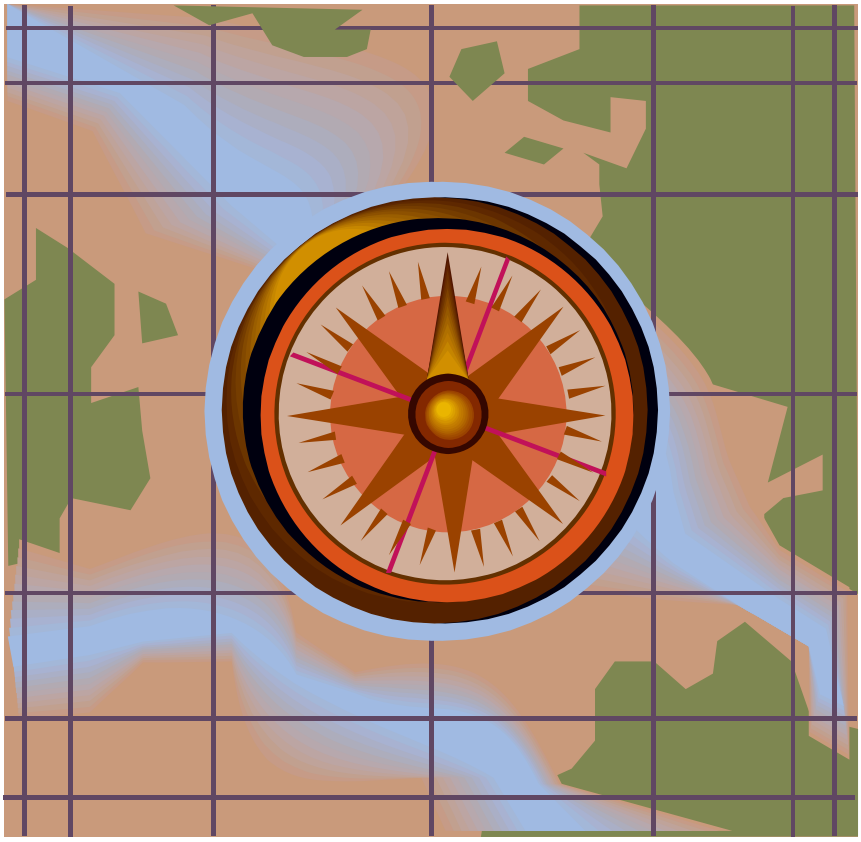
Missing Person Search Management Plan

Edition 2.3
July 15, 2008



Prepared by Rick Slatten
St. Louis County Rescue Squad
Duluth, Minnesota
Cook, Minnesota

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Table of Contents

0.0 Introduction	.....	Page 3
1.0 Dispatch	.....	Page 4
2.0 Response & Pre-Staging	.....	Page 5
3.0 Staging	.....	Page 7
4.0 The Reflex Phase	.....	Page 11
5.0 The Area-Search Phase, Planning	.....	Page 15
6.0 The Area-Search Phase, Sortie Management	.....	Page 28
7.0 The Area-Search Phase, Air Operations	.....	Page 33
8.0 Strategic Planning, Demobilization, and Follow-up	.....	Page 36
9.0 Subject Location, Rescue, & Recovery	.....	Page 38

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

0.0 Introduction

0.1 Many untrained search managers believe that a search operation is a binary exercise—"we either found 'em, or we didn't." This viewpoint is incorrect. You are searching for an object whose location *and appearance* are not precisely known. You don't know if the missing subject is east of the trail, or south of their truck in the swamp. You don't know if they're standing up waving at a search aircraft, shouting for help, or frozen to death beneath a root tangle. You don't know if they removed the red shirt they were reportedly wearing to reveal bare skin, or if they fell in a mud hole that turned their appearance to an earthy brown. Consequently, when a team returns from an unsuccessful trip to the woods (called a **sortie**), you truly don't know if the reason they were unsuccessful is because the subject wasn't in that region, or because he *was* there and the search team didn't see him. Thus, all search planning, as well as all search effort, must be framed in the context of likelihood—in other words, *probabilities*.

0.2 Just as common in the search management realm is the belief that search planning and search management are intuitive activities—that one can accurately and effectively run a search operation by thinking "out of their head" and flying seat-of-the-pants. Again, this viewpoint is dreadfully mistaken. The search—whether it be for your missing car keys or a missing child; an enemy submarine or new oil reserves for which to drill—is a highly scientific endeavor. There is a right way and a wrong way to search. Even when the correct method is used, there is a good, a better, and a best way to apply search effort. Good search managers don't need to be lucky—they create their own luck! But to be "good" searchers we need to be able to accurately, a.) prioritize *where* to look; b.) know *how* to look—deploying our resources in the most effect manner possible; and c.) keep track of *what, where, how*, and *how well* we've searched.

0.2.1 How can you defend a decision to: a.) continue to search here; b.) stop searching here and look somewhere else; or c.) stop searching altogether, if you cannot accurately describe what you've done?

0.3 This document was written to help you plan and run a search. It is not a comprehensive textbook on search techniques—many fine volumes already exist that do that, among them the National Search and Rescue School's (NSARS) *Inland SAR Planning Coursebook*. Nor is this document a step-by-step procedure on how to run a search, though it does contain several step-by-step procedures inside it. Searching is as much art as science, and no lock-step method exists that could allow for all the subtle variables and factors that must be considered on even the most simple missing person searches. More simply, this document is intended to help you cover your blind spots so you don't miss the obvious, as well as serve as a reminder of complex procedures so errors don't creep in undetected. Finally, to the untrained, intuitive, binary-thinking search manager, this document may serve as a wakeup call—a fresh look at how a search can be optimized. Hopefully, by working together to build a better search, we can bring the missing subject—someone's missing child, parent, or spouse—home more quickly, and in better shape.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

1.0 Dispatch

1.1 Professional search resources should be dispatched without delay to any report of a lost or missing person where the current intelligence data indicates the subject is not a runaway or deliberate disappearance. The preceding statement is admittedly nebulous, and bears some additional clarifying points. These are described below.

1.1.1 Dispatch search resources immediately to any report of a hunter, berrypicker, hiker, skier, child, vulnerable adult, despondent, or other individual where the **Point Last Seen** (PLS) and/or stated intentions indicate a woodland search area in which the subject, due to loss or mishap, may be unable to return to safety on their own.

1.1.2 Dispatch search resources immediately to any report of a missing child in an urban or suburban area where the PLS and stated intentions indicate that the subject, due to loss, mishap, or abduction may be unable to return to safety on their own.

1.1.3 Dispatch search resources immediately to any report of an Alzheimer's walkaway from any care facility. Alzheimer's walkaways constitute one of the fastest growing categories of missing person in North America, and the mortality rate for these subjects is extremely high. While not usually a "Code Three" (red lights and siren) call, this search type is a true emergency, and the sense of urgency cannot be overstated.

1.1.4 Do not delay in dispatching search resources to any report of a vulnerable adult in a motor vehicle who fails to reach their intended destination. Examples include mild dementia or Alzheimer's patients who are still allowed to drive. Many agencies will hold off until the vehicle is found, thinking that deploying searchers is a "long shot." Even in this type of call, reflex sorties such as vehicle checks of tote roads, as well as a general "yankee search" by aircraft may greatly reduce the time to find the subject, thereby saving the subject's life.

1.1.5 Upon the evaluation of Law Enforcement, dispatch search resources to assist in the location of victims of foul play in woodland areas. Besides deploying active searchers, search planners can greatly assist in the prioritization and efficient coverage of sectors, as well as the accurate recording of expended effort.

1.1.6 Upon the evaluation of Law Enforcement, dispatch search resources to assist in the location of physical evidence of crimes.

1.1.7 Dispatch search resources to any report of a despondent in a woodland search area where the **Last Known Position** (LKP) is indicated by the discovery of the subject's vehicle. For example, reporting parties believe that a subject, through overt (i.e. suicide note) or implied behavior, may intend to do harm to himself. Later, the subject's vehicle is discovered in a remote location. Search resources should be called to this LKP without delay.

1.2 While local protocols may direct dispatchers to send Law Enforcement to "check on" a missing person report, do **not** delay dispatching search resources while this is done. Searchers will gladly accept a "cancelled en route" call many times to avoid the negative effects of even one delay getting rolling to a real search.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

1.99 ***Review of Steps in Section 1.0***:

- **Dispatch Search resources without delay.**

2.0 Initial Response and Pre-Staging

2.1 Personal Actions

2.1.1 Team members should always be ready to respond immediately to a call for a search. This includes having self, clothing, gear, and vehicle pre-assembled and in good condition.

2.1.2 *Self-Preparation*. A searcher will walk four miles during a typical woods sortie, quite often carrying a 15 to 25-pound personal pack, possibly in darkness or over rough terrain, and almost certainly on little sleep. Wilderness searching is not for the out-of-shape. Search team members should engage in an aggressive program of physical fitness workouts and a healthy diet, including adequate hydration. Good searchers are very self-aware with regard to their bodies...they perform "preventive maintenance" to avoid becoming run-down, and they proactively treat illness or seemingly minor injuries to ensure a speedy recovery.

2.1.3 *Clothing*. The sound of a pager beeping is not the time to run through the house in search of the right socks or the favorite pair of field pants. Search team members should maintain an ensemble of clean, woods-ready clothing, laid out or hung in one location, ready to don and go.

2.1.3.1 Dress in appropriate layers for the climate and activity. Utilize wicking, insulation, and shell layers in cold or inclement weather, as well as appropriate radiation layers in hot weather. During the typical cold weather search operation, you should feel slightly chilled as you prepare to depart the Base Camp, and warm up quickly once underway. Peel off or add layers as needed without delay—don't "tough it out" the last half-mile just because you don't want to slow the team down. Stop before you become overheated or significantly chilled.

2.1.3.2 In addition to your field pack, which should contain a foul-weather outfit as well as an extra insulating layer, prepare a "garrison pack" and store it in the Base Camp. Include a change of clothes to wear after the search in case you end up wading a beaver pond or taking a spill in a swamp.

2.1.3.3 *A hole in the sock means a hole in the foot*. Aggressive foot care is a must. A searcher can develop a nickel-sized blister on the hand and still be an effective contributor to the team. The same blister on the foot will cripple the searcher. Include a change of socks in your field pack, and remove boots and socks during extended rest breaks to cool and air out the feet.

2.1.4 *Personal Gear*. Good searchers carry gear! The olden days of a searcher being over-packed if he had a radio, compass, flashlight, and gun are long gone. You need to be self-sufficient through a wide variety of contingencies, including unexpected storms, an injury to yourself or a fellow team member, or finding a badly injured subject. Remember the acronym of the Search and Rescue specialist: **L.A.S.T.** which stands for

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Locate, **Access**, **Stabilize**, and **Transport**. Your individual and team gear should enable you to accomplish all of these general tasks!

2.1.4.1 Personal equipment should include, but not be limited to, a minimum of the following items:

Compass/Map/GPS	Radio
Drinking water	Food: quick energy & candy
Foul-weather gear	Shelter materials (tarp, cord, duct tape)
Durable flame sources	First Aid supplies
Extra clothing	Flashlight or headlamp
Signaling device	Knife, multi-tool or both

Spare batteries for all electronics and electrical items
Specialty items such as tracking stick, cards, measuring tape
Paper and pencil for recording notes, other intel

2.1.4.2 When pre-staging at a rally point such as a Rescue Squad building or fire hall, and no matter where you fall in the response curve, take five minutes and go over your personal gear. Do not wait until you are in the woods to discover your GPS is dead or your compass is in your other pants!

2.2 Response Actions

2.2.1 A call to search is a true emergency; however, "Code Three" (red lights and siren) driving is rarely indicated. Driving is the Number One cause of death in the Emergency Services, and the time saved by driving Code Three is minimal. By engaging in this dangerous action, we trade a possible increased hardship to the subject for a certain hazard to all search team members. Drive urgently, but responsibly to the scene.

2.2.2 When answering the page, contact Dispatch to inform them that you are in-service according to local protocols. If you are responding from home, simply go in-service. If responding from any other location, give a one or two-word description of that location, such as "7111 is 10-8 (in service) from West Duluth." Or, an estimated time of arrival (ETA) to the assembly area may be given, such as "7110 is 10-8, ETA to Pike Lake is 40 minutes." Do not clog the radio channel with extraneous descriptions of where you are and why you are out of position. The above transmission are sufficient to get you "on the air" for insurance purposes, as well as let your partners know that you are responding and that they need to wait for you.

2.2.3 Depending on position and location of the call, specialty resources such as trailing dogs and human trackers may elect to go directly to the scene to preserve the PLS, as well as begin collecting a scent article and determining Prime Sign.

2.2.4 Appropriate individuals should gravitate to satellite garages and other storage locations to pick up outlying vehicles, as well as any additional equipment such as all-terrain vehicles (ATVs) or boats.

2.2.4.1 Responders should try to make the bulk of their journey in a marked Rescue Squad vehicle. While never completely unavoidable, responders should try not to travel long distances in their Privately-Owned Vehicle (POV). Team up with another rescuer whenever possible.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

2.2.4.2 With the above statements in mind, do not tie up repeater frequencies trying to arrange a ride with someone. If coordination cannot be accomplished in one or two short radio bursts on a tac-channel or by cell phone, then abandon the attempt and drive directly to the assembly area. Dispatch, as well as the General Staff and other Law Enforcement need the channel for more important matters.

2.2.4.3 An alternative and better method is to pre-arrange with other responders in advance of the page-out to meet up with them in specified locations. For example, "If I hear you sign on the air, I'll wait for you at 45th and Glenwood. If I'm not sure you're coming, I'll wait for two minutes at that location after I get the truck started. If I don't hear you on Tac-B by that time, I'm gone."

