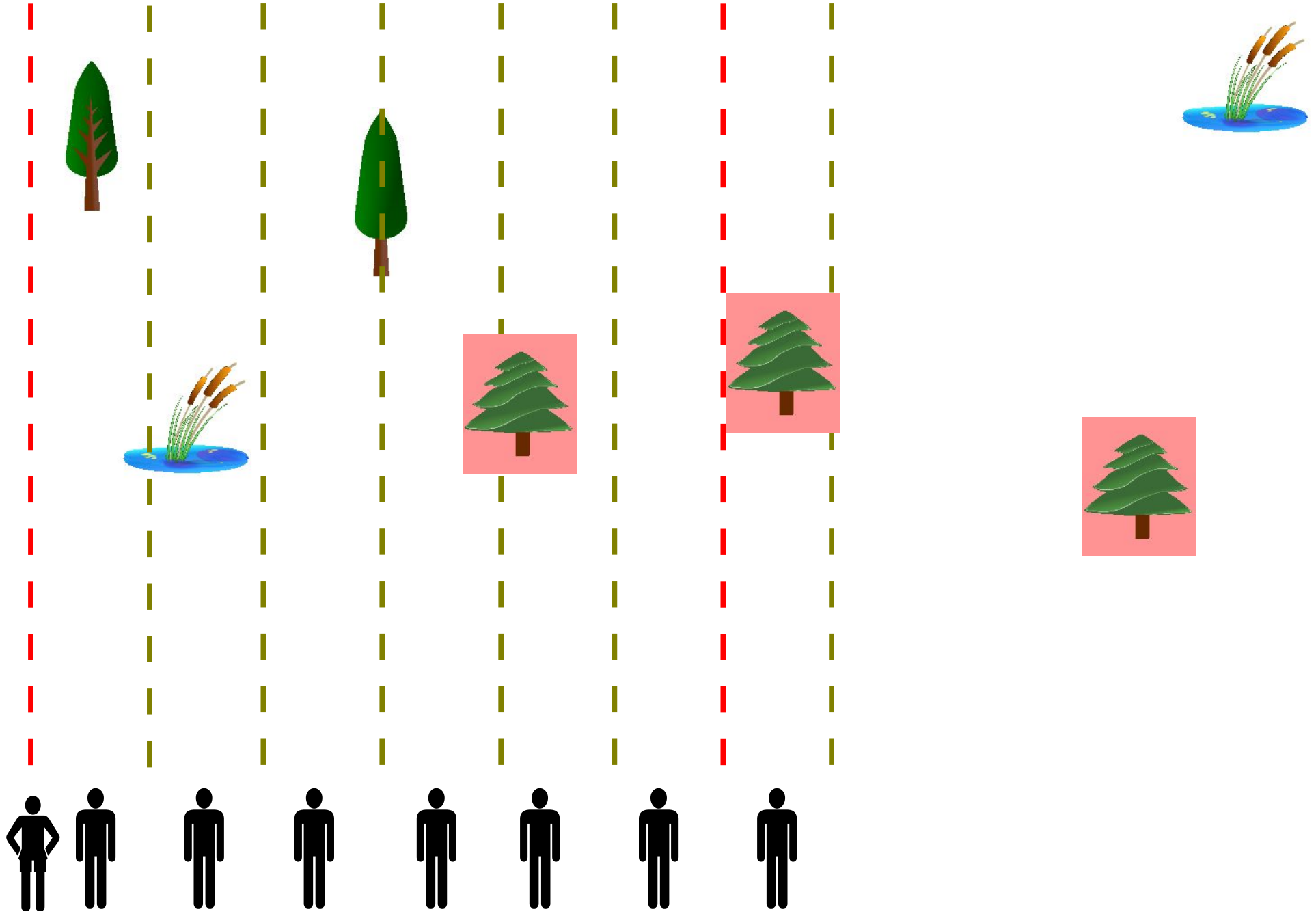
- Apply some sensor to some search segment
- The sensor (task team) estimates its Probability Of Detection for the subject in that segment.



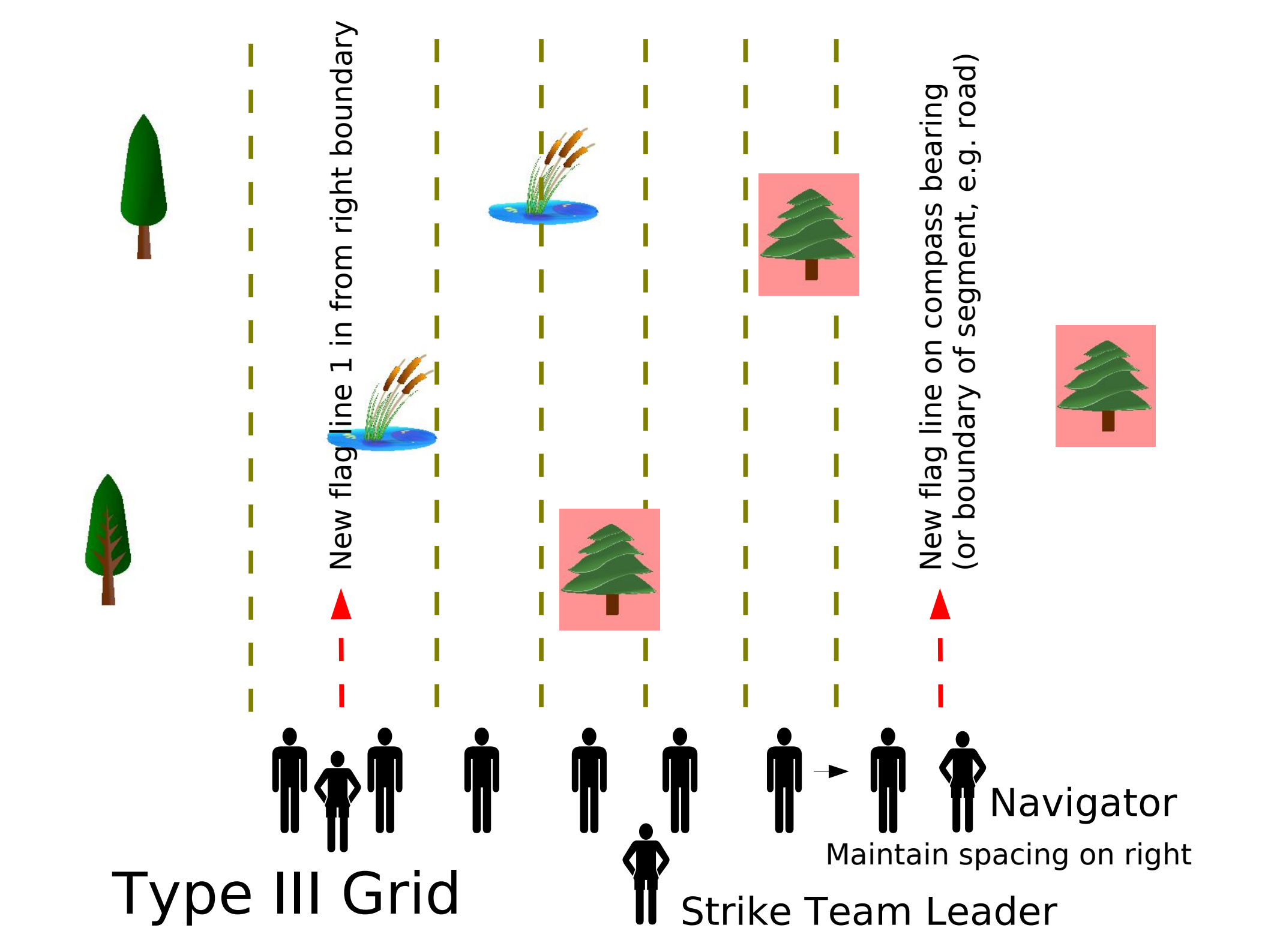

Critical separation & purposeful wandering

# Search Crucials

- Search is an Emergency
- Search is a classic mystery
- Search for clues not just the subject
- Know if the subject leaves the search area
- **Grid search as a last resort**
- Manage by objectives
- (Search management is information management)



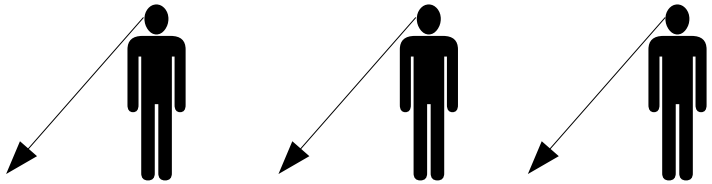
Type III (Line Search / Grid Search)

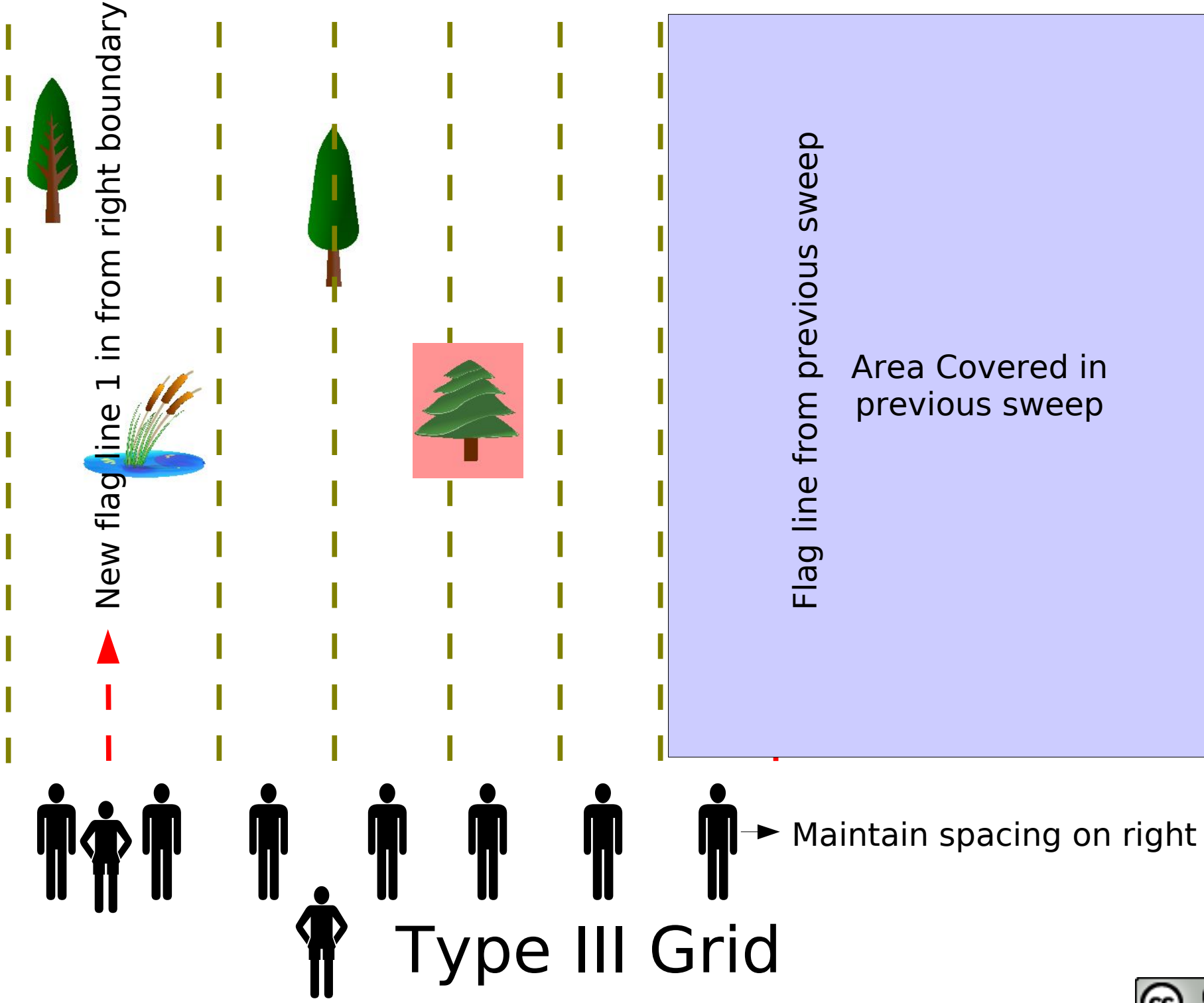


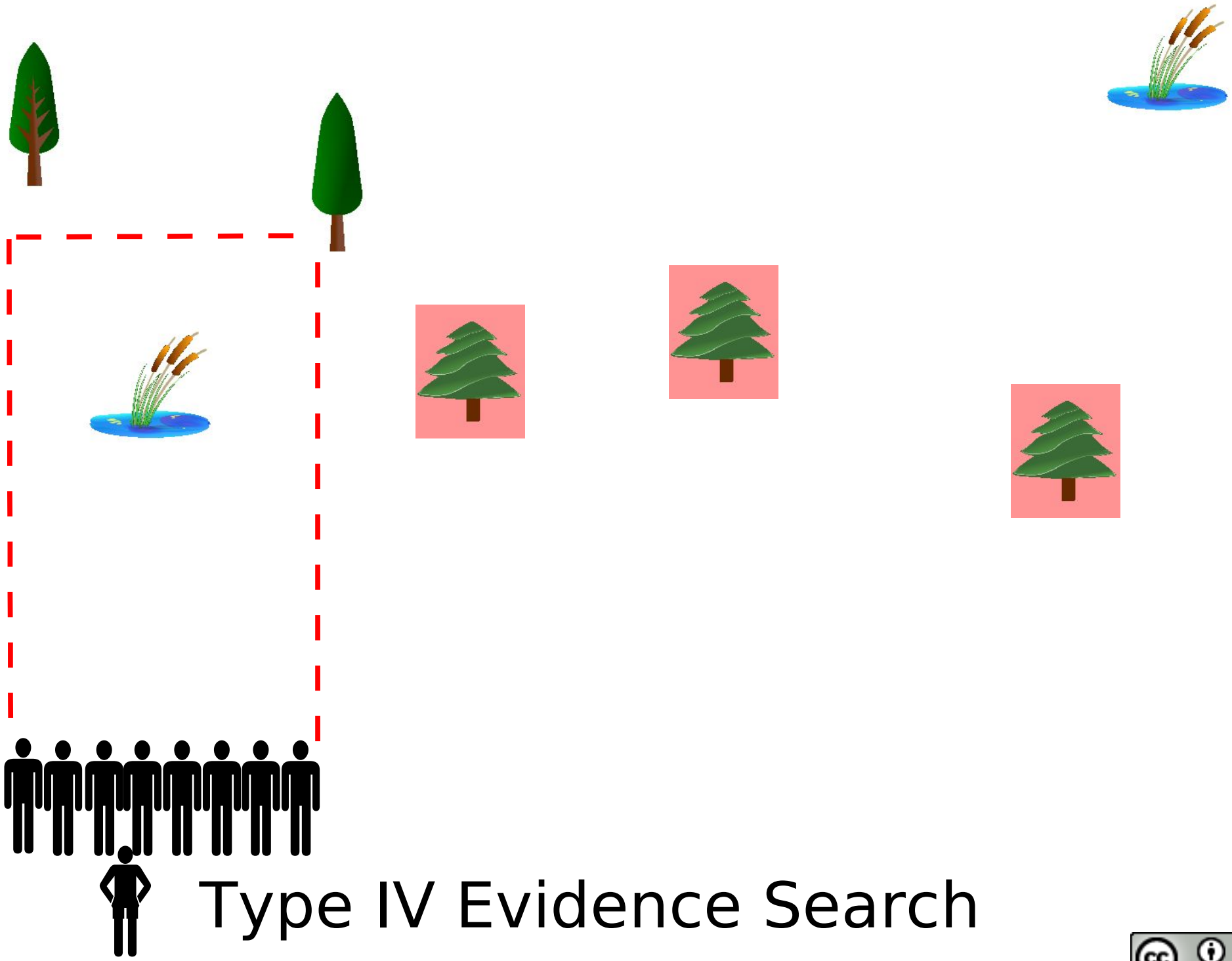

# Type III Grid

# Type III Grid Commands

- Stop
- Look Up, Look Down
- Look Left, Look Right
- Turn Around and Look Behind you
- Look Up, Look Down
- Look Left, Look Right
- Turn Around
- Advance




New flag line 1 in from right boundary
Flag line from previous sweep
Area Covered in previous sweep
Maintain spacing on right
Type III Grid



# Type IV Evidence Search

# Canine Task

# Working with a Canine Task

Canine

Handler

Other Task Force Members

(Communications, Navigation, Tracking)
All observe for clues

Keep Behind the Handler.
Follow the Handler's instructions.

Don't pet, feed, or play with the dog.

# The dog may check your scent

Don't pay the dog any particular attention. Follow the Handler's Instructions



Handler

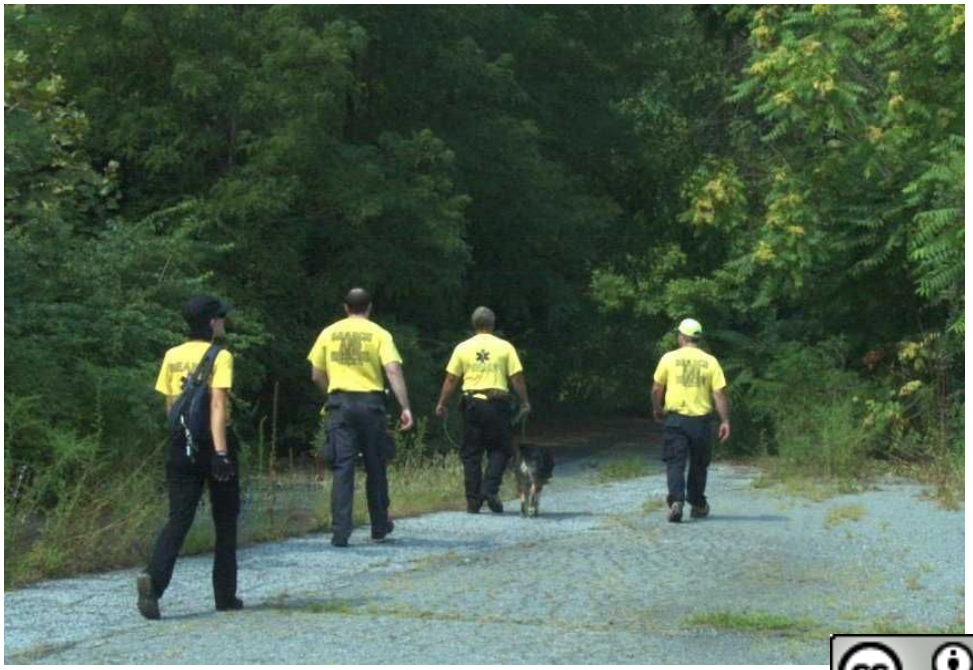
Other Task Team Members

Keep Behind Handler

# Core Land SAR Field Skills

- Land Navigation
- Seeing and Observing
- Evidence Handling
- Wilderness Foot Travel (and fitness)
- Observing and Managing Environmental Hazards

# Clothing









# Equipment

# Missing Person Response

- Initial Response (Reflex Tasks) ~3 hours
  - Secure PLS
  - Confinement, Investigation, Hasty tasks
  - Search High Probability and High Risk areas
- First operational period
  - Investigation, Hasty Tasks, Efficient tasks
  - Trackers, Dogs, Trained ground searchers
- Subsequent operational periods
  - Investigation, Efficient tasks
  - shift to Thorough tasks

# Some Sources/References

- Emergency Response International
  - Search is An Emergency - A text for managing search operations
  - Basic Search and Rescue Skills – A practitioners guide to search and rescue
- National Association for Search And Rescue
  - Introduction to Search and Rescue
  - Managing the Lost Person Incident
- The Center for Search Research (UK)
  - Field Search Skills
- Emergency Management Australia
  - Land Search Operations
- Report of the review panel concerning the disappearance and deaths of three young boys in East Camden June 22-24,2005
- Open Clip Art http://www.openclipart.org


XASTIR Map of 19T 0287680 4706687 (upper left) to 19T 0289003 4705648 (lower right). UTM 100 m grid, WGS84 datum.
RANGE SCALE 1/4 mi
1000 ft
19T
02877
02878
02879
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02885
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02888
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47066
47065
47064
47063
47062
47061
47060
47059
47058
47057


XASTIR Map of 19T 0285309 4708993 (upper left) to 19T 0290564 4705175 (lower right). UTM 1000 m grid, WGS84 datum.
Harvard
Harvard
Center Cem
Bromfield High Sch
Camp Green Eyrie
Bellevue Cem
Four Acre Island
Pond
Ministers Island
Sheep Island
Hill
Bare
H A R V A R D
MASSACHUSETTS ROAD
OAK HILL RD
WARREN AVE
SLOUGH
STOW
MURRAYS
WORCESTER CO
MIDDLESEX CO
ROAD
BARE HILL
WOODSIDE
ROAD
Gravel Pits
BM 83.6
Brook
Meadows
19T
0286
0287
0288
0289
0290
4708
4707
4706


XASTIR Map of 19T 0283519 4707892 (upper left) to 19T 0285169 4706510 (lower right). UTM 100 m grid, WGS84 datum.
RANGE SCALE 1/4 mi
1000 ft
47077
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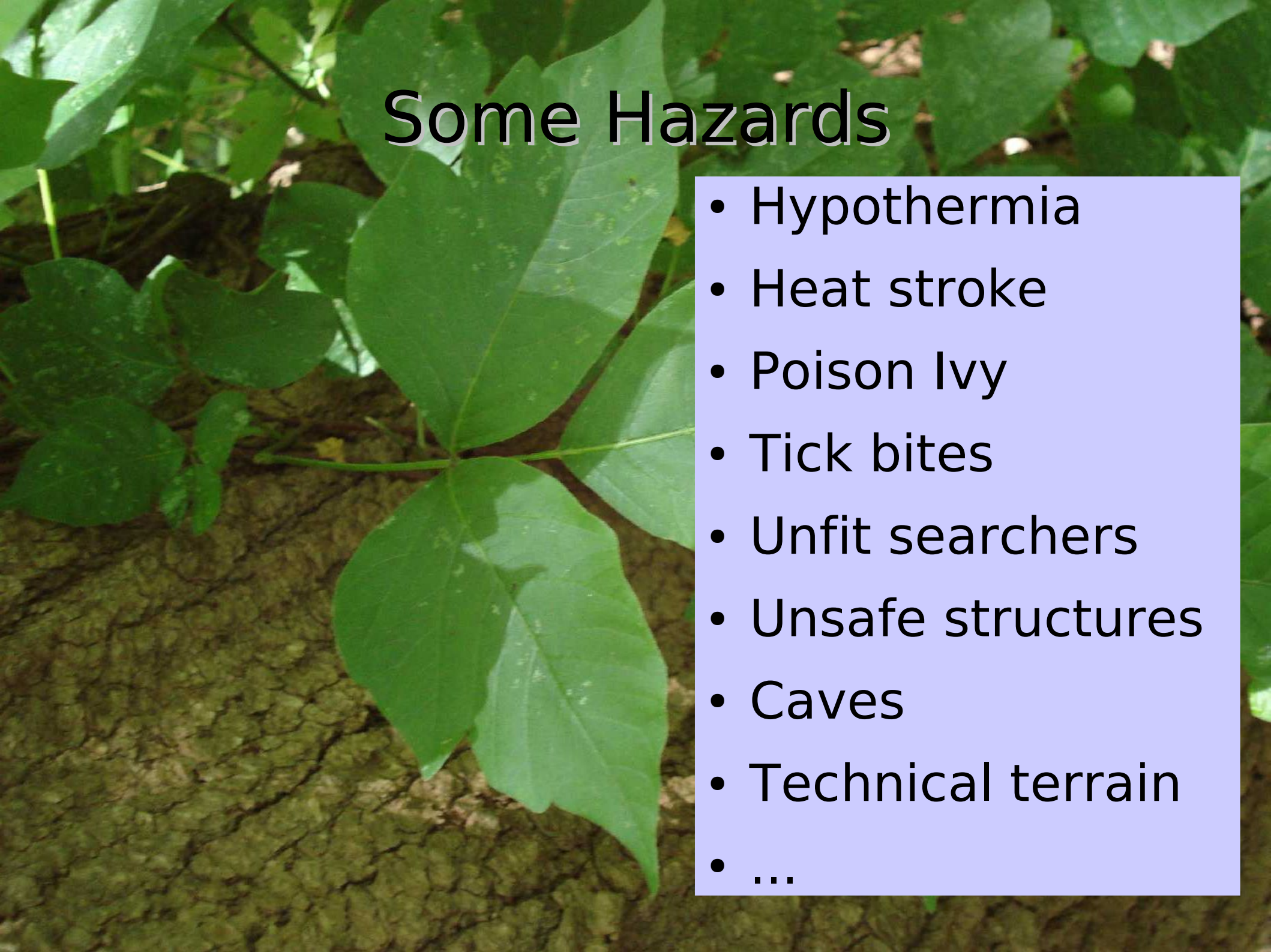


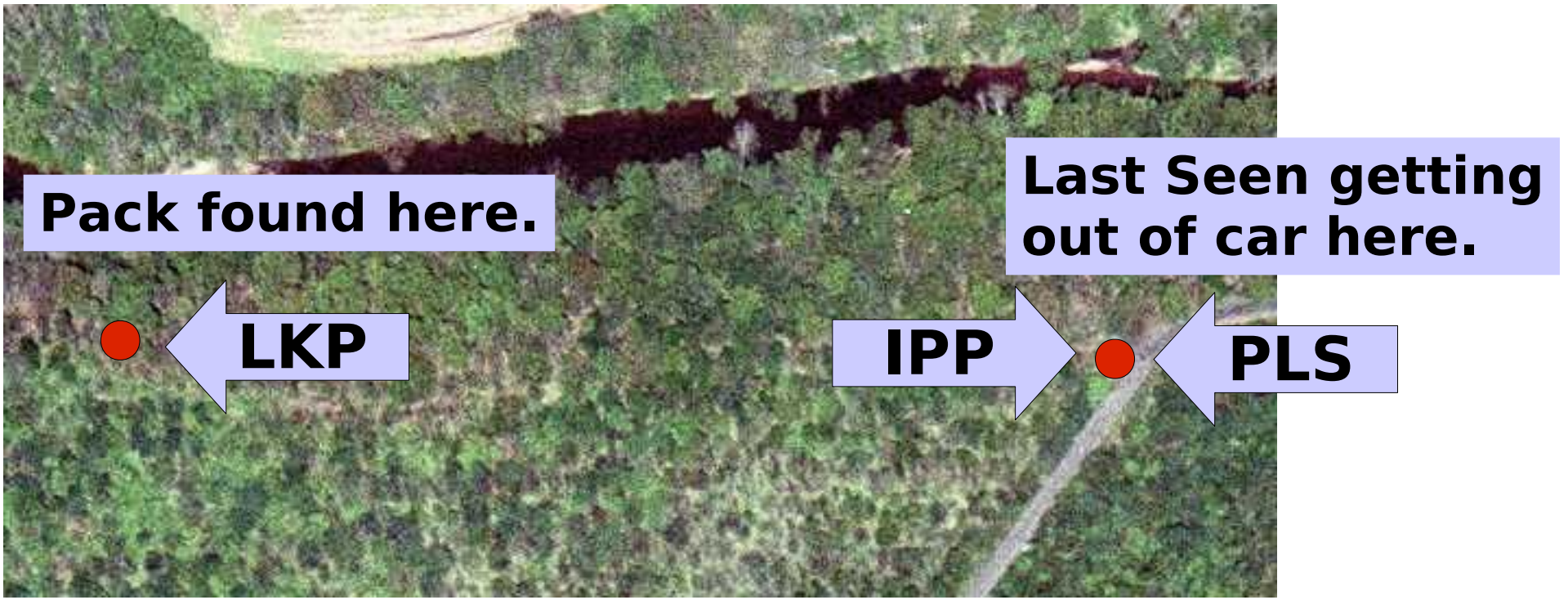
# Some Hazards

- Hypothermia
- Heat stroke
- Poison Ivy
- Tick bites
- Unfit searchers
- Unsafe structures
- Caves
- Technical terrain
- …

# Manage by Objectives

- Initial Response (Reflex Tasks)
  - Objective: Find Clues
  - Objective: High Risk and High Probability
  - Objective: Limit the search area
  - Investigation, Hasty Tasks, Confinement
- First operational Period
  - Objective: Efficient search of high probability areas
  - Objective: Find Clues
  - Investigation, Hasty and Efficient Tasks

- **PLS**: Point Last Seen
- **IPP**: Initial Planning Point
- **LKP**: Last Known Point



# Probabilities

- **POD** - Probability of Detection
- Application of a sensor (a task team) to a search segment has some probability of finding clues or the subject.
- **POA** – Probability of area
- Probability that the subject is in a particular search segment.
- Different sensors with known PODs are repeatedly applied to each search segment, decreasing the POA of each.

# Introducing crucial elements of Ground Search and Rescue for first responding field searchers

Paul J. Morris
Harvard Fire Department
Massachusetts Rescue And Recovery K9 Unit





Title: Introducing crucial elements of Ground Search and Rescue for first responding field searchers.

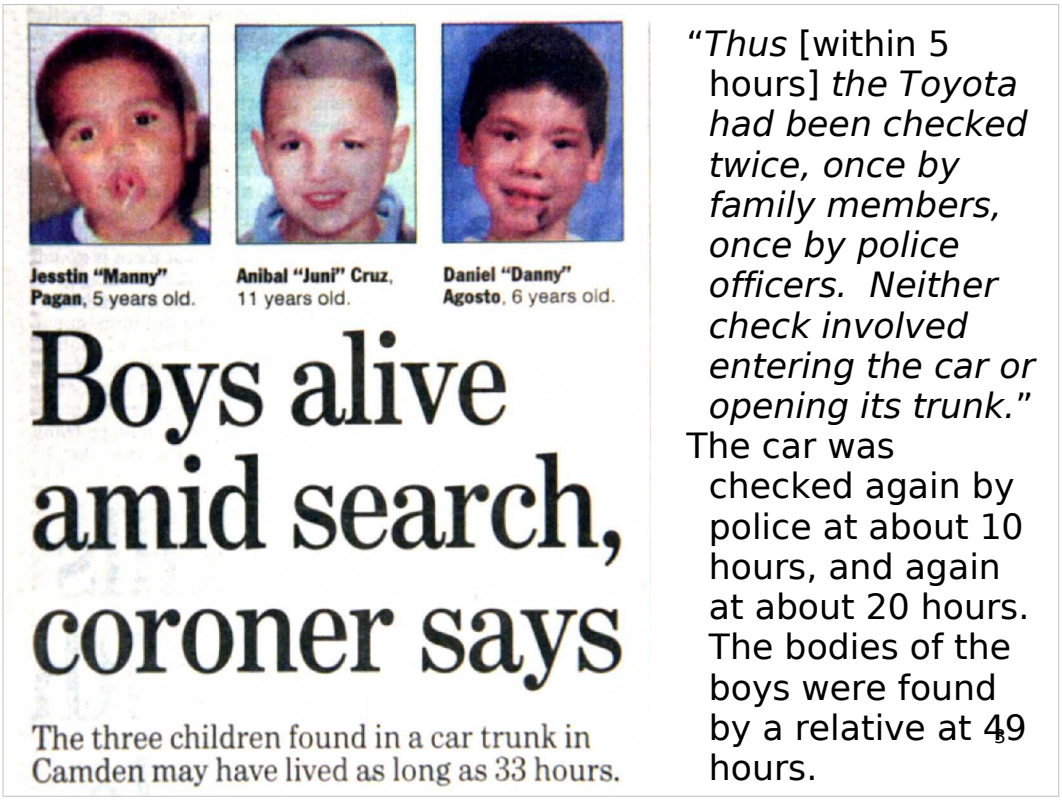
USE AT YOUR OWN RISK

While this presentation is an introduction to aspects of Search and Rescue activities it does not provides enough information to properly prepare a person for SAR operations.

Substantial additional reading and training are required.

Opinions presented here are the author's alone.


SEARCH
RESCUE



Jesstin "Manny" Pagan, 5 years old. Anibal "Juni" Cruz, 11 years old. Daniel "Danny" Agosto, 6 years old.

# Boys alive amid search, coroner says

The three children found in a car trunk in Camden may have lived as long as 33 hours.

"*Thus* [within 5 hours] *the Toyota had been checked twice, once by family members, once by police officers. Neither check involved entering the car or opening its trunk.*" The car was checked again by police at about 10 hours, and again at about 20 hours. The bodies of the boys were found by a relative at 49 hours.

2005. Camden, New Jersey.

Quote from page 5 of Lynch, J.P., M. Kantner, E. Hargis, 2005. Report of the review panel concerning the disappearance and deaths of three young boys in East Camden June 22-24,2005. 28pp.

News clipping: Philadelphia Inquirer 2007 June 27.

# Missing Person Response

- Preplanning
- Notification
- Initial Response (Reflex Tasks) ~3 hours
- First operational period
- Subsequent operational periods
- Suspension
- Critique



Focus for this talk – actions to take in the first three hours or so of a search, setting the framework for the first full operational period

# Search Crucials

- Search is an Emergency
- Search is a classic mystery
- Search for clues not just the subject
- Know if the subject leaves the search area
- Grid search as a last resort
- Manage by objectives
- (Search management is information management)



The Search Crucials framework underlies the ERI Search and Rescue Texts.

# Search is an Emergency

- Respond urgently
- Contain the search area
- Don't Stop at Night
- Mobilize trained search resources
- Search areas of high risk and high probability (hasty tasks) first

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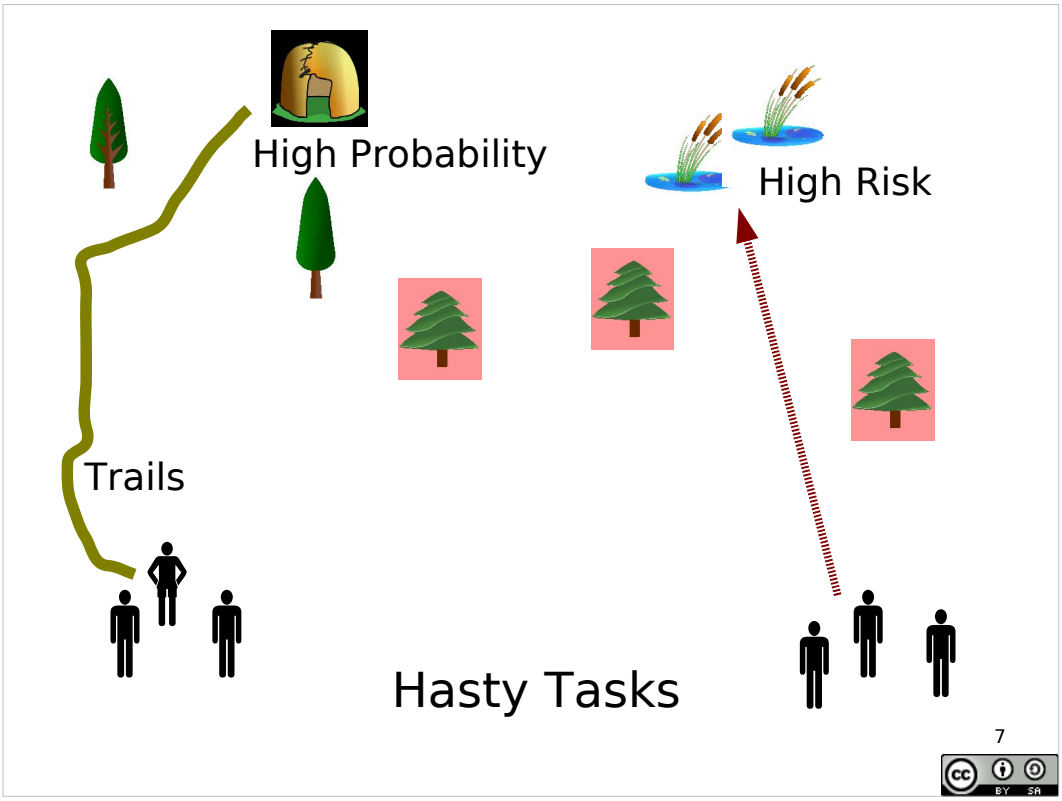
Three key implications of search as an emergency: contain the search area,  search day and night (as safe), get help: trained sensors (air scent dogs, tracking dogs, man trackers, ground searchers) and search managers.