2.2.5 As personnel arrive at the assembly area, and after first checking over their own personal gear, they should immediately begin completing garrison check-out tasks to make all equipment ready for use. These tasks include:

- ☐ Food, water, flashlights and other supplies fully stocked in CP?
- ☐ Soda pop and bottled water in the coolers?
- ☐ Full tanks near full? Fluids topped off and belts tight?
- ☐ Vehicle free of junk from previous operation?
- ☐ ATVs and boats test started? Fuel and fluid levels full?
- ☐ Required safety equipment (e.g. helmets) with towing vehicles?
- ☐ Tie-downs secure? Trailers hitched securely?
- ☐ Copy of the call printed? Do we know where we're going?

2.2.6 When all personnel have arrived (except for late-arrivals), assemble the group for a pre-stage briefing. Included in this briefing should be directions on how to reach the scene so teams do not get lost en route.

2.2.7 Make arrangements for someone to wait for late arriving team members. Then, move to the scene.

2.99 ***Review of steps in Section 2.0***:

- ⊙ **Prepare self, clothing, and gear in advance.**
- ⊙ **Respond promptly and sensibly.**
- ⊙ **Team up. Be sure to grab satellite equipment**
- ⊙ **Perform pre-stage briefing at the Squad garage.**
- ⊙ **Make arrangements for late-arrivals.**

3.0 Staging

3.1 Concurrent Operations Upon Arrival:

3.1.1 Upon arrival at the scene of the developing search, check in with the current Incident Commander to get briefed on the Situation Status, what's been done and by whom, and what's happening now.

3.1.1.1 Searches in woodland areas within of St. Louis County are the statutory responsibility of the Sheriff under Minnesota Statute 387.03, and delegated to the

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Rescue Squad and liaison deputy under Minnesota Statue 387.14. On water-related searches, similar responsibility is granted under Minnesota Statute 86B-105.

3.1.1.2 Exceptions to the above jurisdictional guideline do exist, however. These include mutual aid calls to other service areas, as well as municipal jurisdictions where the simple lost or missing person scenario may be compounded by abduction or criminal implications.

3.1.2 Assign early arriving personnel, or individuals already on-scene, to "cover the hazards." This includes physically occupying approach paths to cliffs, swift or deep water, major roadways, etc. particularly in cases of missing children or vulnerable adults.

3.1.2.1 Consult the Subject Behavioral Profile for the general category of subject you are searching for. If confinement is listed as a priority, establish a confinement patrol on major roads.

3.1.2.2 Consider the potential for the destruction of human sign when you assign confinement patrols. Confinement patrols in some corridors may have to be delayed until signcutters have a chance to examine them.

3.1.3 Begin to round up reporting parties, the requesting officer, or other informants with pertinent intelligence data. This information will be captured in the **Missing Person Questionnaire** (ICS Form 302)

3.1.4 Assign a trained canine handler or tracker to investigate and protect the Prime Sign and scent areas around the PLS. **This is a vital task and should be assigned quickly**.

3.1.5 Set up the **Command Post** (CP) vehicle. Provide generator power, turn on the lights inside the CP area, activate radio, cell phone, and mobile data computer, if available.

3.1.5.1 Start up all available laptops and position them at the appropriate work stations in the CP. Launch mapping software (to record waypoints from field teams), *Search Tracker* (to record search effort and plan sorties), a blank Word document to serve as the Comms Log (ICS Form 309), and the Personnel Tracker (Check-in/Check-out) software. Turn on the wireless router to enable everyone to print documents.

3.1.6 Delegate to someone the task of marking and saving the CP vehicle as a **Global Positioning System** (GPS) waypoint. Once the mapping software is loaded, call up the appropriate mapsheet for the search, and plot the CP coordinates as a waypoint. At this time, it is a good idea to set waypoint *Preferences* to a sharp, contrasting color (like maroon or black), as well as select a small, crisp symbol with which to mark waypoints.

3.1.7 Assign a team to park and/or stage vehicles and trailers so that smooth traffic through the Base Camp may be maintained. It is not necessary to de-trailer ATV's or other equipment until assignments are issued that need them. However, it's a good idea to double-check fuel and other fluid levels, as well as test-start machines.

3.1.8 Check in all SAR and Agency personnel on-scene, using either computer software, or with alcohol markers on the map table. Groups of Agency staff or civilians can be checked in using ICS Form 211B from the folder of blank forms, or with a simple legal pad and a pen, for future loading into the accountability software.

3.1.9 Assign a small team to scout the nearby perimeter for trails or roads that penetrate the Primary Search Area from any main access roads, and save these as GPS waypoints.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

During their scouting mission, ask the team to be on the lookout for a suitable **Landing Zone** (LZ), and save the GPS coordinates for it as well.

3.2 Initial Planning Actions:

3.2.1 Using **Incident Command System** (ICS) principles, designate a Command and General staff. Remember, you activate *functions*, not *people*. An individual may hold more than one function, but a single function is generally not held by more than one person unless the additional member serves as relief for another. At a minimum, the following ICS functions should be activated:

Incident Command (IC)	Plans Section
Operations Section (Ops)	Logistics Section
Law Enforcement Liaison	Family Liaison
Public Information (PIO)	Staging
Communications (Comms)	Situation Status

3.2.1.1 Many resources may be currently inbound to your location. Consider the immediate activation of the Staging Function to funnel these resources to a place where they can be effectively deployed and not clog up the Base Camp.

3.2.1.2 Remember the concept of "No involvement = no commitment." Under the ICS principle of Unified Command, *all agencies having jurisdiction should have a seat on the General Staff*. All participating agencies should have a direct line to the Command & General Staff through an assigned liaison. All participants need to be informed of not only **what** their assignment is, but also **why** it is important to the overall success of the mission.

3.2.1.3 Even at this early stage, begin thinking about relief. Operational periods generally run in 12-hour tricks from 1800 to 0600 hours, 2000 to 0800 hours, etc. Who with a clear head will you call to relieve you tomorrow morning to run the day shift? Failure to relieve fatigued personnel is a major source of critical errors in search operations that go bad!

3.2.1.4 Readers may note the conspicuous absence of a Safety Officer function. This role can provide a real benefit to a tightly compartmented operation such as a motor vehicle accident or small fire, but it fails in principle at more spread-out operations like searches. **Everyone** should be a Safety Officer, trained in the principles of Behavioral-Based Safety. Appointing a "safety cop" is not the answer, for he or she can be in only one place.

3.2.2 Begin to construct a missing person profile, starting with the Missing Person Questionnaire (Form 302-B). Normally, the current IC, as well as the current Law Enforcement Liaison will be the best sources of baseline data. From there, interview direct family members, as well as any friends or partners who were with the subject at the time of disappearance. Round out your profile by interviewing extended family and locals not party to the call, but who may have additional pertinent details. Locals may possess knowledge of map features or terrain information, such as unmarked trails or other landmarks.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

3.2.3 Assemble all known intelligence data from all the previous tasks.

3.2.3.1 Trackers and canine handlers should be able to provide an assessment of the feasibility of applying their respective specialties to this mission.

3.2.4 Based on the intelligence picture formulated to date, calculate Theoretical, Statistical, and Subjective distances.

3.2.4.1 *Theoretical Distance* is simply the number of hours the subject has been missing multiplied by their estimated speed per hour.

3.2.4.2 *Statistical Distance* may be obtained from Brain Books and Subject Behavioral Profiles kept on file in the Command Post.

3.2.4.3 The General Staff determines the *Subjective Distance* by analyzing the current intelligence profile, factoring in both Theoretical and Subjective distance, as well as any barriers, attractions, and the subject's intended route and destination.

3.2.5 Based on all of the above planning information, select a Primary Area on which to base your Reflex effort. "We believe the subject is in *here*."

3.2.6 Pending a more formal **Probability of Containment (PoC) Analysis**, identify rough segment boundaries to help guide interior reflex teams during their sorties. These may change later, but for the moment, they help define reflex team areas of responsibility.

3.2.7 Consider calling for mutual aid from other EMS agencies early in the search. Larger reflex efforts have been shown to have a positive impact on subject outcome, as well as **Probability of Success (PoS)** if the search should progress to the **Area-Search Phase**.

3.2.8 It is not the scope of this document to describe all the logistical concerns such as food, water, hygiene, rest, and transport. These fall under the Logistics Section, and will need to be effectively managed as the operation grows in size.

3.99 ***Review of steps in Section 3.0***: If, upon arrival at the scene, you note that any of the following are not being done, activate functions or assign personnel to take care of them.

- **Cover hazards and establish containment.**
- **Establish a subject intelligence-gathering function.**
- **Perform Base Camp set-up tasks.**
- **Establish a personnel check-in function.**
- **Establish Incident Command System.**
- **Assign Tracker and Canine reflex tasks.**
- **Analyze mission profile to prioritize Reflex Phase tasks.**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

4.0 The Reflex (“*Blitz”* or “Hasty”) Phase

4.1 Concurrent Operations:

4.1.1 Deploy reflex-type (hasty) resources, including trackers, canines, sound teams, perimeter patrols, and trail checks as indicated by the situation and the subject behavioral profile.

4.1.1.1 If the search originates from a residence or other structure, and once sufficient personnel have been assigned to cover hazards, perform a scrupulous check of all buildings in the vicinity of the PLS, including attics, rafters, lofts, and basements of all structures. Also, conduct a grid search (Spacing = 1 x Effective Sweep Width [ESW], obtained from the pink reference card in the CP) of tall grass and scrub woodlines around the property, particularly in searches for vulnerable adults.

4.1.1.2 Perimeter road patrols should be staffed with the overall goal of placing a “set of eyeballs” in every roadside ditch within the Primary Area <u>at least once every thirty minutes</u>. While nearly impossible to attain in practice, the importance of this reflex task cannot be overemphasized. Rotate personnel often to avoid fatigue.

4.1.1.3 Trail-running serves two functions: Searchers scan the trails and the woods to either side, as well as map the trail network for plotting by the Plans Section for future sorties. Be sure to brief trail-search teams to save GPS waypoints for every trail junction and landmark, using the “GPS Shorthand” naming system taught in the Rescue Squad’s GPS training.

4.1.1.4 Personnel should be available to follow up on additional sources of intelligence data or “leads” as they become available. A Law Enforcement (LE) liaison is an excellent person to handle this role.

4.1.1.5 Send deputies or other LE personnel to check nearby businesses such as taverns or stores for both the subject and additional intelligence data from other patrons who might have seen the subject. This sortie is known by the slang term *Bastard Search*, named after what searchers call the subject when they find him sipping a beer at a nearby bar.

4.1.1.6 Issue a missing person alert according to agency protocols, such as an “Attempt to Locate (ATL)” or “Be on lookout (BOLO).”

4.1.2 <u>*Sound searches*</u> require silence when not actively signaling. Random shouting without coordinating in advance is strictly forbidden, as it produces wild goose chases from teams signaling each other. Moreover, random attraction methods such as “trying the siren” without first deploying teams to listen for a reply are also strictly forbidden. You are building a “sound rapport” with your subject, and not a shout is made or a horn tooted unless all teams have been informed that a sound signal is coming, and time given for them to prepare to listen for a reply.

4.1.2.1 Sound teams should establish primary listening posts along ridges and hilltops, and in meadows or clearings away from dense undergrowth. Teams in vehicles who stop to listen should shut off engines, radios, and other sources of noise. A contingent of Base Camp staff should move beyond the camp’s engine and generator noise and listen as well.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

4.1.2.2 The initial signal, called the ***Primary Signal***, is normally made using the search horn—or if the horn is not available, a siren. This signal will normally be made for five seconds, with at least one minute of absolute silence while all teams listen. The signal is then repeated.

4.1.2.3 Secondary signals originate from field teams, and may come in the form of a firearm, whistle, or team shout in unison. For names that are easy to enunciate, like "Joe" or "Frank," a typical shout would be "Hey Joe!" or "Hey Frank!" For names that don't roll off the tongue easily, a typical shout is simply, "Hello!"

4.1.2.4 Before leaving their assigned primary listening post, each team should attempt a secondary signal. This technique is known as **By-the-Ripple**, and should begin with the team closest to the center of the Primary Area. Noise discipline must be maintained by all teams during these signals as well.

4.1.2.5 If the Primary Signal and By-the-Ripple secondary signals fail to elicit a response, the horn is set to Automatic, and serves as a navigational aid for field teams, and an attractor for the subject. The horn will normally stay in Automatic until intelligence data supports a conclusion that the subject is no longer able to travel.

4.1.2.6 Once placed and activated, the Primary Signal is never moved, unless clear, irrefutable intelligence data indicates that its current position will be ineffective.

4.1.2.7 Once teams move off their primary listening posts, they should attempt a shout or whistle approximately **every 12-15 minutes**, or four to five times per hour.

4.1.2.8 Command must establish periodic checks of all teams in the woods to ensure their location and welfare. Record all coordinates in the Comms Log, as well as mapping software.

4.1.3 *Tracking and Signcutting.* Tracking is an extremely viable first response resource. Everywhere people walk, they leave sign of their passage, and skilled trackers can acquire, appropriately age, and follow sign to its maker.

4.1.3.1 Three trained individuals comprise a tracking team, a Point and two Flankers. If absolutely necessary, a team of two trackers can be supplemented by one untrained individual.

4.1.3.2 One team remains with the last known track, called the Prime Sign or simply "Prime." If, for any reason, the Prime Sign team needs to leave the last known track, the track should be encircled in flagging, with more flagging displayed prominently at eye-level. Ensure coordinates are recorded in the Comms Log.

4.1.3.3 The essence of tracking can be captured in four elements symbolized by the acronym "DIRT," which stands for Detect, Interpret, Record, and Trail. Tracking is optimized only when all four elements are performed. Special attention should be given to each team sketching suspected subject tracks on blue pocket cards.

4.1.3.4 Signcutting is the process of acquiring the subject's track by intercepting his trail through the process of scanning or "cutting" areas in a continuous closed loop around the LKP.