Type I tasks – search areas of high risk and high probability

Plenty of high risk areas around.

## Search is a classic mystery

- Investigation
  - Interviews
  - Timeline of events
  - Subject Profile
- What clues to look for (search data)?
  - Clothing, equipment, litter (candy, gum, etc.)
  - Name, Description, footprint, scent articles
- What places to look (planning data)?
  - Where was the subject last?
  - What were they doing?



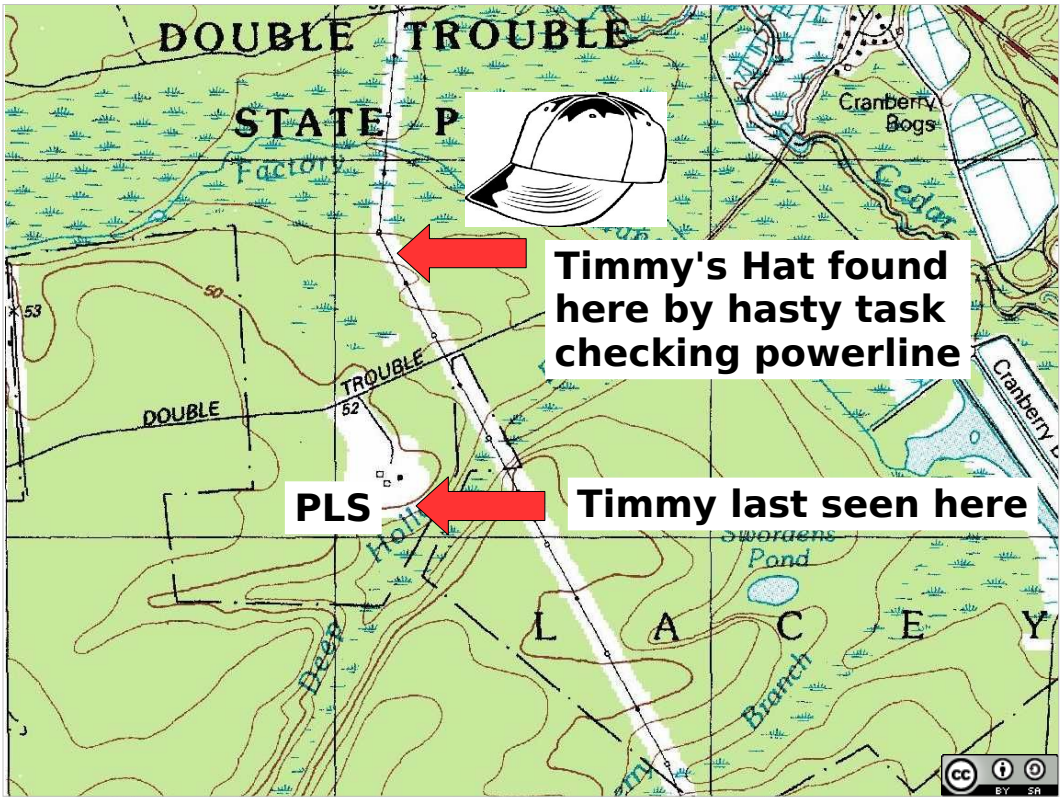
Investigation is essential in SAR.

Investigation produces search data (descriptions of what the searchers are looking for – both the missing person(s) and clues).

Investigation also produces planning data (information about where to look and what tactics to employ in the search).

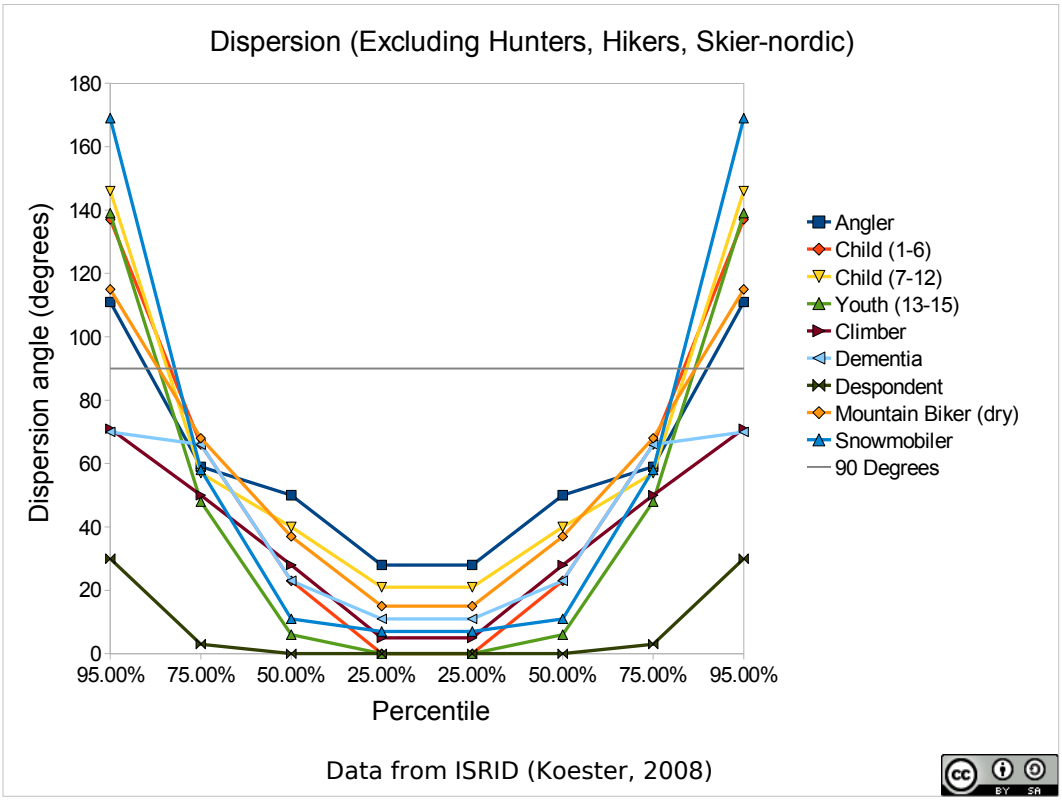
# Search for Clues not just the Subject

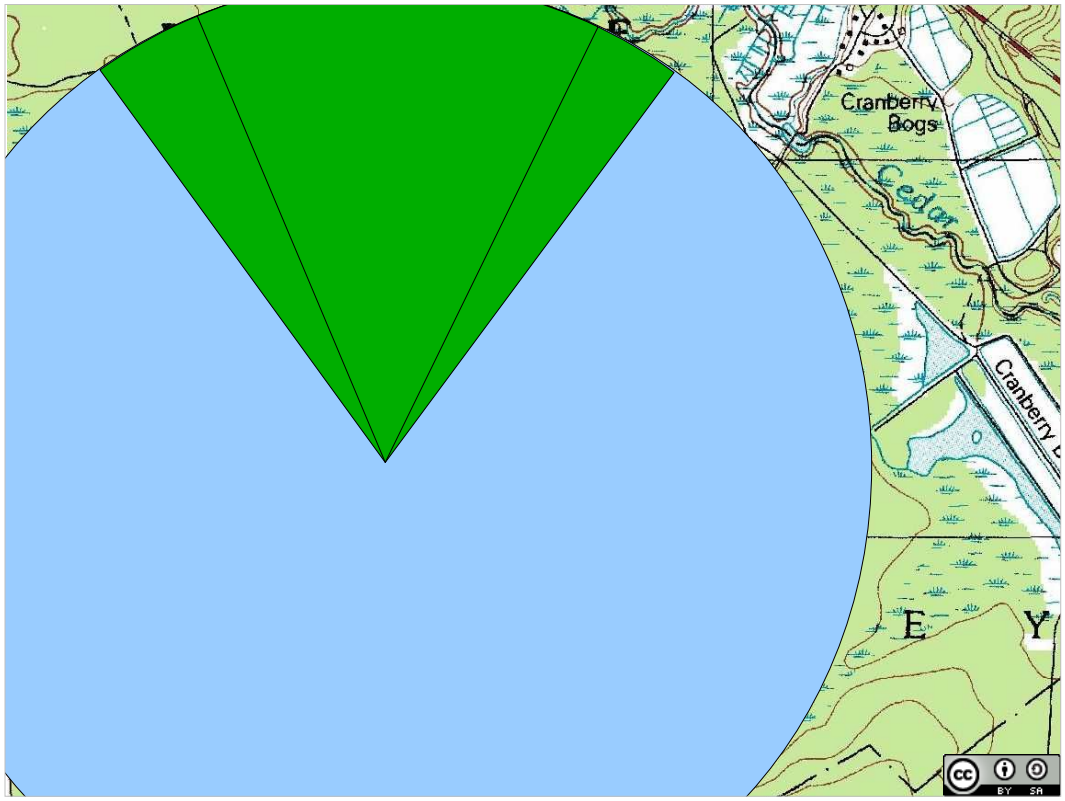
- One subject, many  clues
  - Around 3000 clues per mile when walking [Mantrackers]
  - Scent plumes [Air scent dogs, Tracking Dogs]
  - Dropped articles [Clue aware searchers]
- Clues can give:
  - Direction of travel
  - New last known points
  - Shift of priorities of areas to search




Detecting a clue can indicate a direction of travel and can suggest areas on which to focus search efforts.

[Hypothetical example, Double Trouble State Park, NJ]


Dispersion (Excluding Hunters, Hikers, Skier-nordic)
Dispersion angle (degrees)
180
160
140
120
100
80
60
40
20
0
95.00%
75.00%
50.00%
25.00%
25.00%
50.00%
75.00%
95.00%
Percentile
Angler
Child (1-6)
Child (7-12)
Youth (13-15)
Climber
Dementia
Despondent
Mountain Biker (dry)
Snowmobiler
90 Degrees
Data from ISRID (Koester, 2008)




Detecting a clue can indicate a direction of travel and can suggest areas on which to focus search efforts.

[Hypothetical example, Double Trouble State Park, NJ]


Without investigation, you won't know.

## Search for Clues not just the Subject

- Use Clue aware search resources
- Secure the PLS
- Secure scent articles


- Investigation and Interviews

Search Data: What clues do we look for?
What things t ...s?

15



Trained, clue aware search resources (trained ground searchers, canines, equines) are sensors for both clues and the missing subject.

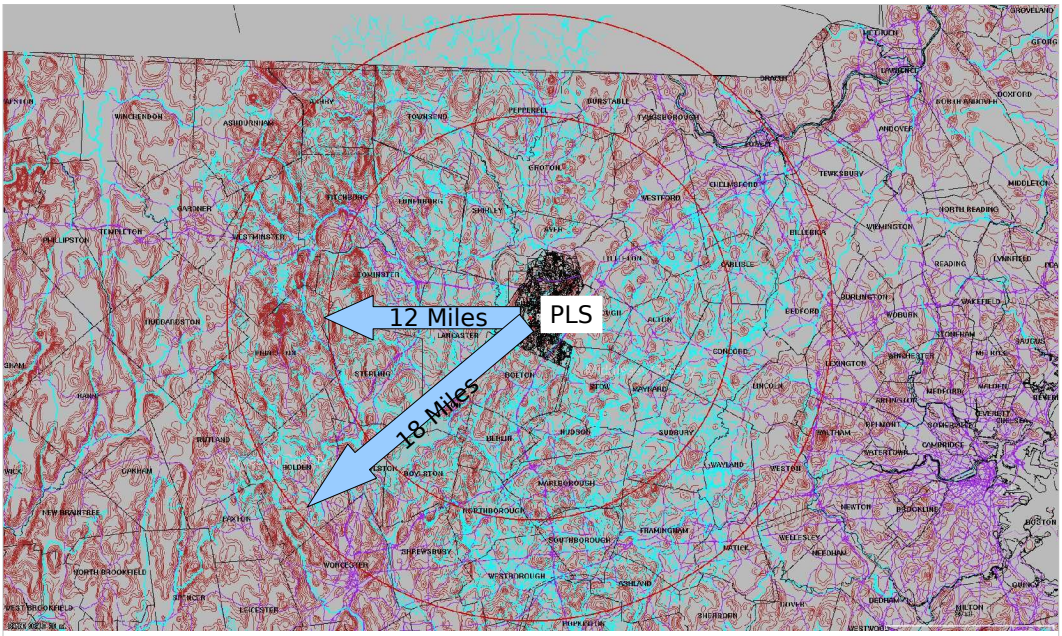
Untrained searchers are subject-only detectors and are likely to both not observe and destroy clues.

The search data produced from investigation and interviews are crucial for determining if random objects encountered by searchers are clues – especially so in urban, suburban, and rural environments, less so in wilderness.

# Know if the Subject leaves the search area

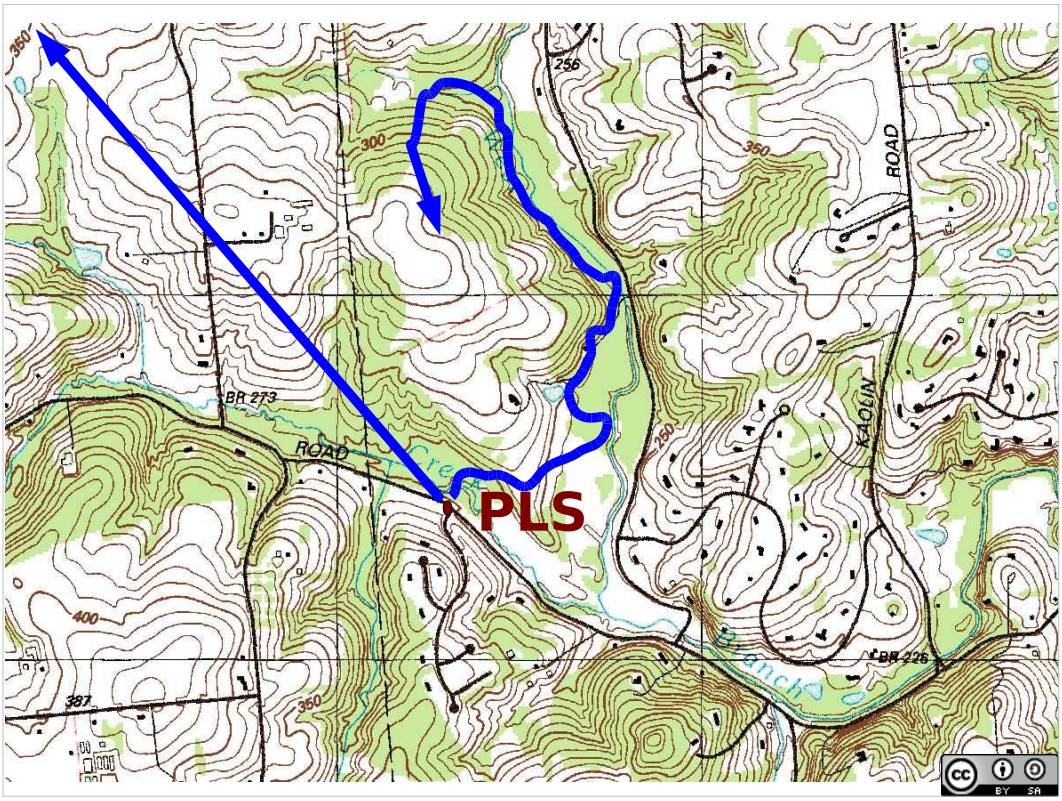
# Confinement





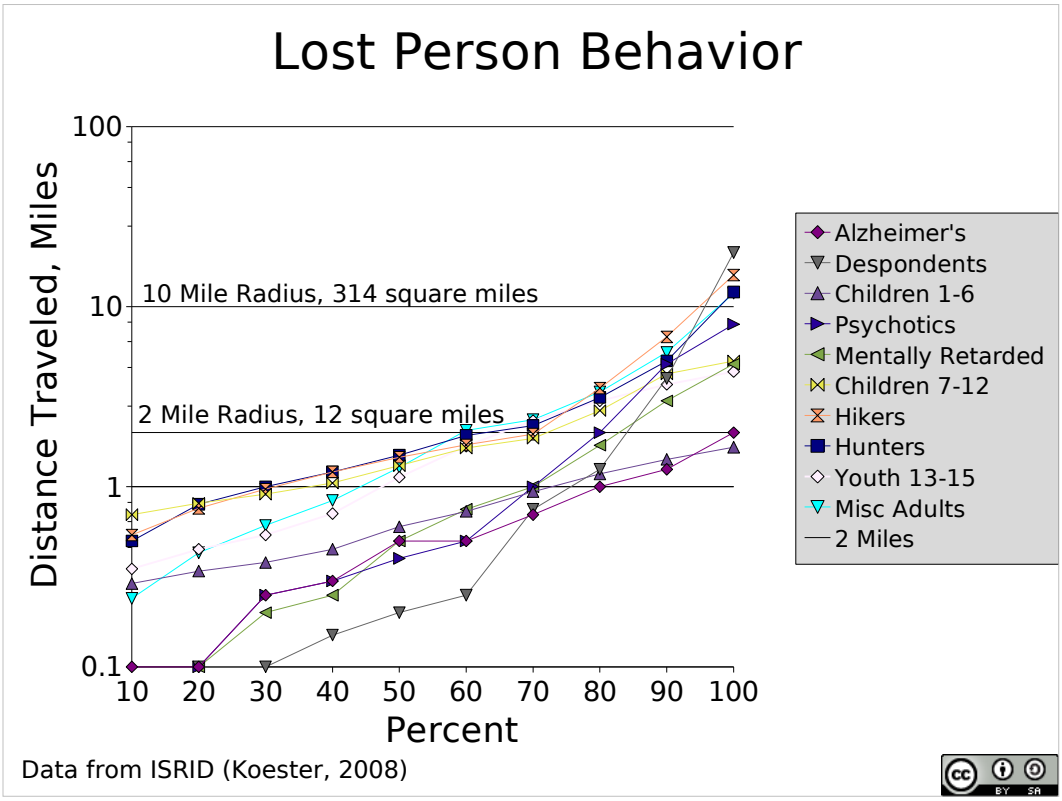

Last seen: About 3AM.  Time now: 9AM.
Theoretical search radius: 12-18 miles
Theoretical search area: 500-1000 square miles [17]

Theoretical search area is large for almost any search.




People don't travel in straight lines. Three miles per hour for 6 hours is not likely to be 18 miles as the crow flies.

Terrain features can block, capture, and constrain the motion of lost persons in predictable ways.

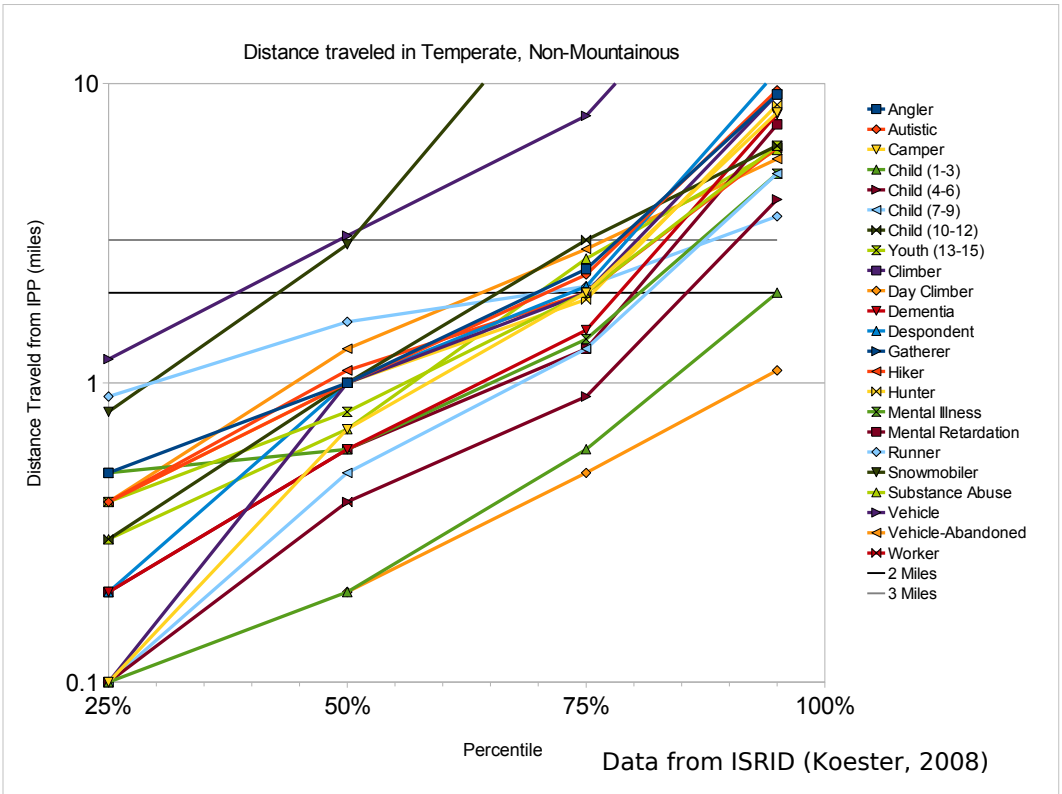



Data From: Search Management Systems

70% of most psychologically normal lost people over the age of 6 are found within 2 miles of the PLS. 70% of most children 6 or under and people with any psychological abnormality are found within 1 mile of the PLS.

20-30% of most categories of subject may be miles away from the PLS.

Early containment of the search area is important for almost all categories of missing subjects (Elderly Critical Wanderers and Children 1-6 being the exceptions, as they very rarely travel more than two miles.


Distance traveled in Temperate, Non-Mountainous
10
1
0.1
Distance Traveld from IPP (miles)
25%
50%
75%
100%
Percentile
Data from ISRID (Koester, 2008)
Angler
Autistic
Camper
Child (1-3)
Child (4-6)
Child (7-9)
Child (10-12)
Youth (13-15)
Climber
Day Climber
Dementia
Despondent
Gatherer
Hiker
Hunter
Mental Illness
Mental Retardation
Runner
Snowmobiler
Substance Abuse
Vehicle
Vehicle-Abandoned
Worker
2 Miles
3 Miles

# Confinement

- Roadblocks / Trailblocks / Camp-ins
- Lookouts
- Road Patrols / Trail Patrols
- Create Track Traps



# Initial Actions

- Classic mystery → Investigate
- Subject in search area → Confinement
- Emergency → Hasty Tasks
  - Areas of high risk
  - Areas of high probability
- Clues and the subject → Get Help

  Protect Clues
  - Secure the PLS
  - Scent Articles
  - Tracks

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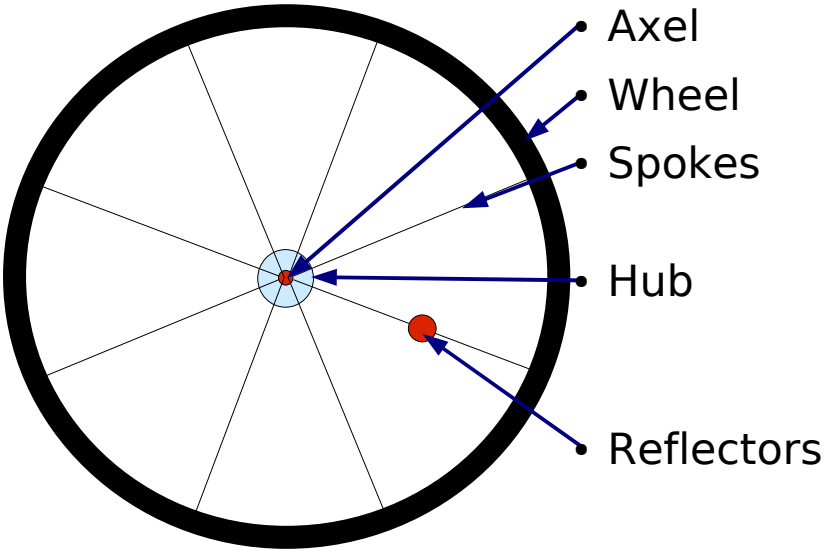
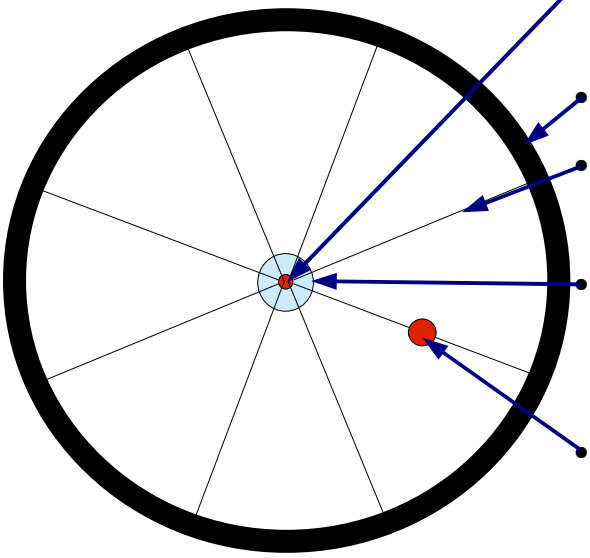
Flowing logically out of the search crucials are actions. Search is a classic mystery – investigate. Know if the subject leaves the search area – contain. Search is an emergency – search areas of high risk and high probability first. Search for clues and the subject – Protect the scene, protect clues, get help from specialised resources (dogs, mantrackers, search managers, etc).

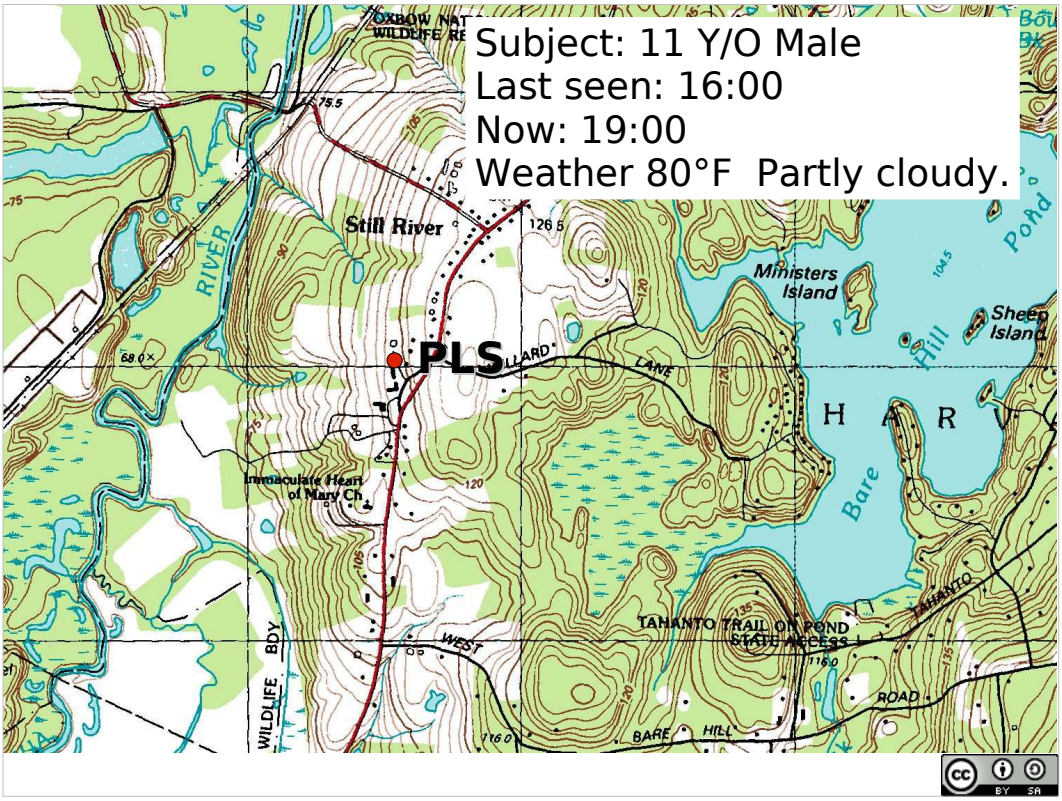
# Reflex actions: The Bicycle Wheel



## Reflex actions: The Bicycle Wheel

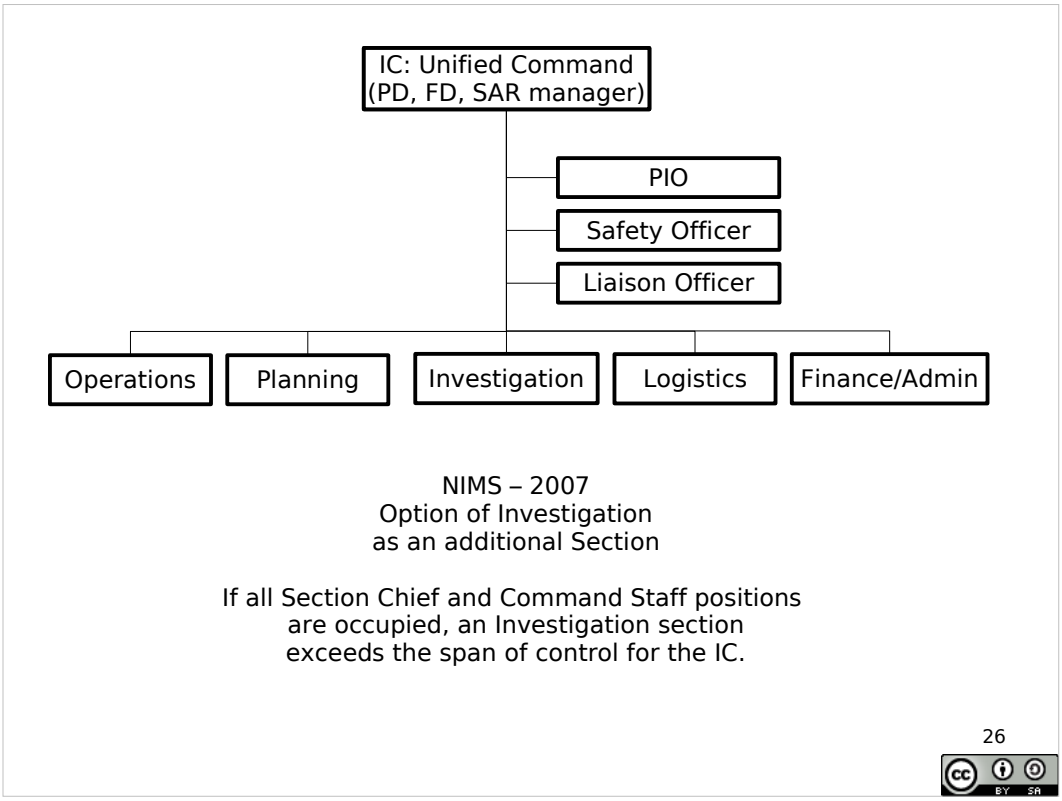


- Secure PLS, Investigation
- Confinement
- Hasty Tasks on likely routes
- Mantrackers and Tracking dogs to area around PLS
- Hasty Tasks to points of high risk and high probability




Hypothetical example search.

Who is involved in the first response?  What resources are available right away? What jurisdictions are involved?



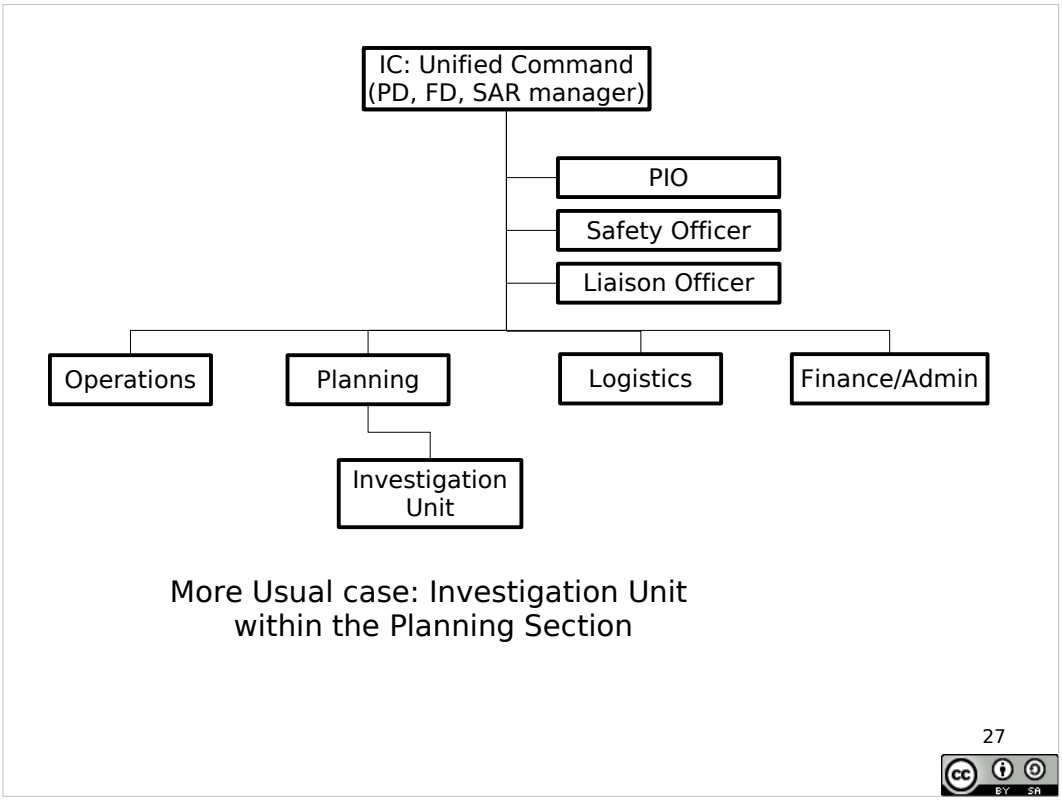

Searches are very logically conducted with the ICS (Unified command may be a good choice for a search. Multiple services and jurisdictions are often involved (e.g. police, fire, park rangers, SAR manager)).

NIMS revision in 2007 added the option of an Investigation Section.
NIMS Draft 2008, p 61. Intelligence/Investigation Function as a Separate General Staff Section:

"This option may be appropriate when there is a significant intelligence/investigations component to the incident for criminal or epidemiological purposes or when multiple investigative agencies are involved. A separate Intelligence/Investigations Section may be needed when highly specialized information requiring technical analysis is both critical and time−sensitive to life saving operations (e.g., chemical, biological, radiological, or nuclear incidents) and/or when there is a need for classified intelligence."

Reflecting the importance of investigation in a search, an Investigation Section is highly appropriate as part of a search management team.

Highly sensitive information can also be encapsulated in a police unit within the Investigation Section and a police official in the unified command.