4.1.3.5 Elimination tracks may be obtained from persons who potentially contaminated the subject's sign by having them step in soft earth, or on a piece of aluminum foil laid across a carpet scrap. Supplies are stored in the CP vehicles.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

4.1.3.6 Trackers and canine resources work very well together—neither one interfering with the other. Canines tend to "trail" a scent, which normally has drifted several feet to the side of the actual track, enabling trackers to follow the uncontaminated sign behind the canine team. However, in areas where the scent lays directly on the track, qualified trackers are able to easily discriminate the subject from the canine team's sign.

4.1.3.7 A request for a track sample should be a standard question when interviewing for the Missing Person Questionnaire. Besides the actual departure track, samples may be obtained from areas where the subject is known to have visited, such as a workshop or garden. Track samples may also be obtained along the route of a recently completed chore or task, such as filling the woodbox (check by the woodpile), or taking out the trash (retrace steps).

4.1.4 *Canine Resources.* The use of dogs in the wilderness search realm is nearly universal, and their reputation is legendary.

4.1.4.1 *Trailing* dogs discriminate and follow a specific human scent. *Air scent dogs* detect and follow the strongest human scent. Finally *cadaver dogs*, also called *Human Remains Detection (HRD) dogs,* are trained to detect the scent of decaying human tissue, to the exclusion of other decomposed material.

4.1.4.2 Only canine teams with documented training records and demonstrated ability to adhere to ICS principles in the search realm should be employed. Colorful freelancers and untrained "mavericks" may show up in the Base Camp with great fanfare, demanding to be deployed.

4.1.4.3 Quality canine teams should be deployed to sectors with a high **Probable Success Rate** (PSR)—in other words, they should work the "hot leads." Do not allow this valuable but finite resource to be assigned to low-containment sectors or "distractions" such as psychic leads or spurious tips.

4.1.4.4 When issuing an assignment to a canine team, tell them *what* to do, not *how* to do it. The handler knows his or her animal, and knows best how to deploy and run the dog. However, as with all field teams, when the canine team returns from an unsuccessful sortie, do NOT accept field assessments of how much the dog "covered." ONLY use scientific formulas that are based on Effort and Effective Sweep Width (ESW).

4.1.5 Brief all field teams before they clear the Base Camp, to include subject profile, terrain, forest conditions, hazards, and Safety Direction for quick exit from the woods. Field team leaders should consult the Effective Sweep Width (ESW) tables for the forest type they will be searching in, and space their team members accordingly to modulate the coverage obtained by their team. Finally, instruct field teams to report in when they begin to search their assigned sector, when they stop searching, and any breaks or delays taken while inside the sector to assist in the accurate calculation of Effort.

4.1.6 Ensure that field teams carry sufficient gear to support the team through unexpected contingencies. Two items that should be double-stocked include radios and flashlights (for night operations). A dead flashlight will cripple the team member, while a dead radio can cripple an entire team. A brief list of essential items is shown below.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

- Compass/Map/GPS
- Drinking water
- Foul-weather gear
- Durable flame sources
- Extra clothing
- Signaling device
- Radio w/spare battery
- Food: quick energy & candy
- Shelter materials (tarp, cord, duct tape)
- First Aid supplies
- Flashlight or headlamp
- Knife, multi-tool or both
- Spare batteries for all electronics and electrical items
- Specialty items such as tracking stick, cards, measuring tape
- Paper and pencil for recording notes and other intel

4.1.7 All field teams should be staffed, at a minimum, with a Team Leader, a Navigator, and a Medic. The Medic should represent the highest medical certification available on site. In other words, don't allow all the Emergency Medical Technicians (EMTs) to bunch up on one team—spread them out so that certification level is represented on every team.

4.2 Planning Functions:

4.2.1 Effort expended on reflex sorties may be used in detection calculations **only** if those calculations adhere to the principles of Search Theory. These criteria are summarized below. A field team **never** calculates its own Coverage or **Probability of Detection** (PoD)—they simply have no way of knowing. Only the Plans staff calculates PoD.

4.2.1.1 Calculation of area searched must be based on Effort, which is the linear distance traveled by the search team. Effort may be determined either by a speed x time ($z = v \times t$) calculation, or by measuring the distance between successive sets of GPS coordinates.

4.2.1.2 Calculation of area searched must also be based on ESW taken from tables kept in the CP, **not** spacing between team members or other arbitrary method.

4.2.1.3 The search resource must visit every part of their assigned sector. If they "pound" one area and ignore another; either the sector must be subdivided, a follow-up sortie dispatched to finish the unswept portion, or the effort cannot be used in the detection calculation.

4.2.1.4 The area searched must be divided by the total sector size in order to determine Coverage.

4.2.1.5 A detection function must be used to account for unknown random error.

4.2.2 Debrief all returning teams thoroughly upon return to the Base Camp. Teams should be allowed to secure gear, care for their canines (if present on the team), change out of wet clothing, if appropriate, and grab water or coffee. However, teams should not be released for major down-time until the debriefing is completed. Debriefing is normally conducted by someone from the Plans staff.

4.2.2.1 For small reflex teams, the whole team should debrief with Plans. For larger teams, at a minimum, the Team Leader and Navigator should be debriefed.

4.2.2.2 The team and the debriefer should compare notes on *where* exactly the team traveled during its sortie. The Plans staff should have map coordinates saved in the mapping software (or plotted on hard-copy) for the team to view, while the

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

team can orient themselves to terrain features encountered, such as swamps, hilltops, streams, trails, etc.

4.2.2.3 Debrief the team on the forest types encountered, referring to the ESW tables as needed. Were the conditions better or worse than expected? What factors contributed to conditions being different than the "nominal" ESW values? Consider thicker-than-normal ground cover, fallen trees (particularly in forest types 2B (Birch/Aspen/Fir) and 5A (Spruce/Fir), and rough terrain.

4.2.2.4 Debrief the team on its perception of its average speed, referring to the GPS plots on the map and the Comms Log as needed. Where did the team "make good time?" Where did they bog down? Was there any part of the sector that the team did NOT search? Why?

4.2.2.5 If pertinent intelligence data was discovered, debrief the team on the characteristics, appearance, and presentation. The team should be given sufficient "air" to offer their perception and opinions on the relevance of this data, keeping in mind they may not be aware of the total picture.

4.2.2.6 Note any mishaps, injuries, personnel issues, or other information.

4.99 ***Review of steps in Section 4.0***: If, upon arrival at the scene, you note that any of the following are not being done, activate functions or assign personnel to take care of them.

- **Brief all field teams thoroughly before deployment.**
- **Maintain perimeter/containment patrols.**
- **Perform reflex tasks as indicated by mission profile.**
- **Record all sortie efforts in Activity Log.**
- **Debrief all returning search teams thoroughly.**
- **Use only Search Theory principles, NOT field estimates!**
- **Analyze mission profile to prioritize Reflex Phase tasks.**

5.0 The Area-Search Phase – Planning:

5.1 Planning Activities

5.1.1 Once all reflex sorties have been deployed to the field, the focus of activity inside the CP will shift from the General Staff to the Comms and Situation functions, who must handle a flurry of radio traffic, position plots, and status reports from the field. At this time, the General Staff should take advantage of this lull in their need to make decisions, and begin to plan the next phase of the search in the event the Reflex Phase fails to locate the missing subject. The following paragraphs describe how to do this.

5.1.1.1 Scratch paper and pens or pencils should be available for all participants to make their individual **Probability of Containment** (PoC) assessments. A dry erase white board or chart pad and markers is useful to collect individual assessments for overall analysis.

5.1.2 Ensure that all intelligence data collected to date has been assembled in a central location, including Word files for "soft" intel such as witness or reporting party testimony, and a folder for hard copies of license checks, print-outs of financial

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

transactions, and other records. Facts should be discriminated from beliefs, from uncorroborated data, to rumors, to total inaccuracies.

5.1.3 A **Probability of Containment / Scenario Analysis (POCSA)** is a formal process used to analyze the intelligence data known and believed to date in order to formulate a more effective search plan, as well as identify and prioritize areas in which to search. A POCSA follows the basic steps described on the following pages. It can be very loose, as when performed by a bleary-eyed General Staff at 3:30 a.m., or be a very structured exercise performed off-site, long after search suspension has occurred.

5.1.3.1 The more formal POCSA process typically produces a document containing the highlights of both the Scenario and Containment Analysis components, and contains information grouped into the following categories:

5.1.3.1 (a) **Subject Information** – A description of the subject, including a physical description, clothing, gear carried, and background information regarding the loss event.

5.1.3.1 (b) **Key Intel** – A summary of all intelligence data, framed in the context of fact (show how confirmed), beliefs (show arguments to support or predictive logic), and other data. Intel items believed to be "key" in the analysis process are often highlighted or boldfaced in the POCSA document.

5.1.3.1 (c) **What Was Done** – A summary description of areas searched and by what types of resources.

5.1.3.1 (d) **Safety Items** – A description of risks and hazards to searchers. This can be as mundane as a hornets' nest on the building next to the CP, to deep gorges and cliffs in a particular search area.

5.1.3.1 (e) **Scenario Analysis** – This is described in paragraph 5.1.4 below. In the formal document, scenarios list broad categories of outcome, supported by sub-scenarios that explain the specific cause. An example is shown below.

I. SUBJECT IS DEAD IN THE WOODS

1.1 Fell off cliff; succumbed to trauma.
1.2 Lost; wandered; succumbed to hypothermia or trauma.
1.3 Criminal; friend murdered him; concealed or unconcealed body
1.4 Criminal; someone else murdered him; (stumbled onto drug lab, growing operation, etc.).
1.5 Suicide
1.6 Abandoned mine or test pit; fell or became trapped.
1.7 Attack by animal
1.8 Other sub-scenario we haven't thought of.

II. SUBJECT IS ALIVE IN THE WOODS

2.1 Lost; hypothermic; panic-stricken; wandering; etc.
2.2 Fell or suffered other trauma; alive and injured.
2.3 Uninjured; avoiding; camping; broke into cabin.
2.4 Other sub-scenario we haven't though of.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

5.1.3.1 (f) **Future Tactics, Regardless of POC Analysis** – Another name for this section is "We can't sleep knowing this hasn't been done."

5.1.3.1 (g) **Containment Analysis** – This section contains the raw region ratings, described in paragraph 5.1.5.

5.1.3.1 (h) **Bin Items** – Things you don't want to forget that don't readily fit into another section.

5.1.4 ***Scenario Analysis***. What could have happened to the subject? Evaluate possible scenarios that would explain the subject's disappearance. Encourage all input, using a brainstorming approach. Feel free to piggyback on others' ideas; however, avoid the pitfall of *scenario lock*, where only one scenario is given serious consideration. Moreover, participants should discipline themselves to confront any use of positional authority to "drive" a particular scenario—every participant's input is vital to a successful analysis. Finally, the Scenario Analysis should be afforded sufficient time and "psychological air" to grow into a complete product. **Warning**: If your analysis is "done" in five minutes; then there are probably several possibilities you overlooked or ignored. Examples of dialogue from typical Scenario Analyses appear below.

- "The subject's stated intention was to hike north to inspect beaver dams in this region. So, assuming he became lost, he could be in these valleys or along this ridge. However, he also scouts for berry patches for his wife while hiking, so if he became lost or injured while doing that, he could also be on this ridge to the east, where the berries are better. I believe he followed his original intentions, and we're much more likely to find him near the beaver ponds in the western region, than in the berry patches to the east."
- "When the subject became chilled while standing, he liked to walk this trail to the end, then double back to the cabin before returning to his stand. But his partner said he preferred to loop west vs. east. This would make the area west of the trail much more likely than either east of the trail, or north off the end." But he knows the west side like his backyard, so if he's in there, there's a greater chance he's hurt or suffered some medical emergency.
- "We know the subject made it to the trailhead here. If he simply got lost, then it's highly unlikely that he's in the northern area—there are just too many landmarks for him to see. But if we're looking at an injury scenario, then he's more likely to be in the southern region with all these cliffs and gorges. He said he was going exploring, and that he'd found some "really cool places." That leads me to think he's in the southern region here—either around Ely's Peak, Elephant Head, or Jarrow's Canyon."

5.1.4.1 Notice from the examples above that, while precise numerical relationships between scenarios have not been stated, the participants frame the possibilities in terms of *likelihood*. They consider potential changes in the subject's plans, as well as possible decisions made by the subject while en route. They also consider broad categories of outcome...berrypicking vs. exploring; lost vs. injured; etc. Moreover, they utilize current intelligence data... "We know the subject made it to

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

the trailhead…"; "…he preferred to loop west vs. east…"; "He said…he'd found some 'really cool places'…".

5.1.4.2 The next step is to draw a boundary around the search area that defines *100 percent Probability of Containment*. In other words, regardless of which scenario resulted in the subject going missing (a scenario from your analysis, or another one that you have not considered); you believe that the subject is inside that boundary. You must consider all plausible scenarios, the Theoretical, Statistical and Subjective distances, as well as all evidence and intelligence data available to you. The resulting area inside the boundaries comprises the overall search area, and is called the **Max Containment Zone**.

5.1.4.3 Wherever you draw your boundaries for the Max Containment Zone, you should feel comfortable that it constitutes virtually 100 percent of the Probability of Containment. Obviously, there is a possibility—no matter how remote—that the subject is snapping pictures of the Eiffel Tower in Paris, or sipping a drink on a beach in Mexico. Quite literally, the subject *could* be anywhere. But given the intelligence data available to you at this moment, decide where YOU think the subject realistically could be, and draw your boundaries accordingly.

5.1.4.4 The next step is to segment the map of the search area into **regions of equal likelihood**. In other words, any spot inside a region is as likely to contain the subject as any other spot in that same region. Use obstacles, decision points, and other definable landmarks to mark region boundaries. For example, a missing child is unlikely to cross a busy four-lane divided highway, so the highway would make an excellent region boundary to separate the "hot" area on one side from the "cooler" area on the other. Conversely, if the subject is equally likely to be west of a popular hiking trail as east of it, then that trail might not make a good region boundary.

5.1.4.5 **Do not be concerned with the "searchability" of the regions you define!** Large regions will be subdivided into searchable sectors later.

5.1.5 ***Probability of Containment (PoC) Analysis***. When a Scenario Analysis has been completed, and the search area segmented into regions of equal likelihood, perform a Probability of Containment (PoC) Analysis. The results of this exercise will be entered into the *Search Tracker* software and used for the remainder of the search to track cumulative Probability of Success (PoS). *This exercise is vital to an effective search planning process. It represents half of the Probability of Success (PoS) Equation, and helps to answer the question, "Are you searching in the right place?"* The PoC Analysis uses the **Proportional Consensus** method, which is described below. Note: Some agencies use NSARS planning software, which while more challenging to use, is also scientifically valid.

5.1.5.1 Open the *Search Tracker* spreadsheet located on the desktop of all Command Post laptops. Perform a *File/Save As*, and rename the spreadsheet. The typical format for naming the new file is yyyymmdd, (Subject Name) Search. For example, "20040918, Joe Bufflitz." Then, enter the appropriate header information at the top of the Planning Page.

5.1.5.2 Note the various colors on the worksheets. **White** fields are cells that require input from you. These are the only field in which you will type, with one exception. **Pink**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

cells are *conditional fields*, meaning you can either accept the result produced by the formula behind the cell, or you can choose to overwrite the formula with your own data. **Blue** fields are formula-driven, and are where the spreadsheet does its work for you. **Do not type in colored fields, or you risk corrupting the spreadsheet and rendering your work useless.** **Green** fields are also formula-driven; however, information in these fields is also used to support your decision-making. *The one exception to the colored-field rule is Pink*.

5.1.5.3 Click on the **PropCons** tab at the bottom of the screen to bring up the Proportional Consensus Page.

5.1.5.4 On a separate piece of paper, each Command Staff participant individually decides which region is **most likely** to contain the missing subject. He or she assigns this region a value of 10. The participant should carefully consider all possible scenarios that might explain the subject's loss when determining which region to assign the 10-rating.

5.1.5.5 Each participant then rates all the other regions **in proportion to** the most likely region. For example, if the participant believes Region B is half as likely to contain the subject as the most likely region, he or she would rate it a 5; if it's a third as likely, a 3; almost as likely, a 9; and equally likely, a 10. Any number on a 0 to 10 scale is permitted, as long as it reflects proper proportion to the most likely sector. If you don't believe there is *any* chance of a region containing the subject, rate it a zero; however, this option should be very carefully considered, and even then used sparingly. Do **not** be concerned with staying inside some arbitrary allotment of points, such as a 100-point scale taught in the Mattson Method. If you believe that four regions are equally likely to contain the subject, rate them all the same.

5.1.5.6 When all participants have completed their individual assessments, load the values into the appropriate white fields in the green section of the PropCons calculator. Enter the name of each participant in the appropriate field.

Scenario 1	Enter your values in the WHITE cells! Do NOT type in the green shaded cells!											
Participant Names	Region A		Region B		Region C		Region D		Region E		Region F	
Curly	10	0.263	9	0.237	7	0.184	3	0.079	4	0.105	5	0.132
Moe	6	0.150	8	0.200	10	0.250	6	0.150	1	0.025	9	0.225
Larry	10	0.313	5	0.156	9	0.281	1	0.031	2	0.063	5	0.156
Participant 4												
Participant 5												
Participant 6												
Participant 7												
Participant 8												
Participant 9												
Participant 10												
Participant 11												
Participant 12												
Raw Region Score		0.726		0.593		0.715		0.260		0.193		0.513
Region Score		0.242		0.198		0.238		0.087		0.064		0.171
Weighted Region Score		0.242		0.198		0.238		0.087		0.064		0.171

Figure 5.1, Sample Proportional Consensus values loaded in the PROPCONS Page. The Region Scores fill in automatically.

5.1.5.7 The scoring fields will automatically fill in with normalized PoC values. "Normalized" simply means the values are divided by the total of all values assigned by each participant to convert them to a percentage on a 100-point scale. Again, at this point we are not concerned with region size or worrying about how we will search

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

them. We are only concerned with rating all *regions of equal likelihood* **in proportion to** the most likely region (the "10" rated region).

POC	A	B	C	D	E	F
	0.242	0.198	0.238	0.087	0.064	0.171

Figure 5.2, Normalized PoC values automatically transfer to the blue section at the top of the page.

5.1.5.8 Notice that the normalized PoC values appear in the blue section at the top of the PropCons Page, as shown in figure 5.2. The normalized PoC values can be expressed as percentages by simply moving the decimal point two places over. For example, in Figure 5.2 above, we can say that, based on our assessment of the intelligence data, there is a 24.2 percent likelihood the subject is in Region A, a 19.8 percent likelihood he is in Region B, a 23.8 percent likelihood he is in Region C. etc.

5.1.5.9 The next step is to segment the regions into searchable sectors, which is done on the Segmentation Page. Click on the Segmentation tab at the bottom of the screen to bring up this page. The normalized PoC Values automatically transfer to that section, saving you a lot of typing. A sample Segmentation Page, before any sub-dividing is done, is shown in Figure 5.3 below.

Section E – PoC Distribution to Segments DO NOT TYPE IN BLUE SHADED AREAS!

Instructions: First, sub-divide your regions into searchable sectors. Then, using Maptech and the "Convert" Page, OR the dot matrix area estimator, measure the area of each sector, and enter it into the appropriate field.

Region	Region PoC	Sector ID	Sector Area	Sector PoC
A	0.242	A1		
	From	A2		
	PropCons	A3		
	Blue	A4		
	Section	A5		
		A6		
		Total:		
B	0.198	B1		
		B2		
		B3		
		B4		
		B5		
		B6		
		Total:		

Figure 5.3, A blank section of the Segmentation Page. Note that the Region PoC values automatically transfer over from the PropCons Page.

5.1.6 ***Region Segmentation***. On your map of the search area, divide each region into searchable segments, called *sectors*. To fit the parameters of the software, you are allowed up to six sectors per region. Wherever possible, use identifiable terrain features to mark boundaries of sectors. This will help prevent search teams from mistakenly straying into another sector, while giving "credit" for their effort to the one they were assigned. Use spurs, draws, drainages, trails, roads, ridge tops, etc. This is not always possible; however, when drawing sector boundaries across featureless terrain, try to make the jump across "no man's land" as short as possible. Sectors greater than one-quarter square mile (0.25 mi^2) should be examined for subdivision. Sectors smaller than one-quarter square mile (0.25 mi^2) are generally able to be searched without further segmentation. Label the sectors according to the convention provided on the

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Segmentation Page. For example, if Region A is divided into three sectors, they would be labeled A1, A2, and A3, respectively.

5.1.6.1 Next, measure the area of each sector in square miles. There are two ways to do this. One method is to use the Dot Matrix Area Estimator. On the map, lay the tool over the sector you wish to measure, and count the dots that fall within the sector boundaries. **WARNING: If you are doing this from the screen or a printout of mapping software, you MUST make sure the scale is 1:1!** Each dot represents 0.01 square miles. So, for example, if you counted 24 dots inside the sector, the square area of the sector is 0.24 square miles. An alternative method to determine sector area is to measure the dimensions of the sector using the distance tool in the mapping software, or with a scale protractor on a hard copy map. Then, using the Convert Page, determine the area of the sector and convert it to square mile units using the calculators provided. Whichever method you choose, enter the square area for each region into the appropriate field on the Segmentation Page, as shown in Figure 5.4 below. The software will automatically determine the Sector PoC, as well as "activate" that sector on the Planning Page.

Section E – PoC Distribution to Segments DO NOT TYPE IN BLUE SHADED AREAS!

Instructions: First, sub-divide your regions into searchable sectors. Then, using Maptech and the "Convert" Page, OR the dot matrix area estimator, measure the area of each sector, and enter it into the appropriate field.

Region	Region PoC	Sector ID	Sector Area	Sector PoC
A	0.242	A1	0.19	0.091
	From	A2	0.11	0.055
	PropCons	A3	0.18	0.096
	Blue	A4		
		A5		
		A6		
	Section	Total:	**0.48**	**0.242**
B	0.198	B1	0.21	0.198
		B2		
		B3		
		B4		
		B5		
		B6		
		Total:	**0.21**	**0.198**

Figure 5.4, A partial Segmentation Page with sector areas loaded. The software automatically calculates the Sector PoC, the total area of the region, and "activates" that sector on the Planning Page. Note that Region A required segmentation, while Region B was small enough to be searched without further sub-division.

5.1.6.2 Click on the Planning tab at the bottom of the screen to bring up the Planning Page. Click on the cell marked *(Name) Search (District) (Date),* and enter the information appropriate to your search. In the smaller *(date)* field, enter today's date. Finally, click on the *Period* field and enter the time period for which this spreadsheet covers, such as "Period: 12/1/05, 0700 to present." This is especially important if you print the spreadsheet to use at a press conference or when briefing higher authorities. Normally, this field will only be changed immediately before and after such printing occurs. Figure 5.5 on the next page shows part of a sample planning page, with header information entered.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

5.1.6.3 The last step in the PoC Analysis is to enter the correct forest type for each sector as shown in Figure 5.6. Correctly entering the forest type enables the software to allow for differences in visibility, Effective Sweep Width (ESW), and average searcher speed in the sector. *This information may not be immediately known*, and that's okay. However, instruct search teams to notify you when they get underway in the sector to describe the forest conditions they experience. Sometimes you might not gain a clear perspective of the forest type in a sector until after the team returns from the sortie and debriefs with you in the CP. Again, that's okay. A description of various forest types appears in Figure 5.6.

5.1.6.4 To further assist field team leaders and planners in assigning the correct forest type to each sector, photographs of each type in both "green" and "brown" seasons are provided in the *Search Tracker* folder.

Laurel N. Hardy Search, Echo Trail, 2005 December 1 DO NOT TYPE IN BLUE OR GREEN SHADED AREAS!											
Section A, Cumulative Probability of Success (PoS) Analysis (PLANNING WORKSHEET)											
12/1/05	Period: 12/1/05, 0330 to present				**Cumulative PoS: 0.0%**						
ID	Description	Forest	ESW Mult	N-PoC	PoDcum	PoDRem	PoS	PoCRem	Size	Pden	PSR
A1	Field area	1b	50	9.08%	0	1	0	0.091	0.18	.504	25.208
A2	Tree Farm	5b	49.8	5.55%	0	1	0	0.055	0.11	.504	25.108
A3	West of Swamp	2b	31.8	9.58%	0	1	0	0.096	0.19	.504	16.033
A4											
A5											
A6											
B1	Swamp	6a	12	19.80%	0	1	0	0.198	0.21	.943	11.314
B2											
B3											
B4											
B5											
B6											

Figure 5.5, A portion of a sample Planning Page, with date, period, and header information entered. Note that the codes for different forest types found in each sector have been updated. The two areas you will watch very closely in your planning efforts are Cumulative PoS, and the PSR column at the far right of the table.

Forest Types Used in Average Maximum Detection Range (AMDR) Study (Slatten, 2005) **Eco-Region Province 212, Laurentian Mixed Forest (Bailey, 1985)**		
Forest Type	**Name**	**Description**
1b	Field, Clear-cut	Open fields and meadow with little or no established overstory. Mid-level growth consists of dogwood, few tag alder, occasional aspen groves. Ground cover mainly grasses, clover, tansy, thistle, and goldenrod.
2a	Birch/Aspen Transitional Forest	Quaking or big-tooth aspen and paper birch dominant. Few spruce or balsam fir. Understory consists mainly of hazelnut, young birch and aspen saplings. Ground cover mainly ferns (ostrich, interrupted, bracken), green leaf aster, sarsaparilla, and thimbleberry.
2b	Birch/Aspen/Fir Transitional Forest	Similar to 2a; with stronger presence of young spruce and balsam fir. Understory features hazelnut, young birch and aspen saplings. Ground cover mainly ferns (ostrich, interrupted, bracken), green leaf aster, sarsaparilla, and thimbleberry. Balsam fir mid-story has boughs all the way to the ground, hindering vision.
2c	Clear-cut Aspen Re-Growth	Clear-cut areas, 2-10 years after cutting; dense aspen sucker saplings, many stumps and slash tangles remain.
3	Lowland Hardwood (Ash/Elm)	Ash and elm dominant, with young saplings in the understory. Ground cover consists mainly of ground pine and aster, with often heavy ferns, goldenrod, grass, and some thimbleberry.
4	Upland Hardwood (Maple/Oak/Basswood)	Maple, oak, basswood dominant. Few young saplings in the understory, very little ground cover, except for spotty patches of ostrich fern and fescue grass

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

5a	Spruce/Fir Forest	Spruce dominant, with isolated patches of mature aspen. Thick hazelnut and occasional dogwood and tag alder may be found. Often many downed trees. Few spruces and firs have boughs all the way to the ground. Vision more open.
5b	Mature Pine Forest	White pine/red pine dominant with little to no established understory. Ground cover mainly composed of decaying needles and duff, with green leaf aster and thimbleberry. There may be exposed rock outcrops as well.
6a	Alder Swamp	Tag alder dominant with isolated paper birch, green ash, and elm in both the canopy and understory. Ground cover consists of swamp and sedge grass, with occasional thistle.
6b	Spruce Bog	Black spruce and tamarack dominant, with smaller saplings in the understory. Ground cover of sphagnum moss, cranberry, and dead or down spruce trunks.

Figure 5.6, Table of forest types used for Average Maximum Detection Range (AMDR) Study. Forest types heavily influence visibility and speed of movement, which in turn affect Effective Sweep Width (ESW) and Probable Success Rate (PSR).

5.1.6.4 **The default forest type for sectors in which the forest type is unknown is 2b, Birch/Aspen/Fir Transitional**. This is one of the most common types in Minnesota, and offers a rather conservative ESW multiplier for your calculations. However, be sure to enter the correct information as soon as it becomes available.