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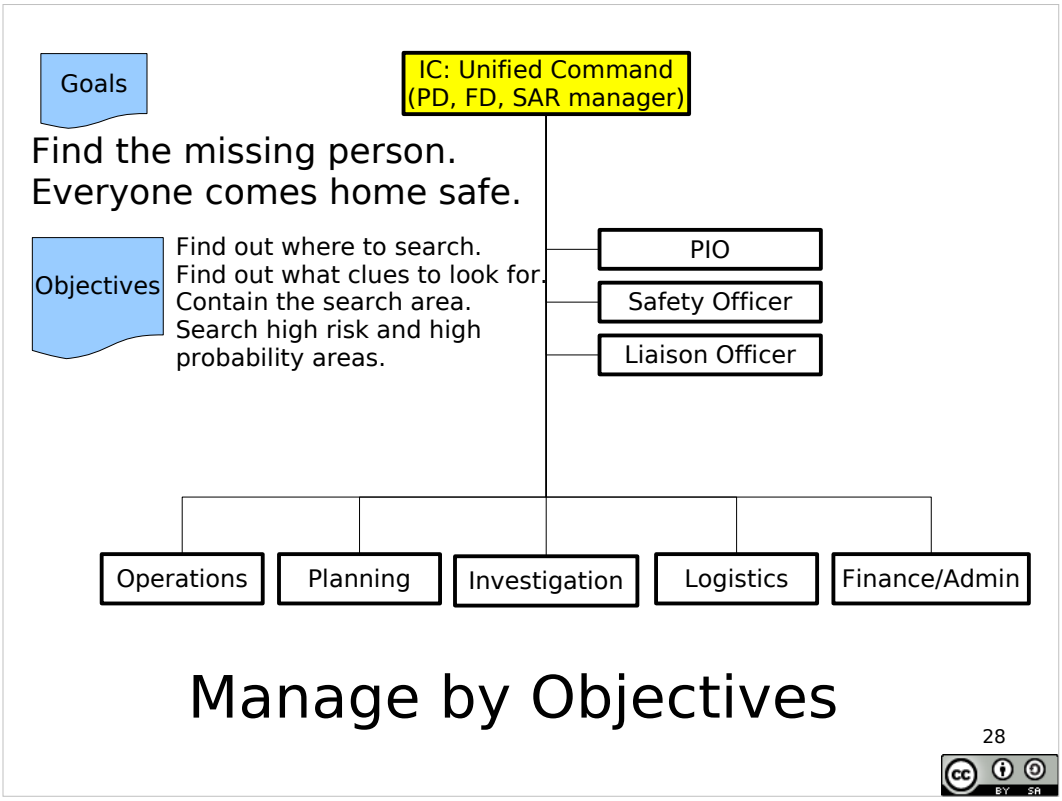
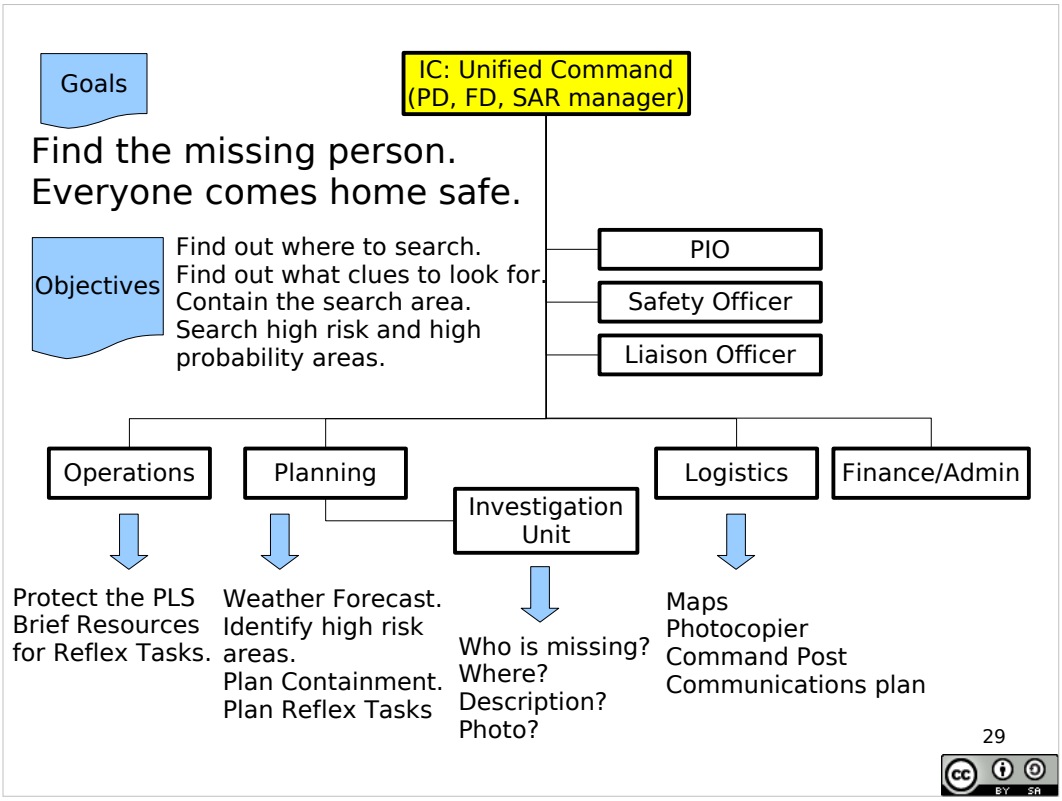
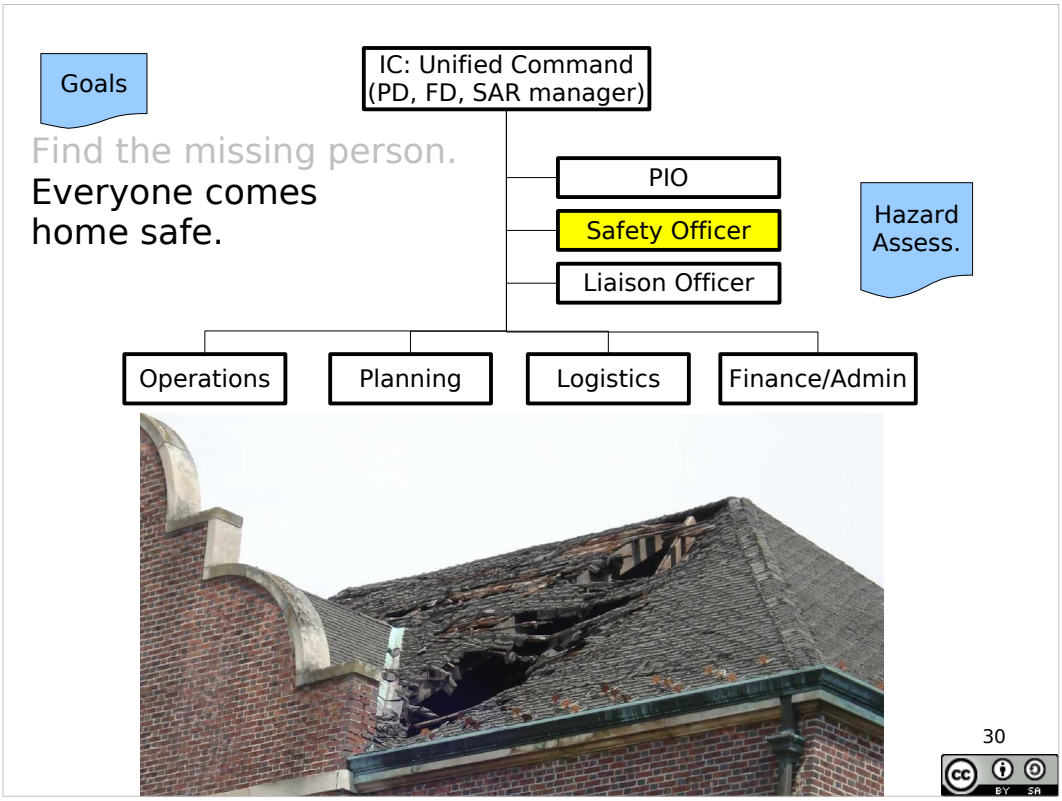



IC sets goals – probably the same two for any search, develops a set of objectives (of which these are abbreviated possible initial objectives (lacking measurable criteria). All else for the operational period flows out of these objectives.

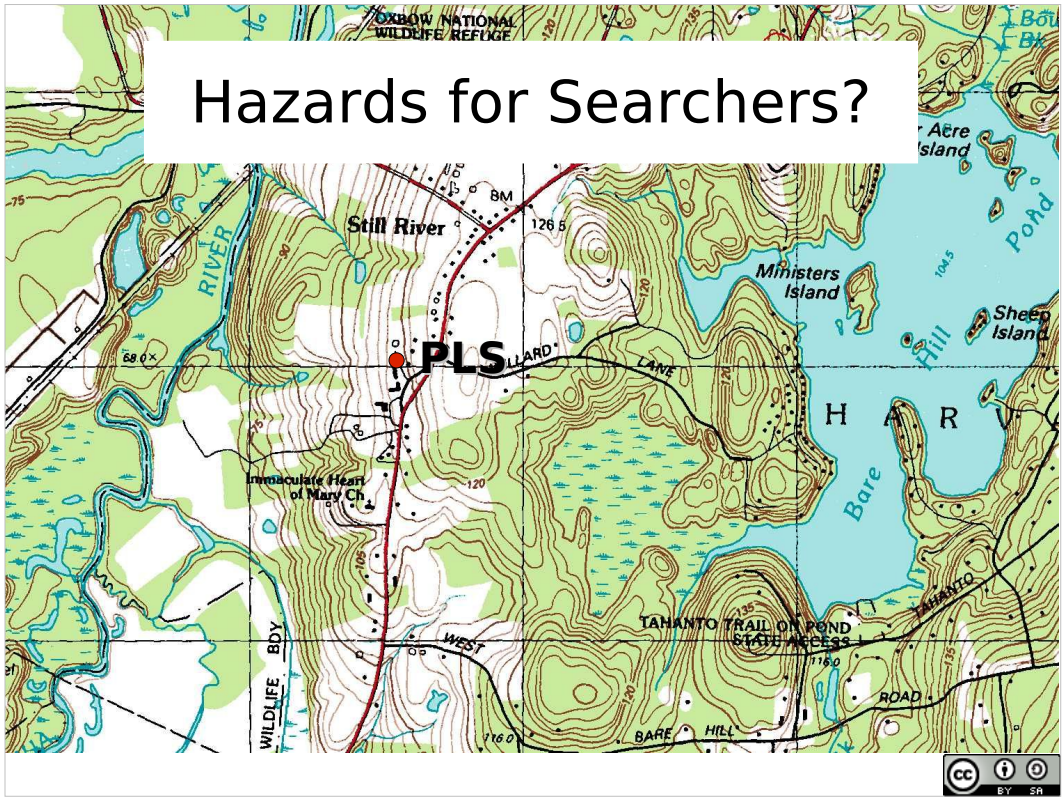



Start delegating right away – lots to be done, lots of framework to be set up for scaling up the search.

Get some initial search and planning data, hold a command staff briefing, and form focused objectives.

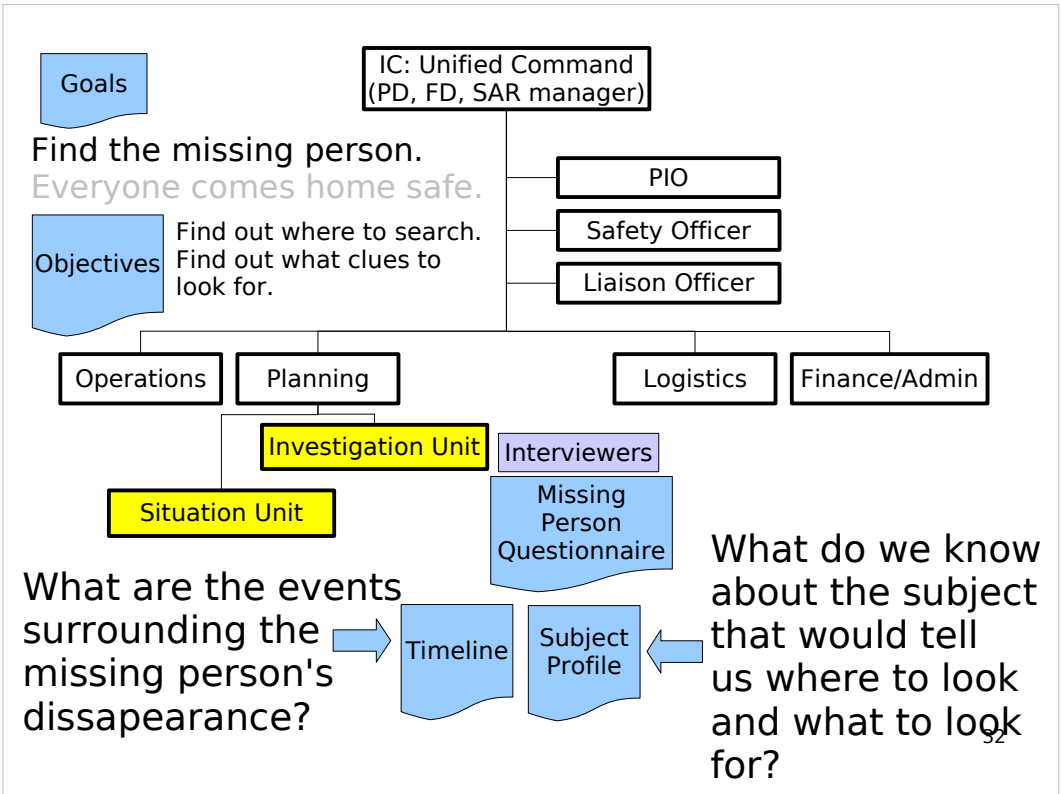



Assess the hazards to searchers and how to mitigate them




What are some specific hazards here?

How do we manage them?

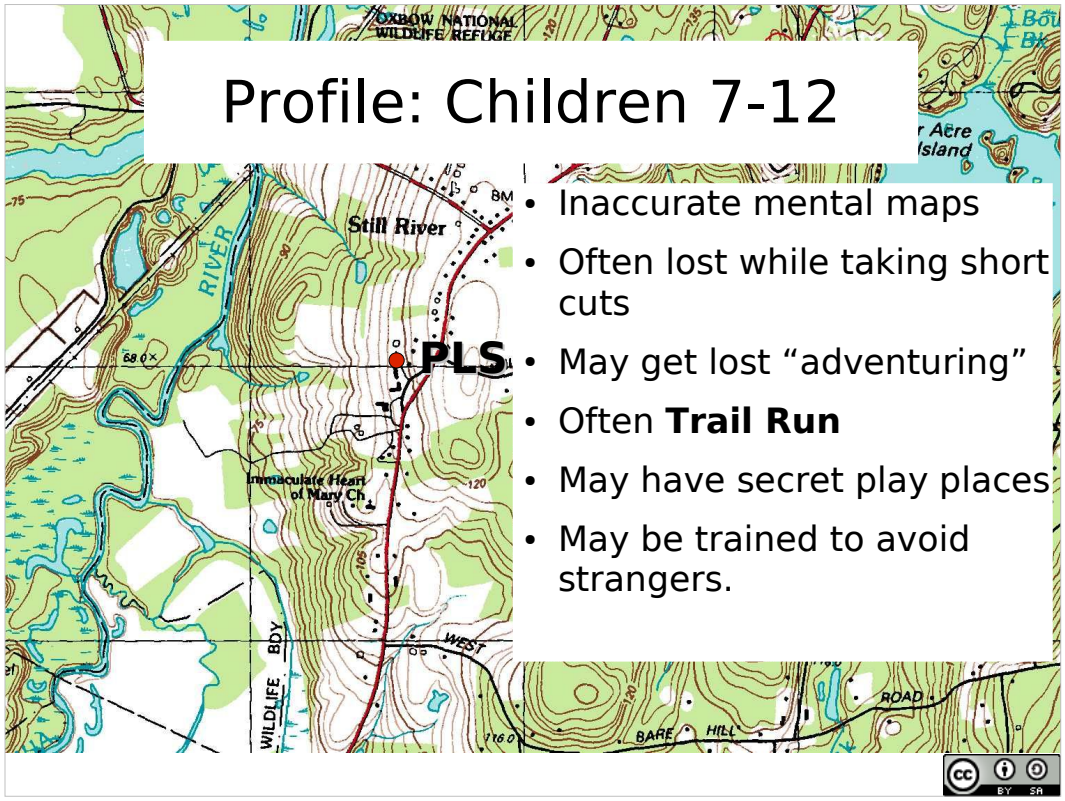




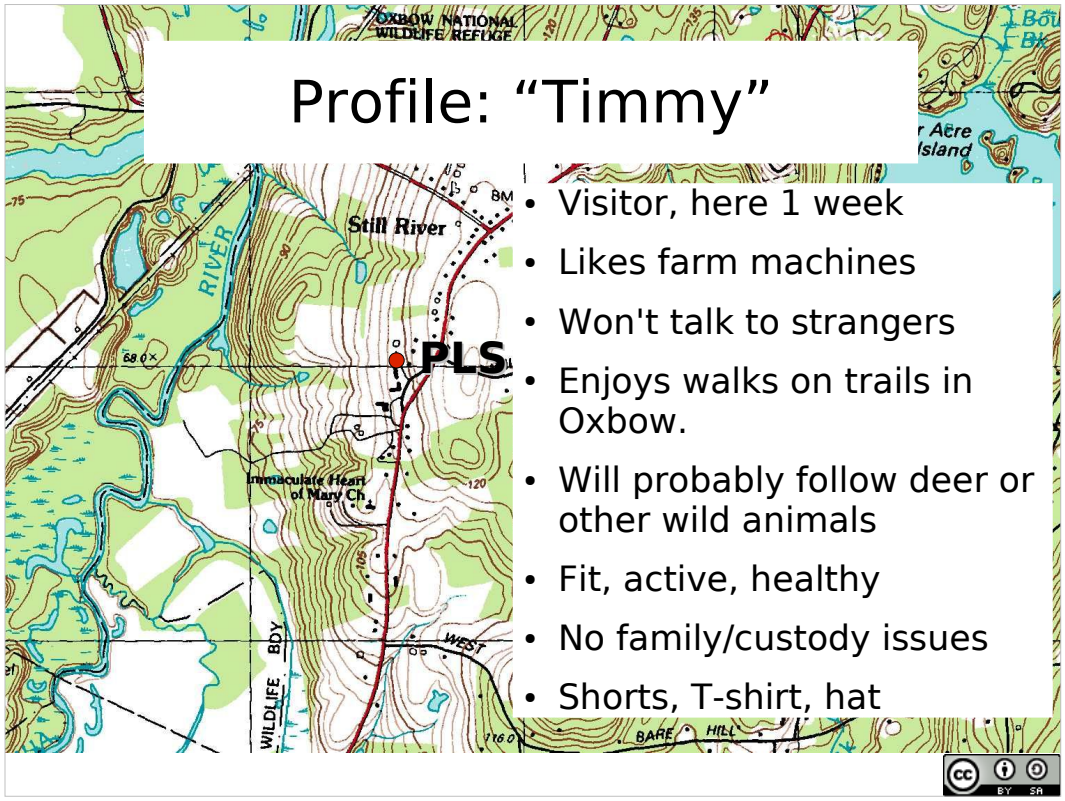

Search is a classic mystery – investigation is at the core of knowing where to search and what to look for.