5.1.7 Once all known forest types have been assigned to respective sectors on the Planning Page, your PoC Analysis is complete. You can now use the spreadsheet to plan sorties as the search moves to the area-search phase. This will described further below.

5.1.8 ***Probable Success Rate (PSR)***. Probable Success Rate, or PSR, is the relative value of searching a given sector over any other. PSR is the "bang for the buck" you would get from assigning a team to search a given sector instead of assigning it somewhere else. The number displayed on the Planning Page carries no unit of measure—its usefulness lies only when comparing it to other PSR values. An excellent illustration to describe the power of PSR was given by Brian Saari of the St. Louis County Rescue Squad. Imagine that you're not searching for a missing person—instead, you're searching for part of a vast sum of money that somehow rained from the sky into your search area. Just as with the missing person scenario, your *regions* define areas of equal likelihood, only this time it's the likelihood of containing money. PSR, then, describes the amount of money *per searcher* you are likely to find *spending one hour in that sector*. Figure 5.7 on the next page offers a fine example of this concept.

Laurel N. Hardy Search, Echo Trail, 2005 December 1 DO NOT TYPE IN BLUE OR GREEN SHADED AREAS!											
Section A, Cumulative Probability of Success (PoS) Analysis (PLANNING WORKSHEET)											
12/1/05	Period: 12/1/05, 0330 to present				**Cumulative PoS: 0.0%**						
ID	Description	Forest	ESW Mult	N-PoC	PoDcum	PoDRem	PoS	PoCRem	Size	Pden	PSR
A1	Field area	1b	50	9.08%	0	1	0	0.091	0.18	.504	25.208
A2	Tree Farm	5b	49.8	5.55%	0	1	0	0.055	0.11	.504	25.108
A3	West of Swamp	2b	31.8	9.58%	0	1	0	0.096	0.19	.504	16.033
A4											
A5											
A6											
B1	Swamp	6a	12	19.80%	0	1	0	0.198	0.21	.943	11.314
B2											
B3											
B4											
B5											
B6											

Figure 5.7, The same Planning Page excerpt shown in Figure 5.5. Note that Sectors A1 and A2 carry the highest PSR values, indicating that Operations should assign teams to search these sectors first. A bigger "return on investment" can be obtained in A1 and A2. In an optimum effort allocation, Sector A3 should not be searched until the PSR values in A1 and A2 have been lowered to the level of A3.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

5.1.8.1 Using our "money" illustration, Sectors A1 and A2 would yield more than twenty-five dollars per searcher per hour, while A3 would yield only sixteen dollars with the same amount of effort! And Sector B1 would yield only 11.31 per searcher per hour! Clearly, the best return on invested effort is found in Sectors A1 and A2.

5.1.9 You may encounter questions as to "why are we doing this?" As stated earlier, contrary to many beliefs in the land search community, searching is **not** a binary exercise! The statement, "we either found 'em, or we didn't," is dreadfully inaccurate! You are searching for an object whose location *and appearance* are not precisely known! When a search team returns to Base Camp unsuccessful, you truly do not know if it was because the object wasn't there, or because it *was* there and the team didn't see it! Therefore**, the prioritization of search sectors and the analysis of expended effort must be framed in terms of probability!** Also, search planning is **not** intuitive, and the results of your PoC Analysis might surprise you!

5.1.10 As new intelligence data adds new regions to the search area, the Proportional Consensus PoC model allows you to simply add these new regions and rate them. The spreadsheet will adjust all the other PoC numbers accordingly. Moreover, command staff personnel who arrive late to the CP can simply review the available intelligence file, study the map, and perform a Proportional Consensus on their own. (They should not be allowed to see the PropCons ratings of others to avoid biasing their thoughts.) This data can be entered in the next open row on the PropCons Page.

5.1.11 PropCons ratings should be reviewed periodically to ensure that your ratings are consistent with your perception of the total intelligence picture. If a new item of key intel is discovered, you have three options:

5.1.11.1 Simply react to the intel item by deploying appropriate resources in response to the interpretation of the item.

5.1.11.2 Change individual region ratings to account for the value of the new intel item. *PoC Analysis changes mid-search should also take into account all searching that has been performed to date.*

5.1.11.3 Start a new PoC Analysis "from scratch." If the new intelligence item completely invalidates the original premise upon which the original POCSA is based, you need to start a new analysis from scratch.

5.1.12 Contrary to many national protocols on PoC Analysis, there is no **"Rest of the World"** (ROW) sector. While not inherently damaging to the analysis, there is no real value in a RoW sector. Why would you prioritize a region you have no intention of searching, and have no way to track coverage in? Taken to an extreme, RoW includes the city of New York. There is no intelligence data indicating you should search New York, so why prioritize it?

5.2 Area-Search Sortie Development

5.2.1 At this point, Reflex Phase sorties are in the woods, while your General Staff has just completed a PoC Analysis to guide the Area-Search Phase, should it become necessary. Your Planning Page is filled in and ready to go, with high-PSR sectors earmarked for the first ground sorties:

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Laurel N. Hardy Search, Echo Trail, 2005 December 1 DO NOT TYPE IN BLUE OR GREEN SHADED AREAS!											
Section A, Cumulative Probability of Success (PoS) Analysis (PLANNING WORKSHEET)											
12/1/05	Period: 12/1/05, 0330 to present				**Cumulative PoS: 0.0%**						
ID	Description	Forest	ESW Mult	N-PoC	PoDcum	PoDRem	PoS	PoCRem	Size	Pden	PSR
A1	Field area	1b	50	9.08%	0	1	0	0.091	0.18	.504	25.208
A2	Tree Farm	5b	49.8	5.55%	0	1	0	0.055	0.11	.504	25.108
A3	West of Swamp	2b	31.8	9.58%	0	1	0	0.096	0.19	.504	16.033
A4											
A5											
A6											
B1	Swamp	6a	12	19.80%	0	1	0	0.198	0.21	.943	11.314
B2											
B3											
B4											
B5											
B6											
C1	Matt's Trails	5b	49.8	11.90%	0	1	0	0.119	0.14	.850	42.330
C2	Swamp S. of Lk	6a	12	11.90%	0	1	0	0.119	0.14	.850	10.200
C3											
C4											
C5											
C6											

Figure 5.8, The same Planning Page excerpt shown in Figures 5.5 and 5.7. However, Region C has been added. WATCH OUT! The addition of Region C may offer new PSR alternatives to consider! Note that Sector C1 now edges out A1 and A2 for "search me now" rights!

5.2.1.1 The ESW Multiplier is based on the forest type. It factors the ability of a searcher to move through that sector, as well as detect objects on the ground.

5.2.1.2 The N-PoC, or normalized PoC, is the likelihood of that sector containing the subject, based on theoretical, statistical, and intel-based subjective data known to date. Sector N-PoC is pro-rated based on the sector's size compared to the overall region. This is the probability that the subject is in that particular sector.

5.2.1.3 The PoDcum column should be blank at this time, since no search effort has been recorded to produce *Probability of Detection (PoD).* This will change as ground sorties are executed and return to record their results. The next column, PoDRem, is simply the PoD remaining in the sector. PoDRem is calculated using the formula [1 - (PoDcum)]. As PoDcum in a sector goes up, the PoDRem goes down.

5.2.1.4 Probability of Success (PoS) is the product of PoC multiplied by PoD. It balances the questions, "Are we looking in the right place?" (PoC, the Containment side), with "Would we detect the subject if he were there?" (PoD, the Detection side). All sector PoS values are summed to produce the Cumulative PoS (PoScum), which will be used to make strategic decisions about continuing the search. **Your goal should be to drive up PoScum as fast as possible. This is the ultimate measurement of overall search effectiveness.**

5.2.1.5 The PoC-Rem column should match the N-PoC at this time (only it is expressed as a decimal instead of a percentage), but should drop as accumulated PoD is entered into the spreadsheet.

5.2.1.6 The Area Size column contains each sector's size, in units of a square mile. This copied over automatically from the Segmentation Page during your PoC Analysis.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

5.2.1.7 The Pden column is the Probability Density, or how "thickly" the PoC is packed into that particular sector. The higher the Pden, the more "dirt" a search sortie will pick up by searching it.

5.2.1.8 The Probable Success Rate (PSR) column displays the relative value (the unit of measure is meaningless) of applying one more searcher to a particular sector. In the example, we can see that sector C1 carries a PSR value of 42.3, while sectors A1 and A2 have PSR values of 25.2 and 25.1, respectively. At this moment, searchers will produce more PoS by searching Sector C1 than A1 or A2, which in turn are produce more PoS than B1. The 42.3 number captures not only the probability of the subject being there, but also the density in which that probability is spread across the sector, as well as the ability of searchers to "sweep up" that probability. Moreover, as unsuccessful search sorties return from the field, the PSR ratings will take that into account as well. So, as Sector C1 gets pounded by searchers who don't find anything, its PSR will drop, until eventually it falls below some other sector. At this point, it might be time to stop searching Sector C1 and focus attention somewhere else. Since the relative PSR values of Sectors C1, A1, and A2 are fairly close, concurrent sorties to all three sectors should be executed.

5.2.1.9 In the theoretical "perfect search," at the end of a desired unit of time (called an *epoch*), **the PSR values off all searched sectors would be the same**, and none would be lower than any unsearched sector. This would mean that each sector got exactly the amount of search effort it needed to drop the overall PSR at the fastest possible rate, which further means we generated the highest amount of PoS possible in that epoch. In short, we were as efficient and effective as we could be. This level of perfection is virtually impossible to attain, but it serves as a guideline for not only planning, but assessing search effectiveness as well. For example, if after several operational periods one of your searched sectors has a PSR of 42, while another searched sector has a PSR of 3, you probably haven't applied your resources as effectively as you could have.

5.2.2 Assign search sorties to the highest PSR sectors on the spreadsheet.

5.2.3 **Beware of "Fish Buckets."** Fish Buckets are sectors that, because they are smaller in size even after region subdivision, receive a higher than deserved PSR. In Figure 5.9 below, a thin strip of land with an area of only 0.04 square miles, labeled Sector C3, has been activated in Region C. Because no sector in Region C has yet been searched, all normalized PoC values are the same. The different PSR values are due to differences in forest type between the sectors. However, Sector C3 has produced a PSR of over 40, easily the highest in the entire search area. The numbers are right, but intuitively, the suggested effort allocation appears to be wrong. Fish Buckets are normally produced by very small regions (that require no sub-division) which are rated very highly in the Proportional Consensus. Fish Buckets can also occur when one of the participants in the Proportional Consensus gets locked into one scenario (appropriately called "scenario lock") and rates one region (usually small in size) very highly, while every other region gets rated extremely low. Always compare your PSR ratings with intuition and common sense. Be very suspicious of sectors containing the Last Known Position (LKP) that *don't* score highly enough to be included among the first sorties to the field! **Search planning software is not a replacement for competent search**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

leadership! Fortunately, due to their small size, Fish Buckets can usually be "cured" in one sortie. It is normally not difficult for a handful of searchers to push the Coverage Ratio up to a very high level. This usually knocks the PSR in the Fish Bucket down to a very small number, meaning that it won't need to be searched again for quite awhile, if ever. The Fish Bucket phenomenon was borne out of inferior planning tools that called for regions to be subdivided ***before*** doing a Proportional Consensus. This resulted in a flawed effort allocation, often full of Fish Buckets. By carefully following the procedures outlined in this booklet, you will virtually eliminate the appearance of Fish Buckets.

Laurel N. Hardy Search, Echo Trail, 2005 December 1 DO NOT TYPE IN BLUE OR GREEN SHADED AREAS!											
Section A, Cumulative Probability of Success (PoS) Analysis (PLANNING WORKSHEET)											
12/1/05	Period: 12/1/05, 0330 to present				**Cumulative PoS: 0.0%**						
ID	Description	Forest	ESW Mult	N-PoC	PoDcum	PoDRem	PoS	PoCRem	Size	Pden	PSR
A1	Field area	1b	50	9.08%	0	1	0	0.091	0.18	.504	25.208
A2	Tree Farm	5b	49.8	5.55%	0	1	0	0.055	0.11	.504	25.108
A3	West of Swamp	2b	31.8	9.58%	0	1	0	0.096	0.19	.504	16.033
A4											
B1	Swamp	6a	12	19.80%	0	1	0	0.198	0.21	.943	11.314
B2											
B3											
B4											
C1	Matt's Trails	5b	49.8	11.90%	0	1	0	0.104	0.14	.744	37.039
C2	Swamp S. of Lk	6a	12	11.90%	0	1	0	0.104	0.14	.744	8.925
C3	Thin strip area	3	53.9	2.98%	0	1	0	0.030	0.04	.744	40.088
C4											

Figure 5.9, Sector C3 has been activated in this hypothetical search. Due to its very small size, a probable Fish Bucket has formed. C3 is unfairly rewarded for being small and easy to search. Fortunately, Fish Buckets are easy to cure, because a small amount of effort usually knocks the PSR down quickly, in effect taking the sector "off the radar screen."

5.2.4 Keep in mind that the search planning process described above is not a rigid, inflexible system. Nuggets of fresh intelligence data will come into the Command Post that require immediate follow-up, and a "tactical reserve" should be maintained by Operations to take on these tasks. This reserve could easily double as the Rescue Function in the event the subject is found alive but needs treatment or evacuation.

5.99 ***Review of steps in Section 5.0***:

- **Perform a detailed Scenario Analysis.**
- **Define the overall search area (100% PoC).**
- **Segment the area into regions of equal likelihood.**
- **Perform a Proportional Consensus PoC Analysis.**
- **Sub-divide regions into sectors as needed.**
- **Prepare area-search sortie assignments based on PSR.**
- **Constantly cross-check and evaluate for "Fish Buckets."**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

6.0 The Area-Search Phase – Sortie Management:

6.1 Deployment Actions

6.1.1 The Operations Function under Incident Command works with the Plans Function to transform the indicated actions generated by their combined analyses into coordinated search tasks. Area search sorties should be assigned to the highest PSR sectors until all deployable resources have been assigned.