Initial interviews for some basic information, followed by in depth interviews using missing person questionaires.

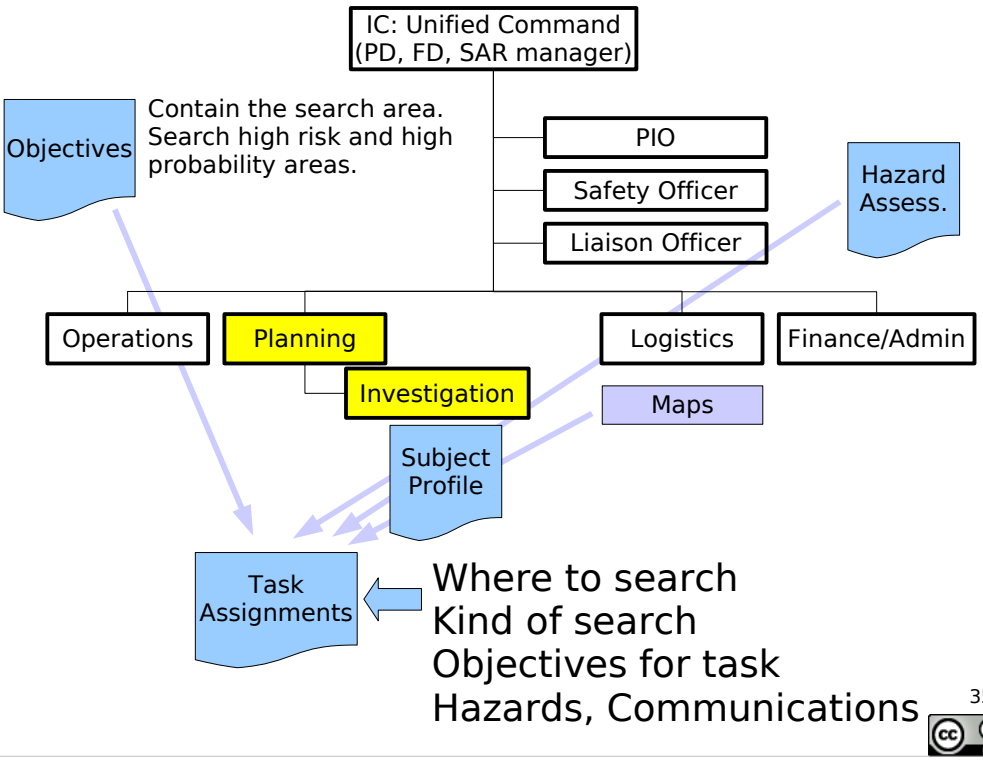
From these derive a timeline of events and a subject profile (combining general information about the behavior of this class of people and specific details about this missing person).

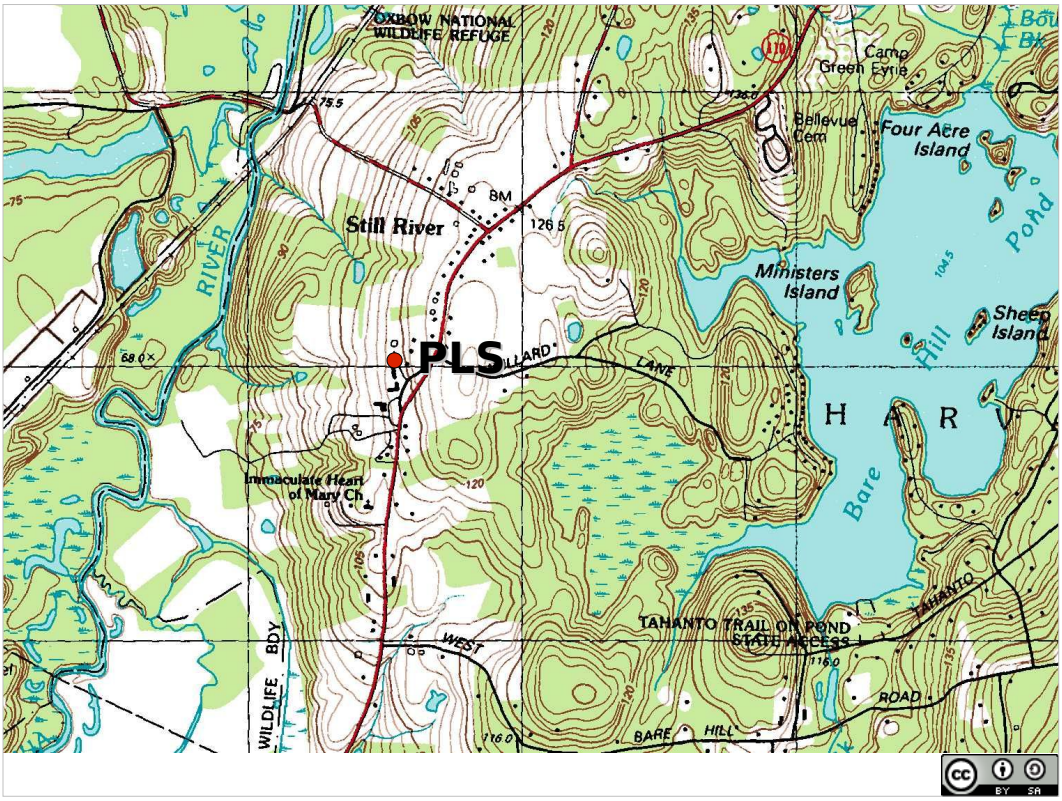



Missing people behave in predictable ways.
People of different age groups and categories (e.g. hunters, hikers) behave in different ways.




Initial interviews provided some specific information about the subject.


IC: Unified Command
(PD, FD, SAR manager)
Objectives
Contain the search area.
Search high risk and high
probability areas.
PIO
Safety Officer
Liaison Officer
Hazard
Assess.
Operations
Planning
Logistics
Finance/Admin
Investigation
Maps
Subject
Profile
Task
Assignments
Where to search
Kind of search
Objectives for task
Hazards, Communications




What initial actions?

What tasks where?

Confinement tasks

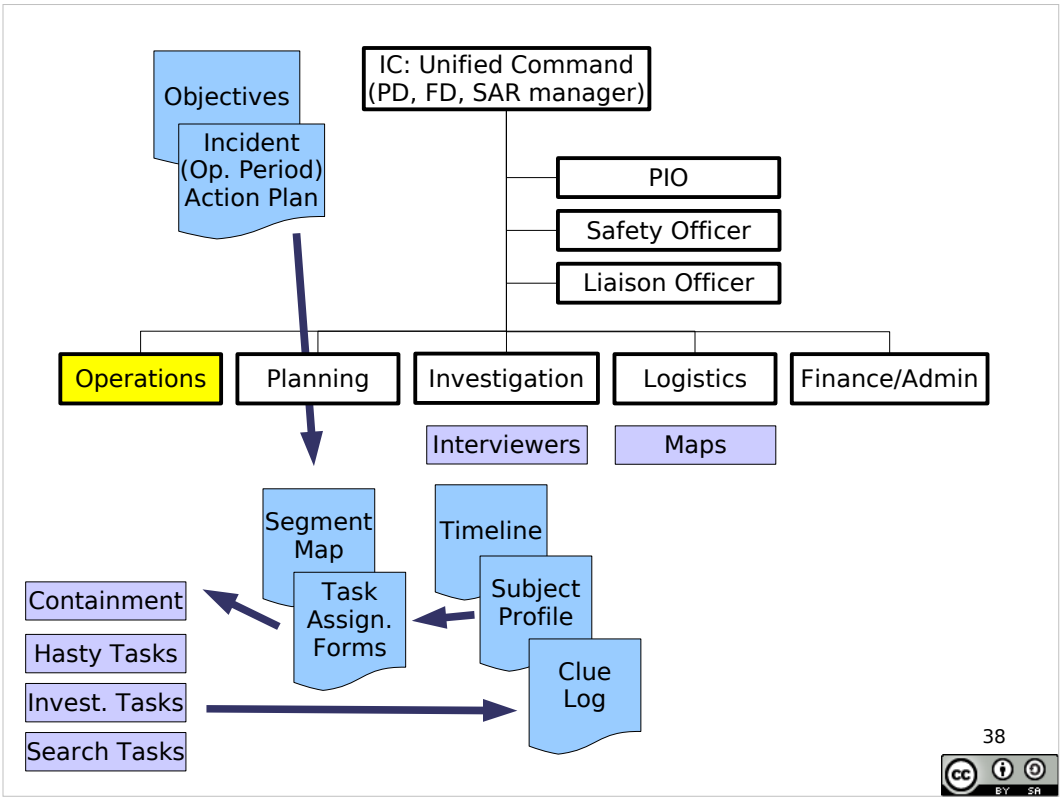
Hasty tasks

Other jurisdictions?

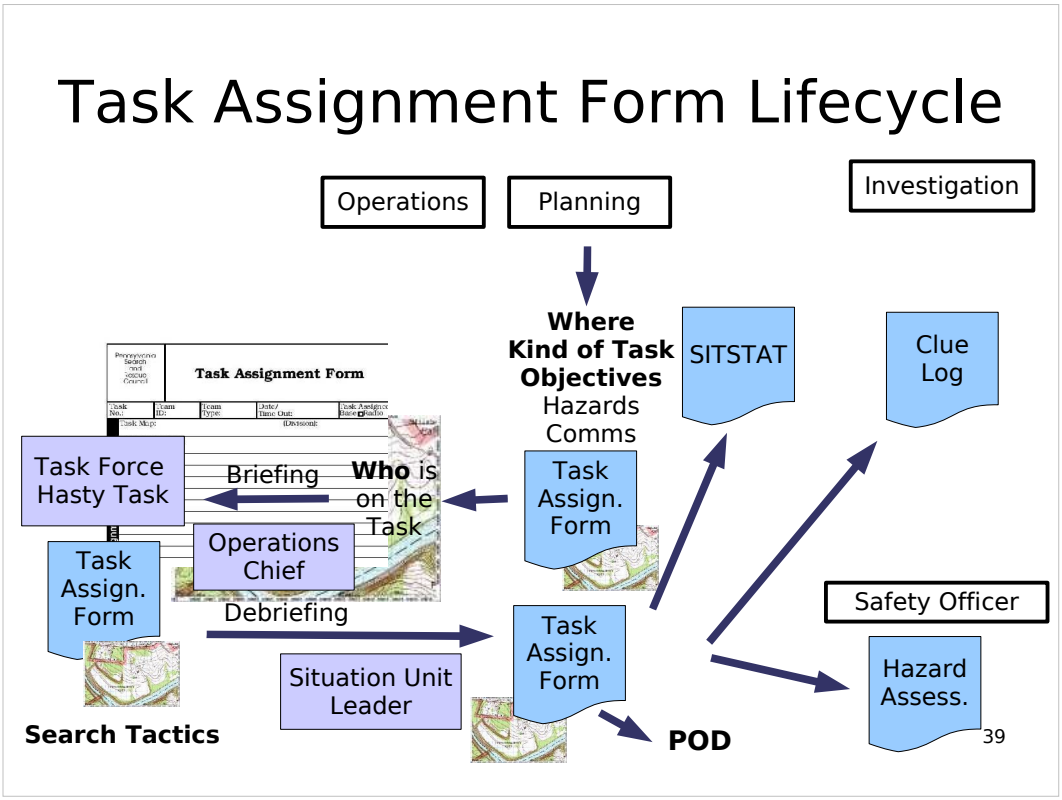
# “Timmy”

- Visitor, here 1 week
- Likes farm machines
- Won't talk to strangers
- Enjoys walks on trails in Oxbow.
- Will probably follow deer or other wild animals
- Fit, active, healthy
- Inaccurate mental maps
- Often lost while taking short cuts
- May get lost “adventuring”
- Often **Trail Run**
- May have secret play places






Task teams within the control of the operations division carry out tasks.




Planning generates instructions on where to search with what kind of task, and what the objectives for the task are.

Operations determines who is going to be on the task.

The briefing officer briefs the task.

The task searches its assigned area.

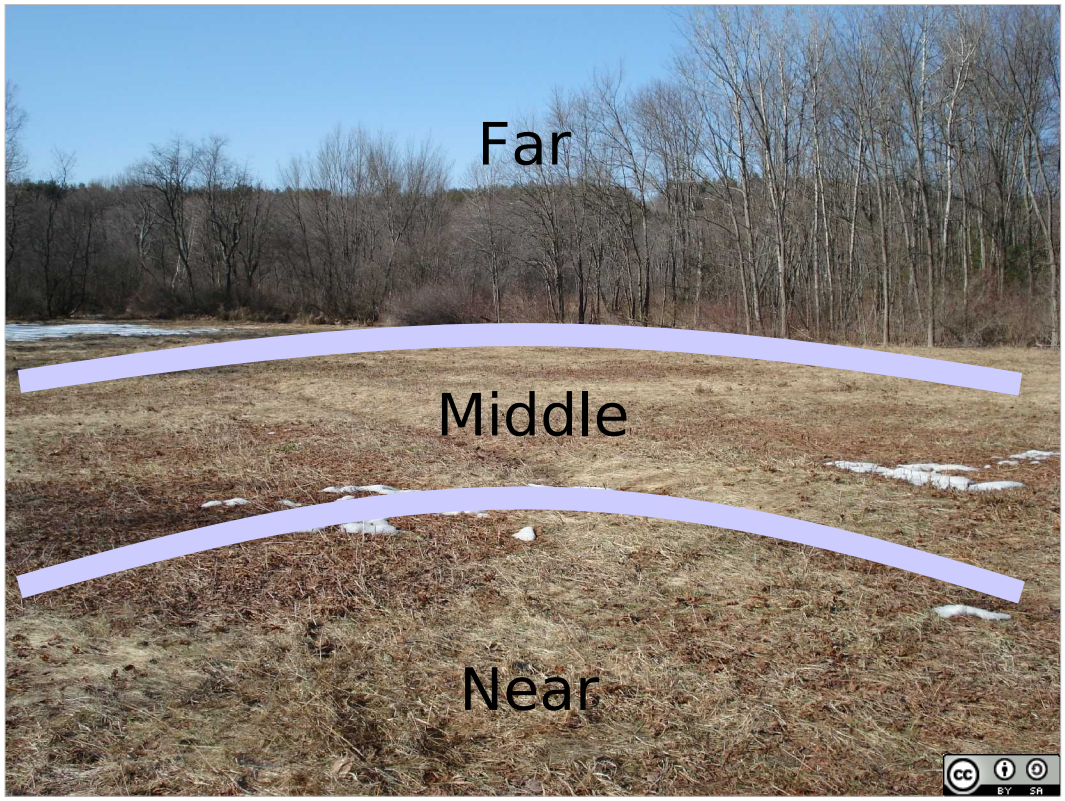
The briefing officer debriefs the task on its return.

Notes made by the task and by the briefing officer during the debriefing are passed back to planning, investigation and the safety officer as appropriate.


Task team out in the field – what do you do?

Some techniques for observing:

Near Ground/Middle Ground/Far Ground
Look Through things, look into shadows
Silhouette against sky
Look Up, Look Down, Look Back




Systematically scan the environment, dividing it into the near ground, middle, ground and the far ground.


Look through foliage for the things behind.

Focus your eyes on the spaces between.

Look into shadows.  Particularly at night.

Don't see a shadow as a dark patch, look into it and observe the things hidden within it.

At night, look slightly away from the places you want to observe.


Clues and subjects (e.g. bowhunters, hangings) may be above you.


As you move through the environment look ahead, to the left, to the right, above you, below you, and behind you.  Some clues will only be visible if you look back.


Be track aware.  Look for and protect places where the subjects tracks may preserved.

## Clue Awareness

- Observe Clues
- Protect Clues: Flag, don't touch, call in.

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A clue may be evidence – treat accordingly.

Anytime a subject is found dead or injured, treat the area of the find as a crime scene.

If you find the subject deceased, call it in by cell phone or some means other than an open radio frequency.

## Grid search as a last resort



Lines of closely spaced untrained searchers destroy clues.

Do not begin a search with grid searches.

What do you do instead?

## Initial Search Tactics

- Active
  - Investigation
  - Hasty tasks
  - [Attraction]
- Passive
  - Confinement

## Progressing to:

- Active
  - Investigation
  - Efficient Tasks
  - [Attraction]
- Passive
  - Confinement





Begin a search with investigation, confinement, and hasty tasks to check areas of high probability and high risk. As more trained resources become available, progress to small efficient task teams (Type II grids, air scent canine tasks, equine tasks). Close grid search (Type III grids, Type IV grids) may have a place later in the search.

## Types of Ground Search

- **Type I**
  - Hasty tasks: speed – trails, high probability and high risk areas.
- **Type II**
  - Small teams, loose grid - efficiency
  - Clue finders with critical separation
- Type III
  - Grid search – Thorough, slow, **destructive**
- Type IV
  - Evidence Search



Early in a search, focus on speed and then efficiency.

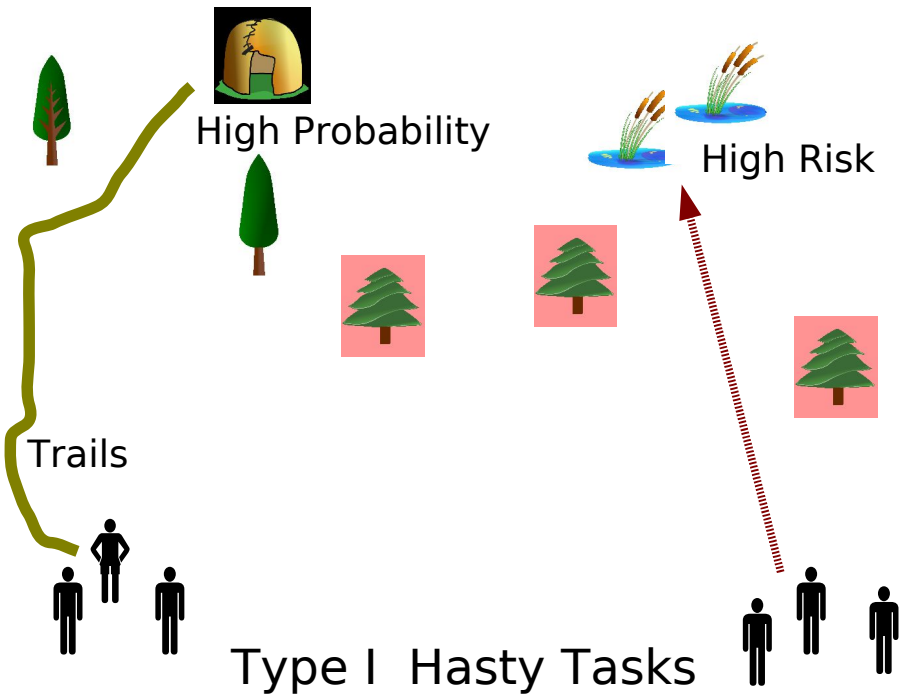
Type I hasty tasks focused on areas of high risk and high probability.

Type II tasks focused on efficient search. Use sensors such as small trained teams of clue finders, air scent canine tasks, tracking canine tasks, equine tasks.

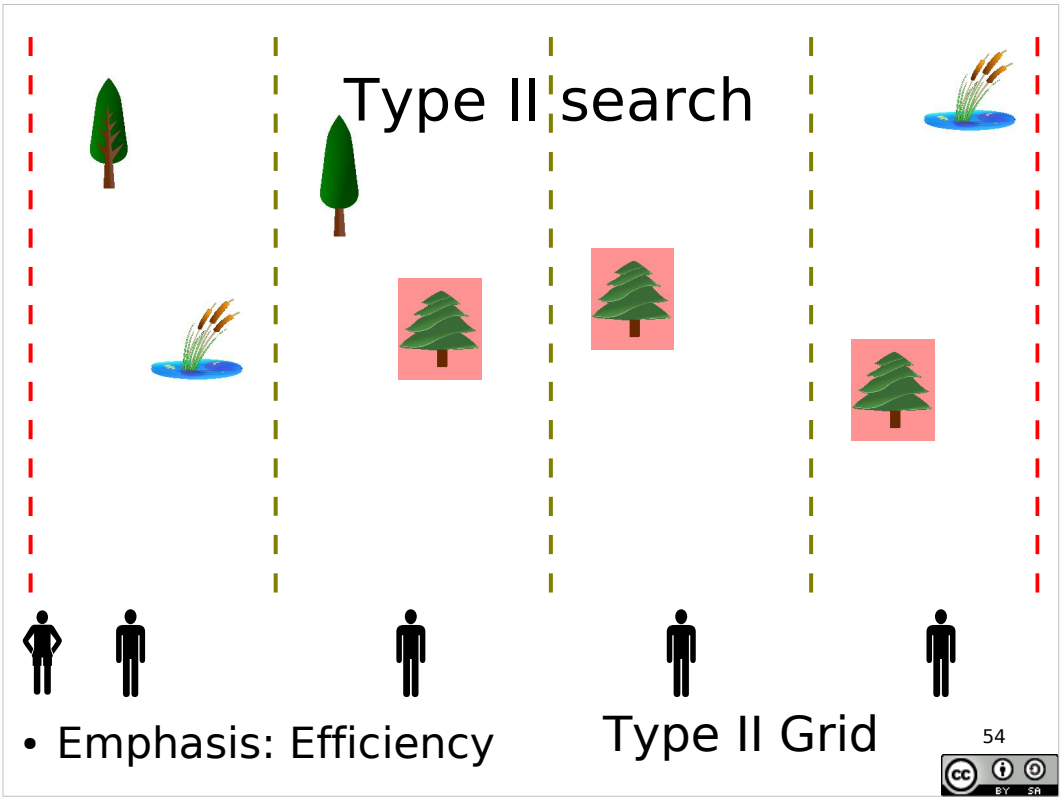
# Type I – Hasty Tasks

- Emphasis: Speed
- Check areas of:
  - high probability
    and
  - high risk
- Small, Fast moving, clue aware teams.
- Detect & Preserve Clues






Type I Hasty Tasks

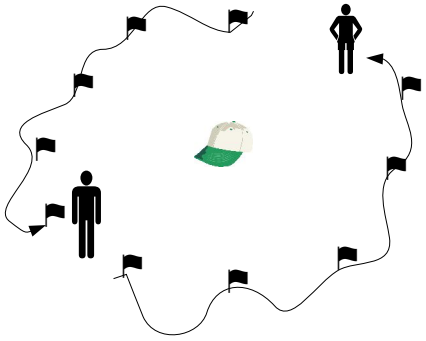



Loosely spaced trained searchers moving efficiently through the terrain.

## Critical Separation Distance

- How far apart do you place searchers in a Type II search?

**Northumbrian Rain Dance**



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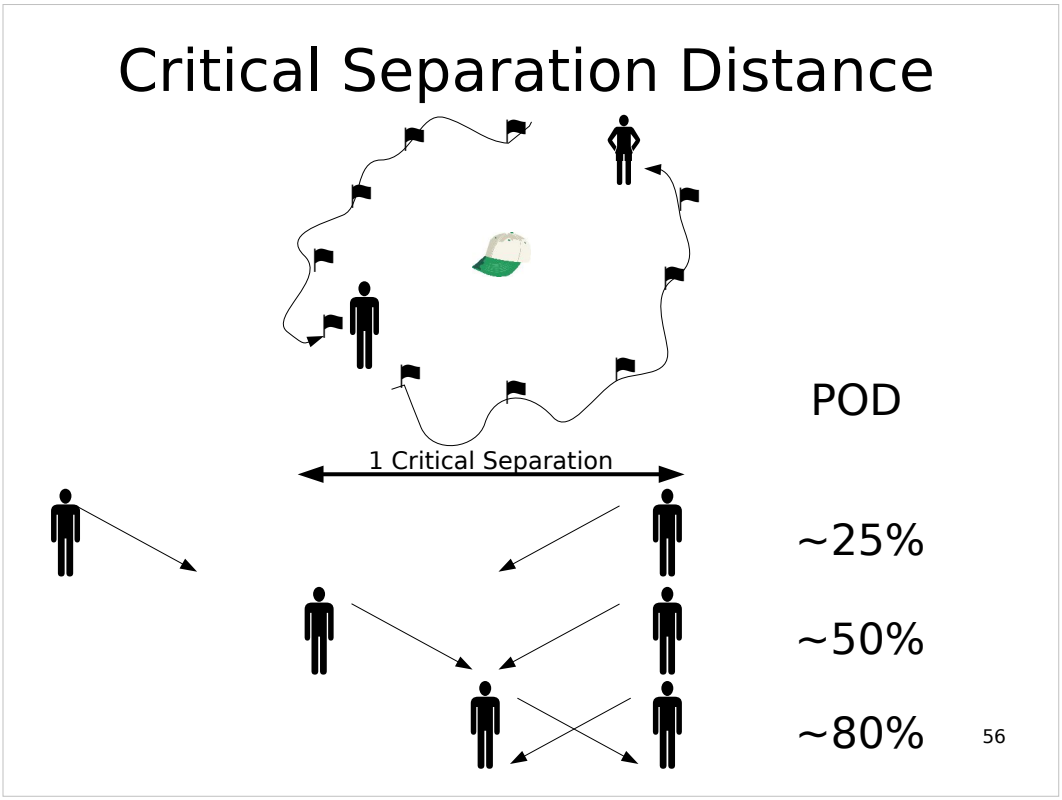
Place an object about the size of the object to be detected (a backpack makes a good proxy for an adult, a hat a good proxy for abandoned items of clothing or a young child) in ground cover similar to that typical of the area to be searched. Have two team members walk around the object moving closer to it and further away from it flagging the points at which they first observe the object while moving towards it. Measure the average distance from the flags to the object.



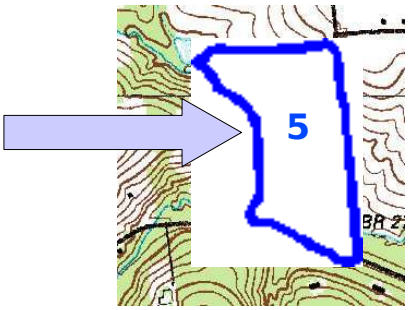

See: Perkins, D. 2008 [Draft] Critical Separation and the Probability of Detection for Grid Searching by a Land SAR Field Team. The Center for Search Research. http://www.searchresearch.org.uk/downloads/papers/paper_and_graph.pdf

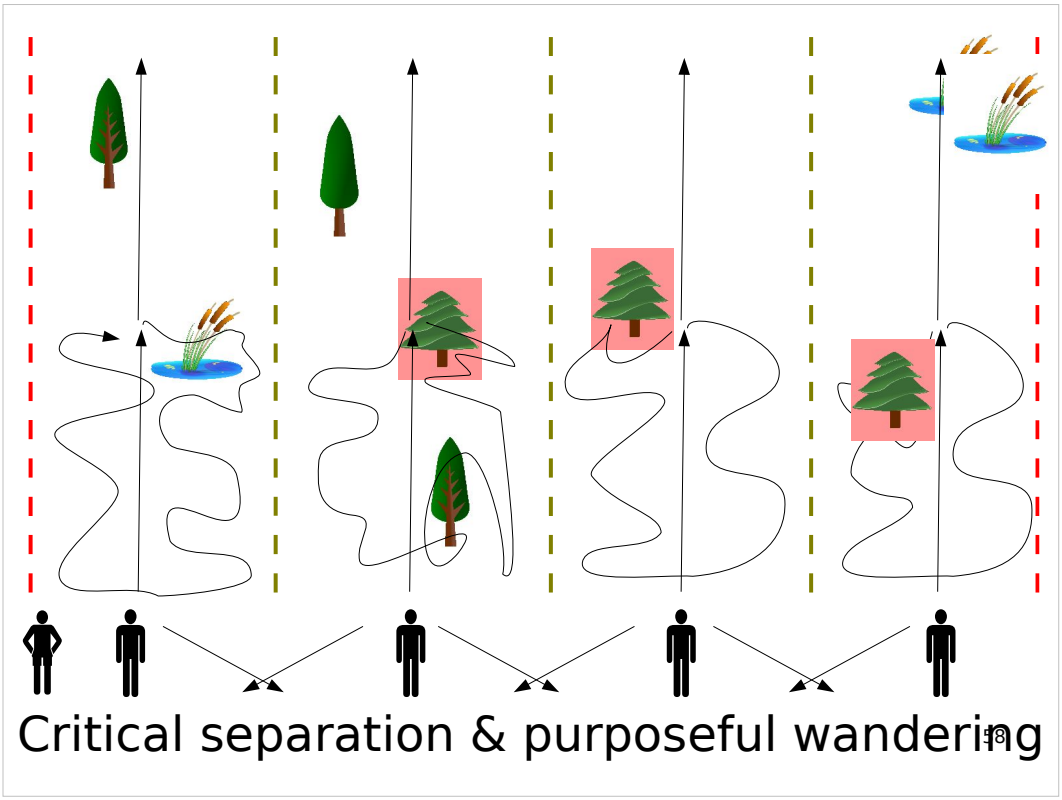
Grid searchers placed at one critical separation distance apart have about a 50% probability of detecting an object of the size used to determine the critical separation distance. Grid searchers placed at about half that distance (the distance from the object to a searcher in the Northumbrian Rain Dance, have about an 80% POD (nominally 83%), and searchers placed at about twice the critical separation distance apart have around a 25% POD.

Given a desired POD on their task assignment, a task team can identify typical terrain for their search segment, perform the Northumbrian rain dance to determine the critical separation distance, and use that as a basis for spacing their grid to approximate the desired POD.

# POD

- Apply some sensor to some search segment
- The sensor (task team) estimates its Probability Of Detection for the subject in that segment.






Trained searchers in a Type II grid can efficiently cover an area by spacing themselves at a critical separation distance and employing directed wandering, where each searcher can wander within their lane to investigate places that may hide a subject or a clue (e.g. young children in hollow logs).

Technical hazards and areas that the team can't efficiently enter and search (e.g. patches of bog, caves, dense thorny brush), should be flagged, reported, and examined later by appropriately equipped task teams.

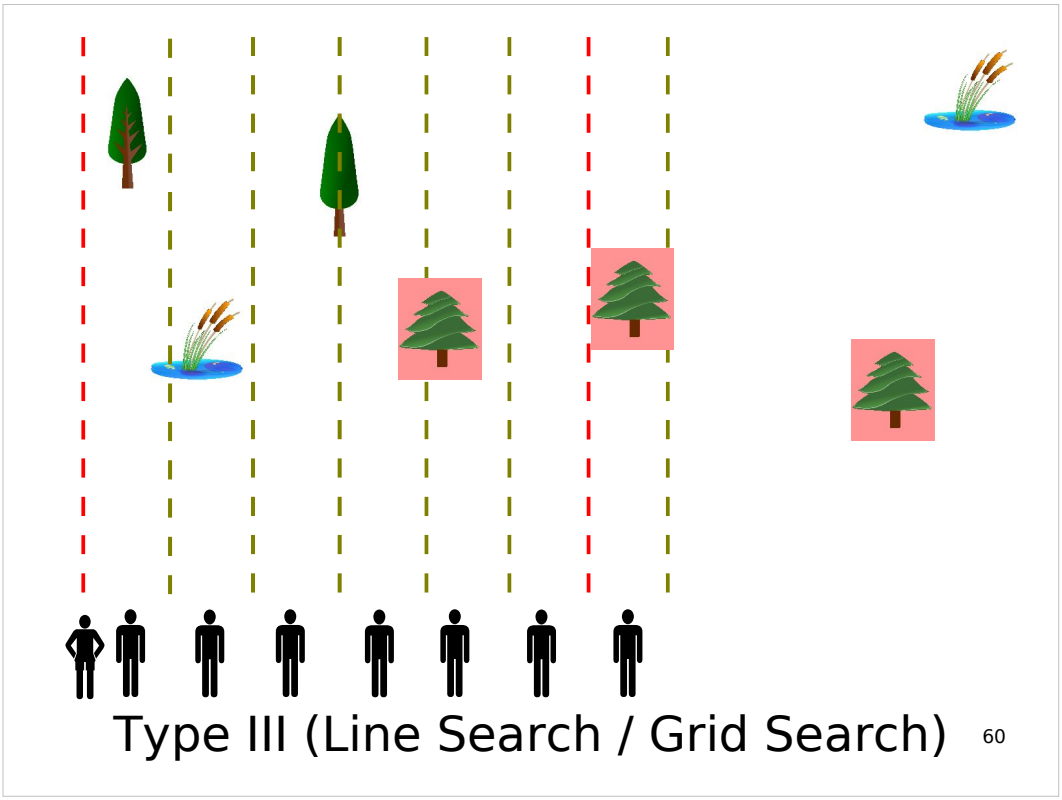
One person at one end of the grid line should flag the boundary of the covered area. Depending on the terrain, this person may be dedicated to flagging the boundary.

# Search Crucials

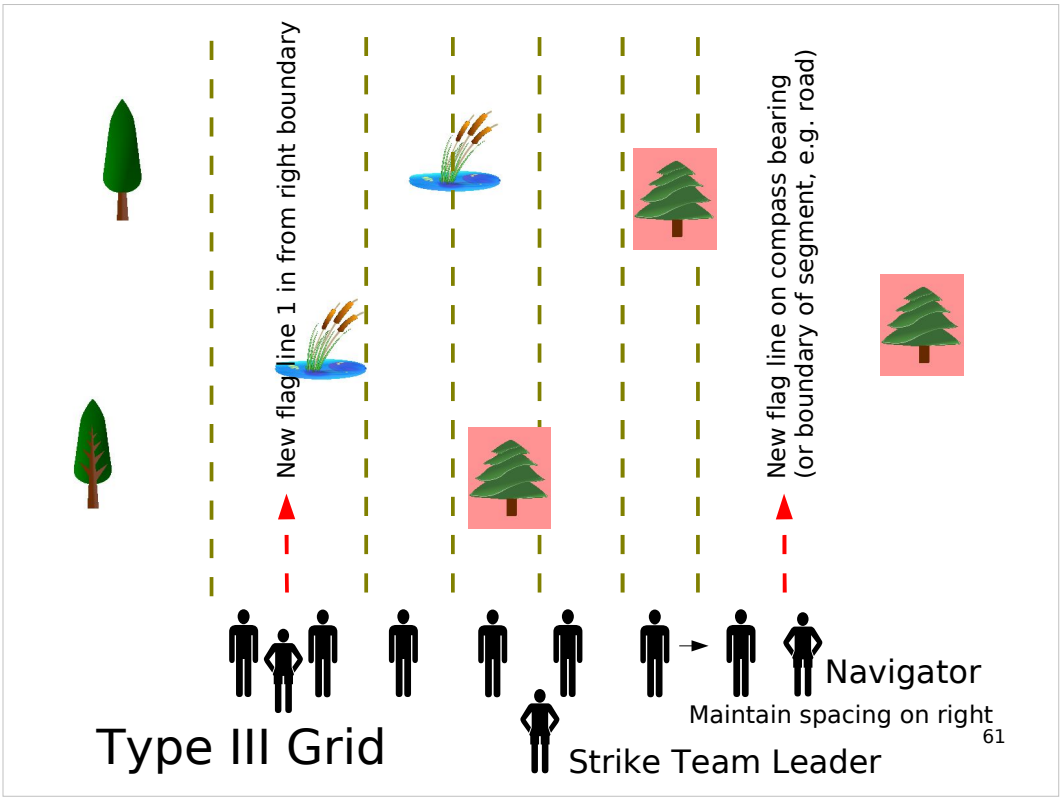
- Search is an Emergency
- Search is a classic mystery
- Search for clues not just the subject
- Know if the subject leaves the search area
- **Grid search as a last resort**
- Manage by objectives
- (Search management is information management)



The Search Crucials framework underlies the ERI Search and Rescue Texts.