6.1.1.1 When deciding how many searchers to assign, consider not only the area size, but also the length, baseline, and Effective Sweep Width as well. If the Overall Effective Sweep Width (OESW) of the team—obtained by multiplying the number of searchers by the Estimated Effective Sweep Width (EESW) for the forest type—equals or exceeds the baseline width of the sector, the sector may be searched in one sweep, thereby eliminating the need to shift the team for an adjacent return track. Consider this technique when searching relatively long, thin sectors.

6.1.1.2 Relatively shorter, wider sectors may require parallel tracks to effectively search. Remember to deduct time and distance spent "shifting" the teams along the sector boundary from any calculation of Effort.

6.1.1.3 Professional Search and Rescue resources should be assigned whenever possible to sectors with a high PSR, followed by other SAR-trained Emergency Services agencies, such as local fire-rescue or first responder groups. Assign untrained civilian volunteers to high priority sectors only as a last resort.

6.1.1.4 Unit or family integrity in assigned sorties should be preserved whenever possible. This helps to improve morale and *esprit de corps*, which in turn produces a better search effort.

6.1.2 All teams must be thoroughly briefed before deployment on their assignment and what is expected of them.

6.1.2.1 Record the names and callsigns of all team members on ICS Forms 104 or 204, on 3x5 index cards, the white board in the CP, or if no other means is readily available, using pen and blank paper.

6.1.2.2 Prepare and provide maps or sketches that clearly show the assigned sector boundaries. It helps a lot to tell the team leader, (for example) "Your team is responsible for Sector D." This helps to convey the importance of their effort to the overall operation.

6.1.2.3 Refer to the pink ESW reference card for the forest type in the team's assigned sector. The search pattern should be modulated (i.e. rough spacing between searchers) to between 80 and 100 percent of the ESW value. Coach the team to pause the line in order to investigate any features they encounter that might hide the subject, such as root tangles, thickets, boulder fields, etc. (a technique is called *Purposeful Wandering*), as well as to pause and look behind them periodically (i.e., back in the direction they came from). Also, coach the team to not hesitate to change the modulation of their pattern if the forest conditions change. Be sure to communicate the change to the Plans Section. Finally, based on rough sortie estimates loaded into Search Tracker, you should be able to

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

provide the team leader with a minimum time-on-station: "It should take you at least three hours to complete this sortie to a Coverage of (xx), which is the Coverage Ratio we desire."

6.1.2.4 Just like with canine and signcutting sorties, beyond setting essential search parameters such as ESW and number of searchers assigned, the Ops section should tell the team leader the *what*, not necessarily the *how*. Untrained teams may need additional help getting started, but it is the team and the team leader's responsibility to accomplish the mission assigned to them.

6.1.3 Whenever possible, provide an area for the outgoing search teams to condition their eyes to the object being searched for, including placement of a representative sample object on the ground. Human body examples may be provided from Rescue Squad inventory, such as "Armless Annie," "Rhonda," and "Veronica." Bones to simulate decomposing bodies are available as well. Brief team members on cues common to the search object that trigger recognition. Human tissue samples to calibrate cadaver dogs are available from the Canine Team.

6.2 Tracking Search Effort

6.2.1 As sorties are assigned and deployed to the woods, the following information must be recorded. **Remember, only type in the WHITE and PINK fields of the sheet!**

6.2.1.1 Enter the designator of the sector to be searched in the *Sector* column on the spreadsheet. The software will look up the sector size from the Planning Page, and automatically fill in that information for you.

6.2.1.2 The *Sortie Description* column offers the Plans staff member a place to quickly enter the summary characteristics of a large number of sorties. This information can be modified as needed and entered into the actual calculation columns at a later time. It's a good idea to enter the name or callsign of the team and the team leader.

Section B – Record of Ground Sorties											
Sector	**Sortie Description**	**# of P**	**EESW**	**Speed**	**Time**	**OEESW**	**W/mile**	**Effort (z)**	**Z-Value**	**Size**	**Coverage**
C1	Blue Team, 7124	4	83	0.7	2	332	0.063	1.4	0.088	0.14	0.629

Figure 6.1, The Sortie Description column offers a place to quickly enter summary information. Sector C1 received a sortie of 4 people, at 83 feet of ESW per person for a planned sortie of 2 hours at an estimated speed of 0.7 mph. Speed and time-on-station may be adjusted based on debriefing notes received from the returning search team.

6.2.1.3 Enter the number of people and the Estimated Effective Sweep Width (EESW) from the pink reference card in the appropriate columns. The Overall Effective Sweep Width (OESW) column will fill in automatically. ESW values can also be obtained from the ESW Data tab in Search Tracker.

6.2.1.4 When the team finishes the sortie, returns to Base Camp and is debriefed, enter or adjust the Speed and Time information as appropriate. The W/mile, Effort (z), and Z-value columns fill in automatically. Another method is to calculate the hard mileage of Effort as determined by plotted GPS coordinates in the mapping software. This method is particularly useful on long, thin sectors where the sortie can be completed in one sweep. The resulting distance measurement can then be entered into the *Effort (z)* conditional (pink) field. *Keep in mind this will delete the formula behind that cell, making any Speed and Time entries on that row useless.*

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

Section B – Record of Ground Sorties											
Sector	Sortie Description	# of P	EESW	Speed	Time	OEESW	W/mile	Effort (z)	Z-Value	Size	Coverage
C1	Blue Team, 731	4	83	0.7	1.75	332	0.063	1.225	0.077	0.14	0.550

Figure 6.2, When the sortie returns, transfer the summary information to the appropriate data columns. Be sure to correct for information learned when debriefing returning teams. Notice that the Effort applied to Sector C1 was corrected due to the Time-on-Station coming in less than the planned two hours.

6.2.2 Debrief all returning teams as described in paragraph 4.2.2.

6.2.2.1 Disregard all statements such as "We covered that," or "This sector is cleared." **Only** use objective results based on Search Theory principles to "clear" a sector or measure its coverage!

6.2.2.2 Make corrections to the ground sortie information to account for any changes learned during the debriefing. For example, the average speed may have been slower due to thicker foliage or rough terrain. Maybe the forest type was different than expected, requiring a different ESW value from the table. Or perhaps the team was delayed in an obstacle such as a swamp, requiring a deduction in time. Or maybe the team completed the sortie in one pass, and you may be able to hard-code the actual mileage into the conditional *Effort (z)* field obtained from a distance measurement off the map. (See paragraph 6.2.1.4)

6.2.2.3 ICS Form 110 "Team Debriefing" may be used to allow teams to "self-debrief" during busy times when several teams complete sorties at about the same time.

Section B – Record of Ground Sorties											
Sector	Sortie Description	# of P	EESW	Speed	Time	OEESW	W/mile	Effort (z)	Z-Value	Size	Coverage
C1	Blue Team, 731	4	83	0.7	1.75	332	0.063	1.225	0.077	0.14	0.550
A1	Red Team, 736	7	64	0	0	448	0.085	0.6	0.051	0.18	0.283

Figure 6.3, Red Team has returned from a single-sweep sortie to Sector A1. From the map, an actual distance measurement of 0.6 miles was obtained, and hard-coded into the conditional Effort (z) field. Note that by overwriting the Effort (z) formula with a hard-data entry, it renders the Speed and Time fields useless.

6.2.2.4 Once the sortie parameters have been adjusted following the debriefing, the Coverage for the sortie will appear in the last column.

6.2.3 The next step is to convert the Coverage Ratio for the completed sortie to a PoD value. This can be done in one of three ways. The most accurate and convenient method is to use the **Exponential Detection Calculator** on the spreadsheet. An alternate method is to calculate the PoD by hand using a calculator. The third method is to consult the Coverage/PoD curve chart on the yellow reference card. All three methods are explained on the next page.

6.2.3.1 The *Exponential Detection Function (ExDf)* accounts for error caused by random variations in the quality of the search sortie and pattern, as well as environmental variation. ExDf, also called the *Random Search Function*, is used on nearly all ground sorties where the pattern is **not** perfectly straight, almost perfectly spaced, and anchored on both ends by a linear terrain feature. To use the Exponential Detection Calculator, enter the Coverage number from the competed sortie into the *Search Sortie Exponential Detection PoD Calculator* in the top section of the Ground Page. Then, read the PoD number for that level of coverage in the green

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

field to the right. Finally, click on the Planning Page tab, and enter the PoD number in the *PoDcum* field for the sector just searched.

6.2.3.2 To obtain the PoD with a scientific calculator, use the formula below and perform the following steps. The example below is for a sample coverage of 0.55.

$$\mathbf{PoD = 1 - e^{-c}}$$

a. Enter the Coverage, in this case 0.55.
b. Make it negative, using the +/- key.
c. Execute the function e^x. You should get something like: 0.576953526
d. Subtract 1, leaving -0.423046474
e. Make it positive, using the +/- key.
f. Your PoD is **<u>42.3 percent</u>**.

6.2.3.3 To use the yellow reference card, locate the Coverage along the bottom of the graph, then read up to the Exponential (Random) curve—the lowest of the three curves.

6.2.4 *<u>Inverse Cube Detection (IC3)</u>*: Occasionally a sortie will experience remarkable conditions that result in a dramatic reduction in random error. This is normally due to two factors.

a. The sortie line is anchored on a known terrain feature on one or both ends.
b. Forest conditions are optimum, with little variability in spacing or track.

6.2.4.1 When a grid sortie is anchored on both ends by straight linear terrain feature such as a straight road or fenceline, and forest conditions permit the virtual elimination of modulation error, the Inverse Cube Detection Function may be used.

6.2.4.2 *Inverse Cube Detection* may be obtained using the IC3 calculator in *Search Tracker*, or using the middle curve on the yellow reference cards.

6.2.5 Once the PoD value for the sortie has been obtained, enter it into the appropriate *PoDcum* cell on the Planning Page. In the example shown in Figure 6.4 below, a PoD of 0.423 has been applied to Sector C1, and a PoD of 0.283 has been applied to A1.

Laurel N. Hardy Search, Echo Trail, 2005 December 1 DO NOT TYPE IN BLUE OR GREEN SHADED AREAS!											
Section A, Cumulative Probability of Success (PoS) Analysis (PLANNING WORKSHEET)											
12/1/05	Period: 12/1/05, 0330 to present				**Cumulative PoS: 7.6%**						
ID	Description	Forest	ESW Mult	N-PoC	PoDcum	PoDRem	PoS	PoCRem	Size	Pden	PSR
A1	Field area	1b	50	9.08%	.283	0.717	0.026	0.065	0.18	.361	18.074
A2	Tree Farm	5b	49.8	5.55%	0	1	0	0.055	0.11	.504	25.108
A3	West of Swamp	2b	31.8	9.58%	0	1	0	0.096	0.19	.504	16.033
A4											
B1	Swamp	6a	12	19.80%	0	1	0	0.198	0.21	.943	11.314
B2											
B3											
B4											
C1	Matt's Trails	5b	49.8	11.90%	.423	0.571	0.050	0.069	0.14	.490	24.424
C2	Swamp S. of Lk	6a	12	11.90%	0	1	0	0.119	0.14	.850	8.925
C3											
C4											

Figure 6.4, Sector C1 has been searched to a PoD of 0.423 and Sector A1 to a PoD of 0.283. These sorties dropped the PSR in their respective sectors to 24.424 and 18.074, as well as generated a PoScum of 7.6 percent. Both Sectors C1's and A1's PSRs have dropped below that of A2, making A2 the highest priority sector. The next sortie should be assigned to A2.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

6.2.5.1 Notice that the sortie has produced some *Probability of Success* or *PoS*. The *Cumulative PoS*, or the total PoS for the entire search operation, is shown at the top. This is the number we are trying to drive up as fast as we can, and upon which future strategic decisions will be based.

6.2.5.2 The PSR levels for Sectors C1 and A1 have now dropped below that of sector A2. If not already assigned, Sector A2 is the next priority to be searched. Also note that Sector C1 will then be next up for a follow-up sortie! It may seem counter-intuitive to search a sector twice before searching other sectors once; however, the PSR takes into account both the Containment side of the PoS Equation (the likelihood that you're looking in the right place), as well as the Detection side (the likelihood that you'd see the subject if he were there. You are running a more effective search!

6.2.6 *Cumulative PoD Calculations*. Multiple sorties will often be assigned to a single sector over time. Since each subsequent sortie is sweeping an area that has already been swept—which resulted in PoD being removed from it, the PoD for multiple sorties must be accumulated correctly to account for the results of all previous sorties.

Section B – Record of Ground Sorties

Sector	Sortie Description	# of P	EESW	Speed	Time	OEESW	W/mile	Effort (z)	Z-Value	Size	Coverage
C1	Blue Team, 731	4	83	0.7	1.75	332	0.063	1.225	0.077	0.14	0.550
A1	Red Team, 736	7	64	0	0	448	0.085	0.6	0.051	0.18	0.283
A2	Orange Team, 702	5	84	0.7	1.5	420	0.080	1.05	0.084	0.11	0.759
C1	Red Team, 736	7	83	0.7	1.25	581	0.110	0.875	0.096	0.14	0.688

Figure 6.5, Red Team has deployed on a second sortie to Sector C1, as indicated by the continued high PSR. They have generated an additional 0.688 Coverage Ratio for a PoD of 0.497. From the example in Figure 6.4, we know that the PoD from the first sortie was 0.423, leaving a PoD Remaining (PoDRem) of 0.577. The section of the ExDf PoD Calculator for multiple sorties calculates a new PoDcum for both sorties of 0.710 as shown in Figure 6.6 below.

6.2.6.1 Obtain the "old" (current) PoD value for the sector from the Planning Page. Enter this number into the appropriate cell in the Exponential Detection Calculator as shown on the next page. Notice the PoD Rem value changes automatically.

Search Sortie Exponential Detection PoD Calculator						
Enter search sortie Coverage from Column L above:		0.688	➔	Read ExDf PoD here:		**0.497**
Has this sector been searched before? If yes, then you need to calculate a new "PoD To Date."						
Enter the "old" PoD for the searched sector from Section A, Column F on the Planning Page:					0.423	
This is the current PoD remaining in the sector BEFORE the current search sortie.					0.577	
PoD contribution from the current search sortie:					0.497	
Read the new "PoD to Date" here:	➔	➔	➔	➔	**0.710**	
Transfer this number to the appropriate line in Column F on the Planning Page!						

Figure 6.6, After completion of a second sortie to Sector C1, the Coverage for the current sortie is entered in the ExDf Calculator as normal. The "old" PoD from the first sortie (0.423) is obtained from the Planning Page and entered into the appropriate field. The software automatically calculates the new PoDcum for all sorties to date.

6.2.6.2 Then, enter the Coverage Ratio for the just-completed sortie into the calculator like you normally would for any sortie. The ExDf Calculator computes the PoD for the current sortie, and applies it against the PoD remaining in the sector. The new, cumulative PoD is displayed at the bottom of the calculator.

6.2.6.3 Enter the new PoD in the appropriate cell on the Planning Page. Note the changes to PSR resulting from the new sortie.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

6.99 ***Review of steps in Section 6.0***:

- **Assign Area-Search sorties through the Operations Section.**
- **Utilize professional SAR on high-priority sectors.**
- **Deploy EMS Agency and civilian sorties as appropriate.**
- **Thoroughly brief and debrief all teams.**
- **Track Effort and sortie results in appropriate software.**
- **Assign sorties based on Probable Success Rate (PSR).**

7.0 The Area-Search Phase – Air Operations:

7.1 Deployment Actions

7.1.1 Whenever environmental conditions permit, search aircraft should be dispatched promptly to the scene of a developing search. The most common resource is the Minnesota State Patrol (MSP); however, several other private and government flight programs have been utilized to assist, including the Civil Air Patrol (CAP), medical helicopters, the Department of Natural Resources (DNR), and private owners.

7.1.2 Besides visual observation, the MSP helicopter offers Forward Looking Infra-Red (FLIR) technology. Moreover, Night Vision Devices (NVD) and handheld Thermal Imaging (T/I) units may be placed aboard aircraft to enhance their capability as well.

7.1.2.1 In daylight sorties, the Effective Sweep Width (ESW) of an aircraft is increased by the square root of the number of observers aboard. Consequently, if the sortie flies with only the pilot, the ESW multiplier is 1. But if an extra observer is added, the ESW improves to a multiplier of 1.4. Two observers further increase the ESW multiplier to 1.7, while a total of four souls on board produces an ESW multiplier of 2.0. **Adding observers to an aircraft with the means to carry them represents a <u>huge</u> opportunity to increase the effectiveness of the aircraft sortie, one that can't be underestimated!**

7.1.3 The search aircraft is a finite, expensive resource that also involves an element of risk to life and limb (aircraft do experience occasional mishaps). Plans, Operations, and the inbound pilot need to coordinate carefully to ensure the pilot has a clear plan of where to search. Moreover, it is irritating to the pilot to be told to simply "fly around" the search area.

7.1.3.1 Utilize your PoC Analysis results, as well as GPS coordinates of search sector corners, prominent terrain features, and pre-specified Landing Zones (LZ) to craft a search plan for all available aircraft.

7.1.3.2 Multiple aircraft on-scene present a risk of mid-air collision. Avoid overlapping sector assignments, placing "buffer zones" between on-station aircraft whenever possible.

7.1.3.3 Most aircraft sorties—unless the search area is very close to a regional airport—will last approximately two hours.

7.1.4 Search aircraft may be deployed to perform a general search of the entire area, or, they may be assigned to search a specific sector or sectors based on intelligence data.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

7.1.5 Whenever possible, debrief the pilot and all observers on board. This may not be immediately feasible if the ship deploys from a distant airfield. The most important debriefing item is visibility in comparison to the stated ESW. Could the observers consistently see litter and other debris on the ground? Could the forest floor readily be observed despite dense foliage? What is the reported meteorological visibility?

7.2 Tracking Aircraft Search Effort

7.2.1 Aircraft Sorties. Search sorties by aircraft represent a challenge to the Plans staff in the recording of Effort. Since the aircraft rarely stays in one sector during its sortie, the Effort expended must be accurately spread out over all the sectors searched by the aircraft. In thick green-out conditions, this may mean a lot of numbers-crunching to capture a small amount of PoD; however, it is a necessary step in the search planning process. To distribute area across several sectors, follow the process below.

7.2.1.1 Determine the overall area searched by the aircraft, including non-sectored regions overflown during turns, etc. "Square off" and project the overall search area to major landmarks visible to the aircraft. Take into account any GPS coordinates of search area corners given to the pilot. Enter this estimated total area into cell G-28 (Overall Search Area) in the spreadsheet. This value will show up as "Sector Y" in the *Aircraft Sortie PoD Contribution* section on the Aircraft Page. Figure 7.1 shows a sample area of 3.5 square miles.

7.2.1.2 The area sizes from the bottom section of the spreadsheet are programmed by formula to automatically copy from the Planning Page to the appropriate column in the *Aircraft Sorties* section.

7.2.1.3 Once the total search area size has been loaded, the spreadsheet will calculate the total area of "unsegmented balance" not assigned to any sector. This will appear as Sector X.

Section C – Aircraft Sortie PoD Contribution								
Remember: Enter the Coverage Ratio into the ExDf Calculator to apply the sortie Coverage to each sector!								
Sector	**Sector Description**	**Sector Size**	**N/Y**	**Sortie C(f)N/Y**	**Sortie PoD**	**PoD Rem**	**Net Gain**	**New PoD**
A1		0.18	0.036	0	0	0.717	0	0.283
A2		0.11	0.022	0	0	0.468	0	0.532
A3		0.19	0.038	0	0	1.000	0	0
A4								
B1		0.21	0.042	0	0	1.000	0	0
B2								
X	Unsegmented	2.76						
Y	Overall Search Area	3.5						

Figure 7.1, Enter the overall search area, including unsegmented regions, into the *Overall Search Area* field in cell G-28. The unsegmented balance will appear in the cell for Sector X. Notice that the current PoDcum has been copied over from the Planning Page, and is displayed in the "New PoD" column. Ignore this for now.

7.2.1.4 To accurately record the results of aircraft sorties, you will first need to estimate the Effective Sweep Width (ESW) of the aircraft. Use the *Aircraft ESW Calculator* in the middle of the Aircraft Page. From the pink ESW reference card enter the baseline ESW (determined from search altitude and atmospheric visibility), the time-of-year correction factor, the terrain/vegetation factor, the correction factor

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

for number of observers, and the speed factor. The software will calculate the corrected ESW for the aircraft at the bottom. Communication with the pilot is vital to a successful aircraft sortie! **Whenever possible, brief the pilot in advance of his arrival, as well as debrief with him after completion of the sortie. If possible, the pilot should land at a secured nearby Landing Zone and compare notes with the Plans staff while looking at the map. Aircrews can often add vital intelligence data about new features that don't show up on the map, as well as current conditions in the field.**

Aircraft ESW Calculator			
Obtain Baseline and Correction Factor Values from the Pink ESW Reference Card.			
	Baseline ESW Value in Feet ➔	**2400**	
	Correct for Time of Year ➔	**0.3**	
	Correct for Terrain/Vegetation ➔	**0.1**	
	Correct for # of Observers ➔	**1.7**	
	Correct for Aircraft Speed ➔	**1.5**	
	READ CORRECTED ESW HERE:	**183.6**	

Figure 7.2, The Aircraft ESW Calculator, with sample values loaded to produce an estimated Effective Sweep Width. Values were obtained from the pink ESW Reference Card.

7.2.1.5 The *Aircraft Sorties* section offers a *Sortie Description* field to load sortie data for later processing. It is not uncommon for the aircraft to show up on-station during busy times in the Command Post. An example is shown in Figure 7.3.

Sortie Description	(f)Correct	EESW	Speed	Time	W/mile	Effort (z)	Z-Value	Coverage
MSP-9, 3p x 50 @ 0930 arrival, 300'/5nm	1.0	184	50	2.5	0.035	125	4.356	1.245

Figure 7.3, A sample aircraft sortie. MSP Trooper 9 arrived with 3 souls on board at 0930 hours. Discussion with the pilot and a check of local weather confirmed three souls on board, a search speed of 50 knots, an average altitude of 300 feet, and atmospheric visibility of five nautical miles. Visibility into the forest canopy required no arbitrary (f)Correction.

7.2.1.6 The *Aircraft Sorties* section also offers the *(f)Correct* field to enter additional correction factors resulting from diminished visibility into the tree canopy. Experiments conducted locally suggest that even with Time-of-Year and Terrain/Vegetation corrections, the resulting ESW value might still be too generous, particularly in mid-summer green-out conditions. The default value in this column is 1.0, meaning no correction. **Use this field cautiously and sparingly!** Arbitrary corrections replace science with "feelings," which could compromise the whole basis for search planning. **General corrections <u>must</u> be defended and consented to by the Plans Staff!**

7.2.1.7 The conditional formula column *Sortie(f)N/Y* takes the Coverage obtained by the completed aircraft sortie, and credits it to each sector, each according to its size. Any remaining Coverage left over is credited to the Unsegmented area. However, the software needs to know which Coverage Ratio to distribute, and for this it looks at the Coverage you enter in the *Exponential Detection PoD Calculator*.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

You must enter the Coverage Ratio for the aircraft sortie you wish to distribute into the calculator!

7.2.1.8 The New PoD for each sector appears in Column I on the far right of the screen. **To apply this new PoD against the PSR for the sector, you must *hard key* (do NOT copy and paste) the new data into each New PoD field on the Planning Page!** Do this only once per sortie, because an "endless loop" is created within the software. As you type in the New PoD entries for each sector, the New PoD field on the Aircraft page will update again...and again, and again, if you're not careful. **The New PoD value for each sector must be transferred to the Planning Page by hard-keying each New PoD. Warning! "New PoD" will become obsolete after the transfer, so remember to only update New PoD ONCE for each aircraft sortie!**

Section C – Aircraft Sortie PoD Contribution								
Remember: Change the coverage reference in Column E at the end of each aircraft sortie! Example: =D4*J29								
Sector	Sector Description	Sector Size	N/Y	Sortie C(f)N/Y	Sortie PoD	PoD Rem	Net Gain	New PoD
A1		0.18	0.051	0.064	0	0.717	0	0.283
A2		0.11	0.031	0.039	0	0.468	0	0.532
A3		0.19	0.054	0.068	0	1.000	0	0.065
A4								
B1		0.21	0.060	0.075	0	1.000	0	0.072
B2								
X	Unsegmented	1.78						
Y	Overall Search Area	3.5						

Figure 7.4, A partial Aircraft Sortie PoD contribution (Regions C through F are not displayed; thus, the sector sizes don't add up to equal the overall search area). When the Coverage Ratio for the completed aircraft sortie is entered into the ExDf Calculator, the software applies the correct portion of the Coverage to each sector according to its size. The New PoD for the sector displays in the right hand column. Transfer this data to the Planning Page. Remember to do this only once, because the endless loop in the software (caused by a formula referring to itself) will continue to update the PoD to infinity.

7.99 ***Review of steps in Section 7.0***:

- **Call for aircraft resources early in the search.**
- **Give clear assignments.**
- **Increase the number of observers on board, if able.**
- **Debrief the aircrew whenever possible.**
- **Track Effort and sortie results in appropriate software.**

8.0 Strategic Planning, Demobilization, and Follow-up:

8.1 Tracking Cumulative Probability of Success (PoScum)

8.1.1 As stated earlier, the purpose of tracking search effort is three-fold: First, we must be able to scientifically determine *and be able to defend* an allocation of effort that places search resources where they can obtain the best "bang for the buck"—the greatest likelihood of finding the missing subject. In other words, we must decide **where** to search. Second, once we've determined *where* to search, we need to deploy our resources in a manner that optimizes their effectiveness, and be able to measure and record that effort on a running basis: We must decide **how** to search. Third, we need

© 2008 St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education. All rights reserved.

to use the results of our Search Management process to make strategic decisions, such as, "Should we continue searching here? Should we search somewhere else? When should we stop searching altogether?" The PoC Analysis and Scenario Analysis help us to address the first point. The outcome of these tools, coupled with the Probable Success Rate (PSR) values, tell us the highest priority sectors most deserving of the next block of search effort. The recording of search effort devoted to ground and air sorties addresses the second point. By accurately tracking search effort, we can readily report and defend how good a job we're doing. The third point—strategic decision making—is addressed by tracking *Probability of Success*, or *PoS*.

8.1.2 The spreadsheet on the Planning Page multiplies the Cumulative PoD by the normalized PoC to produce the PoS for each sector. The PoS values for each sector are then added together to obtain the *Cumulative PoS*, or *PoScum* for the entire search to date.

8.1.3 A typical day of searching will produce between 15 and 30 points of PoScum. Although PoScum is subject to the Law of Diminishing Returns as the search progresses, the corresponding increase in search resources (as additional volunteers show up on subsequent days) often offsets the decreased return on invested effort—there is simply more effort applied to the search on say, Day Three, as on Day One.