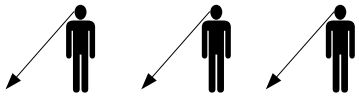

Close spaced grids are inefficient, require large numbers of people, and destroy clues. They use closely spaced subject finders to produce a high probability of detecting a subject in an area.



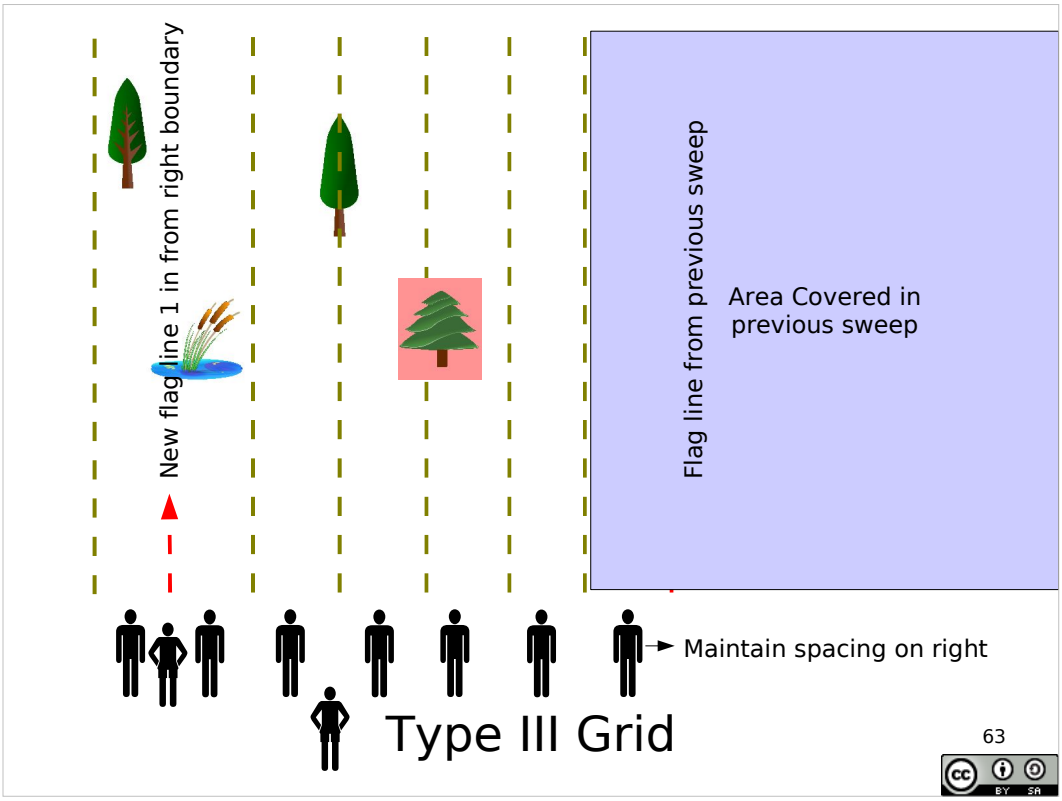

Maintain span of control. Use a relatively small number of untrained searchers mixed with trained searchers.

# Type III Grid Commands

- Stop
- Look Up, Look Down
- Look Left, Look Right
- Turn Around and Look Behind you

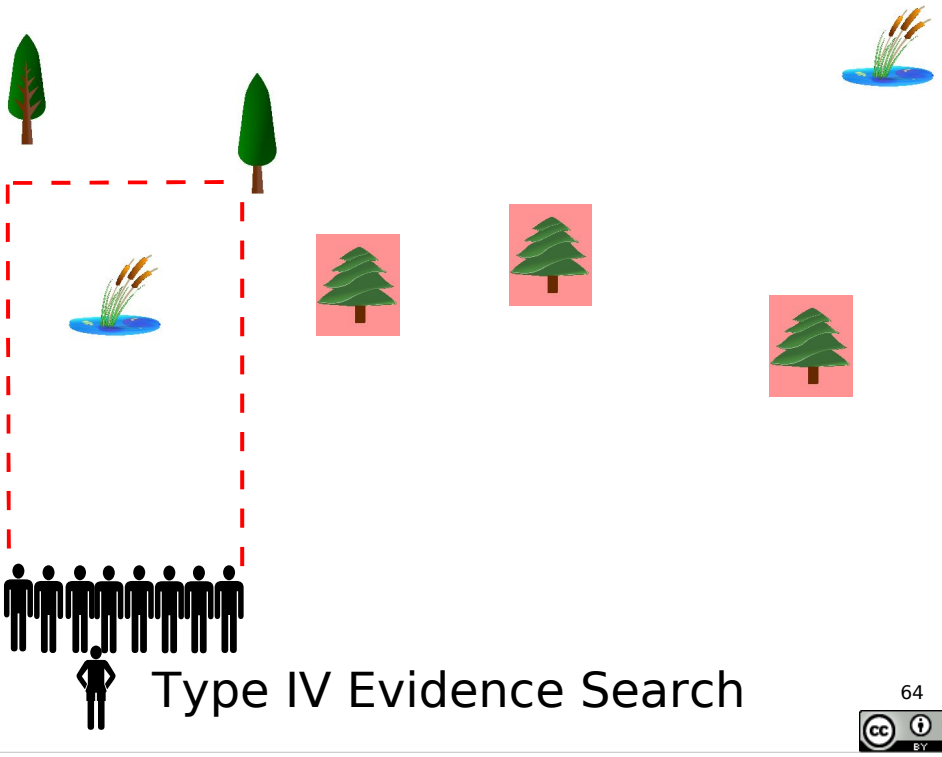


- Look Up, Look Down
- Look Left, Look Right
- Turn Around
- Advance




Have one end of the line follow a marked boundary. Instruct each person on the line maintain a constant distance from the person on that side. In this case, everyone walks forward staying six feet from the person on their right.

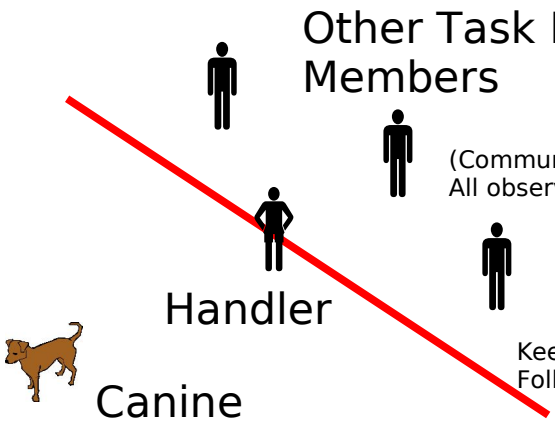
Have one person on the far end of the line flag the boundary of the sweep. In brush, it may be necessary to dedicate this person to flagging rather than searching.



# Type IV Evidence Search

# Canine Task

# Working with a Canine Task



Other Task Force Members

(Communications, Navigation, Tracking)
All observe for clues

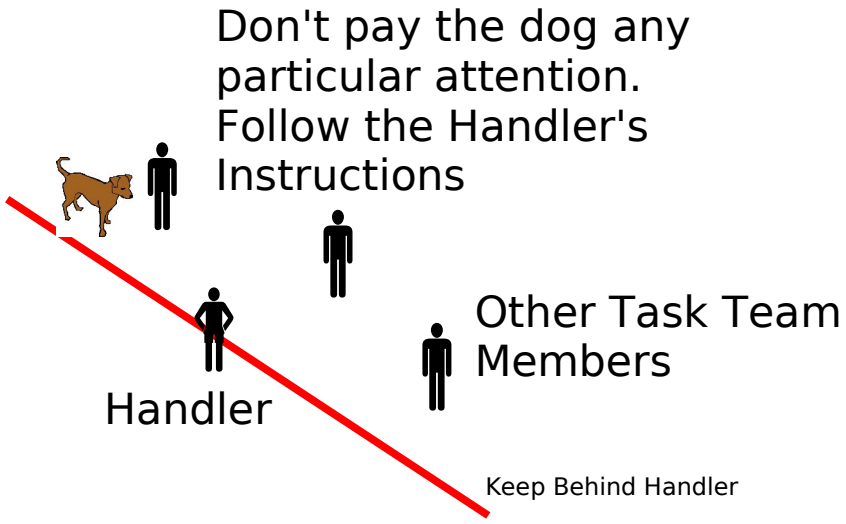
Handler

Canine

Keep Behind the Handler.
Follow the Handler's instructions.

Don't pet, feed, or play with the dog.

# The dog may check your scent

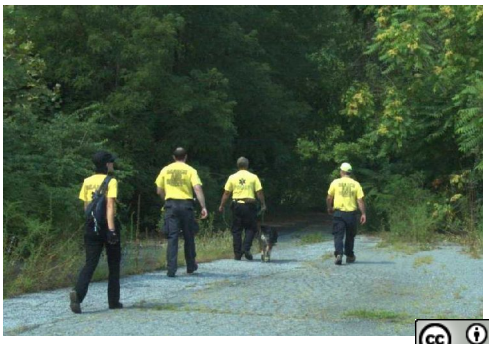


# Core Land SAR Field Skills

- Land Navigation
- Seeing and Observing
- Evidence Handling
- Wilderness Foot Travel (and fitness)
- Observing and Managing Environmental Hazards



## Clothing



Appropriate for the weather and terrain.

Not turnout gear.

Good boots.
Foul weather gear.


Land navigation, including:

Maps, Compass, GPS, Watch. Never rely on any single means of navigation.

Safety, including:

Water, gloves, whistle, flashlights, first aid kit, sunblock, insect repellent, foul weather clothing, fire starting, emergency shelter

SAR, including:

Flagging tape, radios, rope.

Balance – not too much weight, not too little equipment.

Consider environment: urban, rural, wilderness.

# Missing Person Response

- Initial Response (Reflex Tasks) ~3 hours
  - Secure PLS
  - Confinement, Investigation, Hasty tasks
  - Search High Probability and High Risk areas
- First operational period
  - Investigation, Hasty Tasks, Efficient tasks
  - Trackers, Dogs, Trained ground searchers
- Subsequent operational periods
  - Investigation, Efficient tasks
  - shift to Thorough tasks



Focus for this talk – actions to take in the first three hours or so of a search.

# Some Sources/References

- Emergency Response International
  - Search is An Emergency - A text for managing search operations
  - Basic Search and Rescue Skills – A practitioners guide to search and rescue
- National Association for Search And Rescue
  - Introduction to Search and Rescue
  - Managing the Lost Person Incident
- The Center for Search Research (UK)
  - Field Search Skills
- Emergency Management Australia
  - Land Search Operations
- Report of the review panel concerning the disappearance and deaths of three young boys in East Camden June 22-24,2005
- Open Clip Art http://www.openclipart.org





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LaValla, P. 1995. Search is An Emergency: A text for managing search operations [4th ed.] ERI International. Olympia, WA. 314pp.

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Hill, K., and D. O'Connor, eds. 2007. Managing the Lost Person Incident [2nd ed]. National Association for Search and Rescue. Centreville, VA. 351pp.

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**Others:**

The Center for Search Research. Extracts from: Field Search Skills. http://www.searchresearch.org.uk/www/published_papers/ Searching at night, 2003; Critical separation, 2003;

Perkins, D. 2008 [Draft] Critical Separation and the Probability of Detection for Grid Searching by a Land SAR Field Team. The Center for Search Research. http://www.searchresearch.org.uk/downloads/papers/paper_and_graph.pdf

Emergency Management Australia, 1997. Land Search Operations. Australian Emergency Manuals Series. Part IV. Manual 4. 104pp.

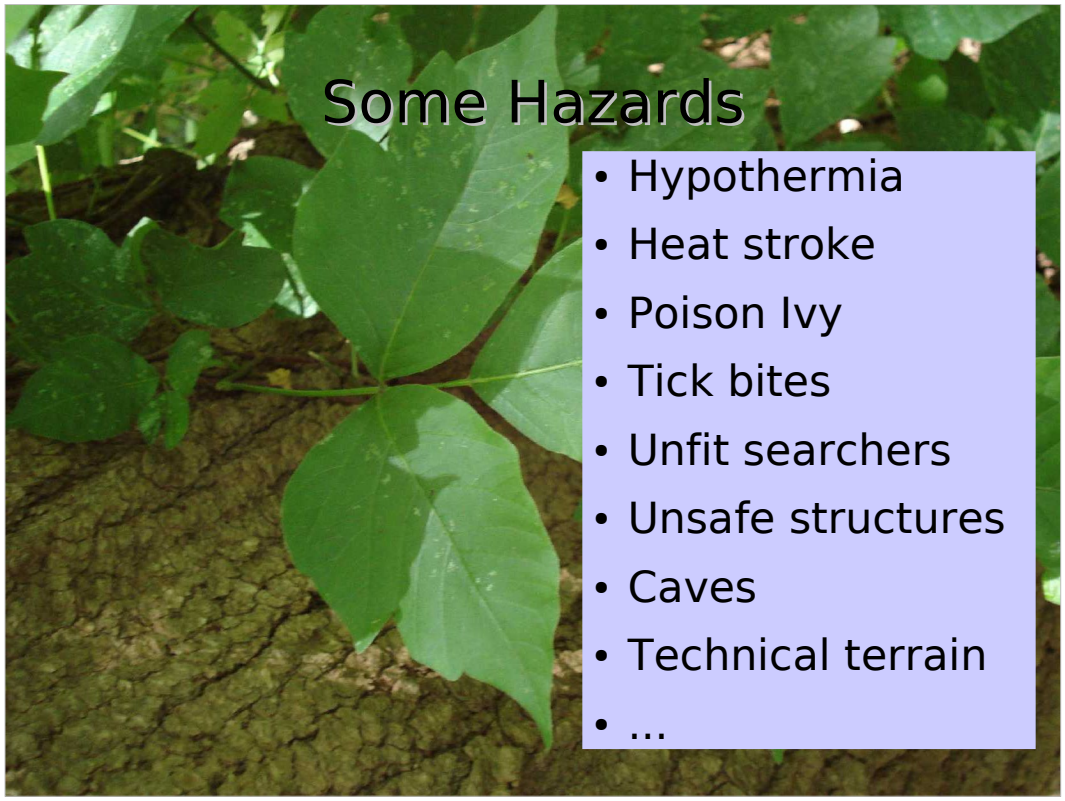
Lynch, J.P., M. Kantner, E. Hargis, 2005. Report of the review panel concerning the disappearance and deaths of three young boys in East Camden June 22-24,2005. 28pp.

Extra slides follow.


ASTIR Map of 19T 0287680 4706687 (upper left) to 19T 0289003 4705648 (lower right); UTM 100 m grid, WGS84 datum.
4706
4706
4706
4706
4706
4706
4706
4705
4705
19T
02877
02878
02879
02880
02881
02882
02883
02884
02885
02886
02887
02888
02889


XASTIR Map of 19T 0285309 4708993 (upper left) to 19T 0290564 4705175 (lower right). UTM 1000 m grid, WGS84 datum.
Harvard
Harvard
MAYHAN
Camp Groton Fyrie
Bellevue Cem
Four Acre Island
Pond
Ministers Island
Sheep Island
Hill
H A R V A R D
Bare
LANE
Center Cem
Radio Towers
ROAD
AVENUE
SLOUGH
STOW
MURPHYS
WORCESTER CO
MIDDLESEX CO
Brook
BM 93.6
RARE HILL
WOODSIDE
Gravel Pits
19T
0286
0287
0288
0289
0290
4708
4707
4706

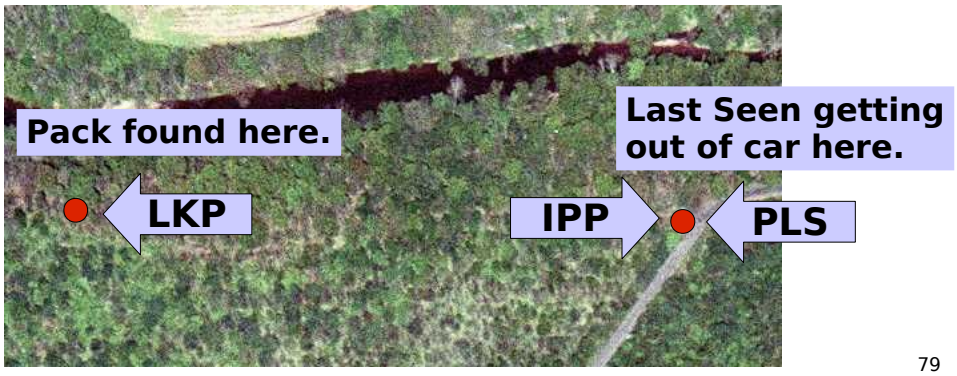

Hypothetical example search.


Some Hazards
• Hypothermia
• Heat stroke
• Poison Ivy
• Tick bites
• Unfit searchers
• Unsafe structures
• Caves
• Technical terrain
• ...

# Manage by Objectives

- Initial Response (Reflex Tasks)
  - Objective: Find Clues
  - Objective: High Risk and High Probability
  - Objective: Limit the search area
  - Investigation, Hasty Tasks, Confinement
- First operational Period
  - Objective: Efficient search of high probability areas
  - Objective: Find Clues
  - Investigation, Hasty and Efficient Tasks

- **PLS**: Point Last Seen
- **IPP**: Initial Planning Point
- **LKP**: Last Known Point

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Investigation determines places to start searching.

## Probabilities

- **POD** - Probability of Detection
- Application of a sensor (a task team) to a search segment has some probability of finding clues or the subject.
- **POA** – Probability of area
- Probability that the subject is in a particular search segment.
- Different sensors with known PODs are repeatedly applied to each search segment, decreasing the POA of each.



Search theory is driven by probabilities: the probability that a particular sensor may detect clues or the subject, and the probability that the subject is in or passed through the area where that sensor is searching.

Search areas are never “Cleared”. They have only had a sensor with some probability of detection applied to them.

Improve the chance of finding the missing subject by repeatedly applying sensors to the same search areas.