8.1.4 In most cases, when the PoScum reaches 80 points and the subject has not been found, prepare a demobilization plan. Keep in mind that the analysis required to develop the plan may cause new sectors to be added, or new intelligence data to be discovered that increases the normalized PoC (N-PoC) of existing sectors. **Both of these events will <u>lower</u> the PoScum value, causing the search to continue without demobilization until these leads are followed up.**

8.1.4.1 The demobilization plan should include the following elements:

a. An assessment of area coverage, sector by sector. Are there any sectors with a high PSR value, a high Pden value, or a relatively low (less than 63 percent) PoD_{cum} value that can be economically searched to produce a significant increase in PoS?
b. A reevaluation of the scenario analysis and resulting search plans. Are there any "blind spots" we missed that call for a change in strategy without suspending the search?
c. The survivability of the missing subject. If there is a realistic chance the subject is still alive, **do not suspend the search!**
d. Continued availability of resources.
e. Continued safety of operations, to include weather and environmental considerations.
f. Family, media, public, and political considerations. How will their concerns be addressed, and how will they be kept informed as the search progresses to the Passive Phase?
g. Methods for new intelligence data to be collected and forwarded to appropriate authorities for follow-up.
h. A process for releasing resources to their home jurisdictions and normal operational status.

8.1.5 When the PoScum reaches 85 points, activate the demobilization plan.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

8.1.5.1 As stated in paragraph 8.1.4.1 (f), all external influences, **especially the family**, should have been involved and aware of the development of a demobilization plan. **Suspension of active search efforts should <u>not</u> come as a surprise!**

8.1.5.2 When communicating to the news media about the suspension of active efforts, avoid such phrases as, "We've looked everywhere we possibly can." Quite frankly, no, you haven't. You have looked everywhere that is *reasonably* expected to contain the missing subject, based on the information available at this time. You are merely "suspending active efforts" and "switching to a passive mode" pending the discovery of new intelligence data.

8.1.6 Electronically save and print copies of all intelligence files, planning spreadsheets, maps, and comms logs for the operation. Compile these in a folder for future reference.

8.1.7 Debrief participants and supporting agencies to assess what went well, as well as improvements to structures and systems for next time. Debriefing should focus on improvement—not on placing blame.

8.2 Passive Search Efforts

8.2.1 Passive search efforts include the following:

8.2.1.1 Intermittent flyovers by aircraft, particularly during seasonal changes in forest canopy. Aircraft may also disturb scavenging birds and mammals, revealing the possible location of decomposing animal matter.

8.2.1.2 Scheduled training exercises in the search area, such as land navigation practice, canine drills, or airborne observer training.

8.2.1.3 Continued periodic follow-up by investigators to uncover new leads.

8.2.1.4 Reminders to the general public through the news media just before the opening of pertinent hunting and fishing seasons.

8.99 ***<u>Review of steps in Section 8.0</u>***:

- **Track Cumulative POS in appropriate software.**
- **Prepare a demobilization plan when PoScum reaches 80.**
- **Involve external influences and keep them informed.**
- **Consider demobilizing when PoScum reaches 85.**
- **Activate Passive Search efforts.**
- **Compile all search data in an archive for future reference.**
- **Debrief all participants.**

<u>9.0 Subject Location, Rescue, and Recovery:</u>

9.1 The Subject is Found Alive!

9.1.1 In many cases, the subject will be found awake, alert, and willing to be found. Responsive subjects, particularly missing hunters, should be approached with concern for the safety of both the subject and the search team. A lost person with a firearm, driven by fear to the ragged edge of panic, may discharge rounds in an unsafe direction. Steps should be taken to ensure the safety of the team, while approaching in a manner that conveys calming professionalism to the subject.

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

9.1.1.1 Hold up the team approximately 50 meters away from the subject.

9.1.1.2 Select one person to speak for the team. This "spokesperson" will do all the talking for the team.

9.1.1.3 Once conversational voice contact is established, the team spokesperson should keep talking with the subject. All replies from the subject should be assessed for tone and content. Is the answer appropriate to the question asked, and is the cadence, timber, and pitch of the voice consistent with someone who is not panicked? If the subject fails this test, do not approach; but rather, hold off and continue talking with the subject until they calm down.

9.1.1.4 As the "comfort level" between the subject and the spokesperson builds, the team moves closer to the subject. At this time, begin to compile the following information:

a. Confirm the identity of the missing subject. For example, "Are you (name of subject)? Stay where you are! We'll come to you!"
b. Confirm medical status. Is the subject okay and uninjured, injured but stable, injured and unstable, or medically ill? Radio this data to the Command Post immediately.
c. If a hunter, coach the subject to unload his or her weapon and set it down, and continue to recheck and reconfirm this as the team continues its approach. It is remarkable how many weapons mysteriously reload themselves during this critical period!
d. The exact location of the missing subject, confirmed by GPS. Broadcast this to Command and other teams as well.

9.1.1.5 When physical link-up is finally achieved, perform a quick assessment of the subject's condition and ability to travel. If a hunter, secure the weapon and have one field team member confirm it is indeed unloaded. Moreover, offer to carry the weapon—perhaps offering a flashlight in exchange—until you are sure the subject has his wits about him.

9.1.1.6 Assist the subject in the treatment of any injuries, offer food and water as appropriate, and help the subject break down any campsites they may have set up.

9.1.1.7 Perform a complete 360-degree check of the area to secure any articles left behind, and begin egress from the woods.

9.1.2 In the case of an injured or medically stricken subject, all actions should be planned with the safety of the team and the survival of the subject in mind.

9.1.2.1 If the cause of the injury or illness was environmental, does the same condition pose a risk to the team? If so, either mitigate the hazard or radio Command for appropriate technical rescue help.

9.1.2.2 Safely gain access to the subject, and begin to assess and treat injuries according to your certification's Standard of Care, as well as in accordance with any local protocols and variances. Radio your assessment to Command as soon as it is complete. **If the subject is the victim of a shooting, preserve pertinent**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

evidence. Do <u>not</u> cut through bullet holes to expose wounds! Be prepared to document what was done and said at the conclusion of the operation.

9.1.2.3 Assess what additional manpower and equipment support is needed, and radio these requirements to Command. This, combined with the results of your medical assessment, may indicate the need for a medical helicopter evacuation.

9.1.2.4 Save and transmit GPS coordinates to Command and other teams as soon as possible.

9.1.2.5 "Talk in" the inbound medical teams as needed, referring to trail junctions and other landmarks.

9.1.2.6 Treat and package the patient for evacuation, perform a 360-degree check, and begin egress from the woods.

9.2 The Subject is Found Deceased

9.2.1 Deceased subjects are a common outcome in wilderness search operations.

9.2.1.1 Only one or two people should approach the subject, not the entire team. The rest should hold back about ten meters, scanning the perimeter and observing the actions of the attending team members. Be prepared to document your observations at the conclusion of the operation.

9.2.1.2 Assess for indications of mortality (pulse, respirations, lividity, rigor mortis, decomposition) to confirm the subject is deceased. Be deliberate and thorough in your assessment. Severe hypothermia or shock may produce such a depressed Level of Consciousness (LOC), that the subject may be mistaken for dead. This is a mistake you <u>don't</u> want to make! *Beyond confirming death, do not move the subject further until cleared to do so by Law Enforcement*.

9.2.1.3 Once death has been confirmed, notify Command. To protect the radio net during this critical transmission, the callsign 740 has been issued to the deceased subject. Thus, a sample broadcast from Blue Team of, "We have found the subject, and he is dead," might sound as follows.

Blue Team: *Blue Team to Command*.
Command: *Go ahead, Blue Team*.
Blue Team: *We're switching some team members around out here, and 740 is now with Blue Team*.
Command: *Copy 740 is now with Blue Team. What is your location?*
Blue Team: (Gives GPS coordinates.)

9.2.1.4 Given the nature of the operation, the Law Enforcement liaison may follow up with questions regarding the cause of death. If clearly natural causes, the Liaison may authorize the recovery of the body by the team on the scene with no further follow-up. However, this is Law Enforcement's call! **The location is now officially a crime scene until released by Law Enforcement!** If the cause of death was by trauma due to accident, suicide, homicide, or by suspicious medical

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

circumstances, the liaison may order further investigation. If this is the case, retreat to the perimeter and wait there until backup teams arrive.

9.2.1.5 Document the scene through sketches, photographs (if the team has a camera), and GPS coordinates of appropriate landmarks and the subject's personal effects. Note appropriate measurements and compass directions on all sketches.

9.2.1.6 **Do not clear or secure weapons** until released to do so by Law Enforcement! A loaded and cocked weapon will remain that way if not touched or jostled, but handling a weapon may destroy evidence forever. Be sure to stay out of the line of fire.

9.2.1.7 **You cannot rule out foul play unless you first consider it!**

9.2.2 Assess what additional help will be needed to complete the recovery. For short distance carries (less than 100 meters to a trailhead), a single litter team is normally sufficient, allowing for frequent rest breaks, as needed. For longer distances, two litter teams are needed, who must switch off frequently. For victims of average weight, plan on six litter bearers per team. For heavier weighted victims, eight litter bearers will be needed. In two-team configuration, two members of the "off" team should assume a scouting role, choosing and marking the trail ahead, as well as warning of hazards. If the recovery is to be made with only one litter team, staff it with two extra personnel to serve as scouts, as well as provide relief.

9.2.2.1 Consider creative means to bring ATVs as close to the scene as possible. This may include using chainsaws and sweeper crews to clear a trail.

9.2.3 When the recovery is complete and the body has been brought to safe processing area away from curious onlookers, be sure to provide a short debrief with Command and Law Enforcement before clearing the scene.

9.2.4 Document what was seen, heard, and done from the moment of the find to the completion of the recovery. Do this in the next 24 hours.

9.2.5 Consider Critical Incident Stress Debriefings (CISD) for all high-stress rescues and recoveries, such as subjects found injured or dead.

9.3 The Subjects are in a Crashed Aircraft

9.3.1 Downed aircraft require slightly different procedures to process the scene. These are described on the following page.

9.3.1.1 Clues to detect the proximal location of an aircraft crash include damage to vegetation, the smell of aviation fuel, the odor of burnt plastic, rubber, and human remains, the glint of light off windshield glass or polished metal, and of course, the discovery of the physical wreckage.

9.3.1.2 Assign team members to perform the following tasks. Brief team members to avoid moving any wreckage or stepping on evidence, such as impact marks, instruments, or other material, *and to coach other personnel to do the same*. All teams should be on the lookout for survivors. *If survivors are encountered, all site-processing tasks are subordinate to the care, stabilization, and evacuation of the injured*. If no survivors are found, the next priority is to look for human bodies

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

or remains. If any are encountered, save the GPS coordinates, mark the spot with survey tape, and give the coordinates to the scribe (see item "a." below). Also, brief all teams to be on the lookout for unauthorized personnel inside the site perimeter, and to direct those people to leave the scene.

a. Appoint a scribe to keep notes. The softcover "brain book" works great for recording information. The scribe's job is to document intel discovered by the other teams.
b. Send a team "up-track" (the direction from which the aircraft came) and save the coordinates of the Point of Impact. Then, continue up-track to the first point of contact between the aircraft and the trees. Be sure to scan beyond the first point of contact several dozen meters to ensure nothing is missed. It is not unusual to find wing wreckage near the farthest contact point up-track. Set up a perimeter around any wreckage found with survey tape, or with crime scene tape, if available.
c. Send a team "down-track" (the direction the aircraft was headed) to the farthest point of wreckage, then several dozen meters beyond that. It is not unusual for remains and personal effects to be ejected from the cockpit and thrown a considerable distance down-track.
d. Deploy teams to string crime scene tape around the entire crash site.
e. Deploy fire suppression teams as necessary to fight fires. If appropriate, deploy a fire suppression team to stand by in reserve, as it is not uncommon for fires to rekindle, especially in peat bogs or in dry forest conditions.
f. Locate the cockpit and save the coordinates of its location. Without moving anything, report pertinent gauge readings to the scribe for recording. If you don't understand what a particular gauge means, sketch it. Pay meticulous attention to accurate detail in your sketches! With a lensatic compass, shoot an azimuth from the cockpit in the up-track direction.
g. All teams should compile a "soul count" of the total number of humans found. Record this number and transmit to Command as soon as it is available. This number should jibe with the manifested number of souls on board the aircraft. Keep in mind that in larger commercial air crashes, all bodies may not be visible.
h. Number the bodies, both in the scribe's record and on the survey tape marking the location. If a Medical Examiner (ME) is on-site, he or she may direct the numbering of bodies. Along with the number in the scribe's record, note a key identifying characteristic, such as "Male, black T-shirt," "Male, Nomex flight suit," or "Female, gray slacks." In some high-impact crashes, the clothing may have been blown off some or all of the bodies, requiring descriptions based on tattoos or injuries. In some cases, it may be possible to note the seating location of the victim inside the aircraft, such as "pilot," "seat 3B," or "tail jump seat."

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.

i. When the above tasks are completed, assemble all personnel in a staging area outside the crash site perimeter and await further instructions. Government investigators will grant approval to recover and remove human remains.

9.3.1.3 Aircraft crashes with a significant number of survivors require a Mass-Casualty response, which is a different protocol and one not covered in this management plan. As stated earlier, the task list above falls subordinate to efforts to locate, access, stabilize, and transport injured survivors (the LAST acronym).

9.4 Demobilization from a Successful Search

9.4.1 Electronically save and print copies of all intelligence files, planning spreadsheets, maps, and comms logs for the operation. Compile these in a folder for future reference.

9.4.2 Debrief participants and supporting agencies to assess what went well, as well as improvements to structures and systems for next time. Debriefing should focus on improvement—not on placing blame.

9.4.3 Consider scheduling a Critical Incident Stress Debriefing promptly after operation, particularly in cases of death, injuries, or high-stress/high-emotion rescues.

9.99 ***Review of steps in Section 9.0***:

- **Execute approach procedures for responsive subjects.**
- **Care for injured subjects and arrange for evacuation.**
- **Preserve potential evidence in all cases.**
- **Limit contamination at scenes of death.**
- **Document promptly what was said, heard, and done.**
- **Process aircraft crash scenes carefully.**
- **Compile all records in an archive file for future reference.**
- **Debrief all participants.**
- **Schedule CISD promptly in high-energy cases.**

© 2008 **St. Louis County Rescue Squad, and WoodsTalk Search and Rescue Education.** All rights reserved.