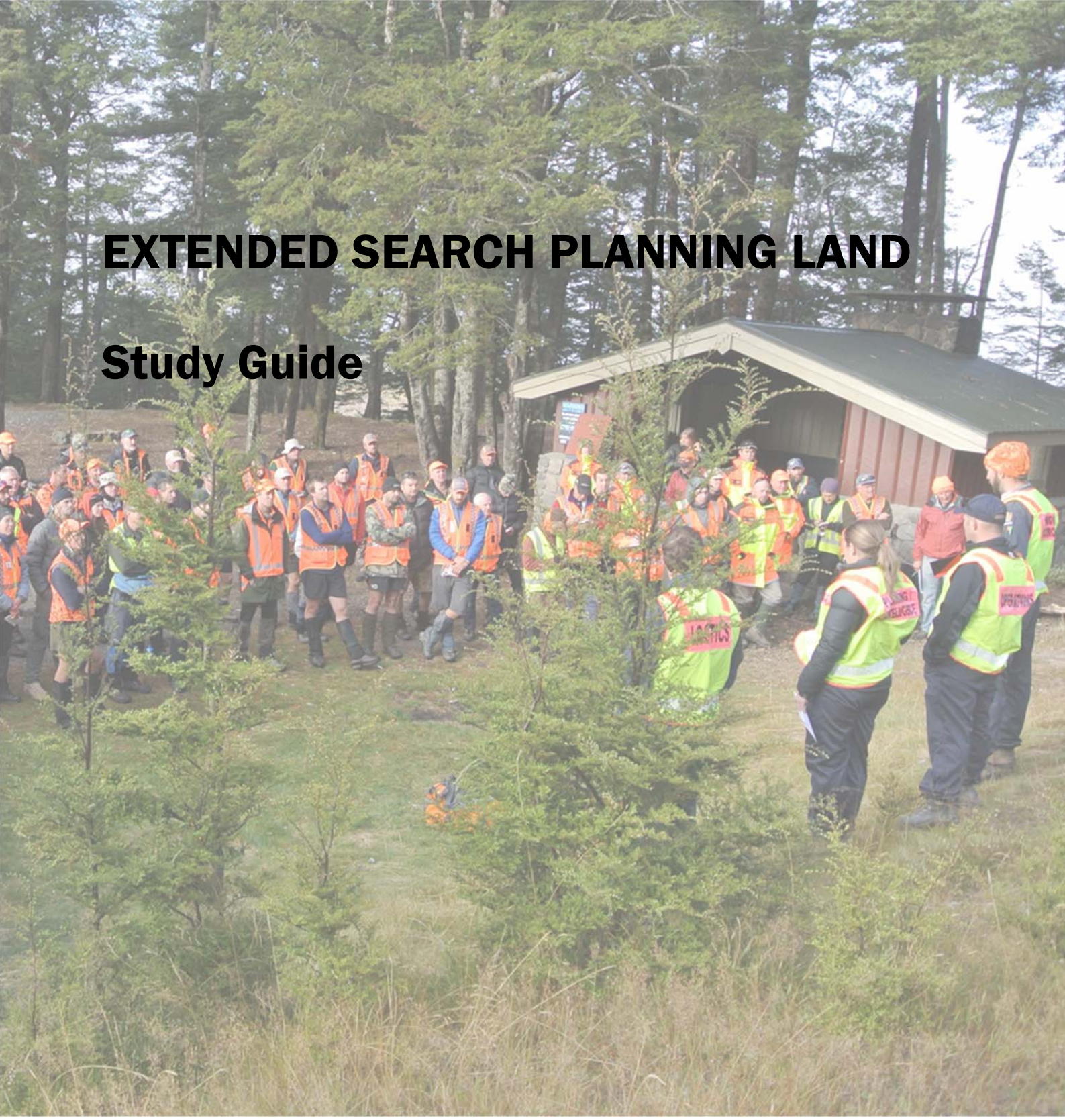
EXTENDED SEARCH PLANNING LAND

Study Guide



NZSAR
New Zealand Search and Rescue

Acknowledgements

NZSAR would like to acknowledge the input and contribution of:

LandSAR New Zealand

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New Zealand Police

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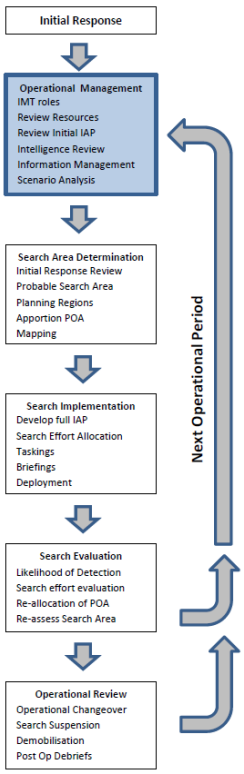
Abbreviations

CIMS	Coordinated Incident Management System
CIS	Critical Incident Stress
CISD	Critical Incident Stress debriefing
EAP	Employee Assistance Programme
ESP	Extended Search Planning
ETA	Estimated Time of Arrival
GOSA	Goal, Objectives, Strategies, Assignments
GPS	Global Positioning System
GSMEAC	Ground, Situation, Mission, Execution, Administration, Command, Control, Communications
IAP	Incident Action Plan
IC	Incident Controller
ICP	Incident Control Point
IMT	Incident Management Team
IPP	Initial Planning Point
ISRID	International Search & Rescue Incident Database
LAST	Locate, Access, Stabilise, Transport
LPB	Lost Person Behaviour
MBO	Management by Objectives
MMTIR	Marine: Manage the Initial Response
MP	Missing Person
NOK	Next of Kin
NSARC	National Search and Rescue Council
NZDF	New Zealand Defence Force
NZSAR	New Zealand Search and Rescue Council
PIM	Public Information Management
PLS	Position Last Seen
POA	Probability of Area

POD	Probability of Detection
POS	Probability of Success
RCCNZ	Rescue Coordination Centre of New Zealand
ROW	Rest of World
SAD	Search Area Determination
SAR	Search and Rescue
SAREX	Search and Rescue Exercise
SARNET	Search and Rescue Network
SAROP	Search and Rescue Operation
SEE	Search Effort Evaluation
SMART	Specific, Measurable, Achievable, Relevant, Timely
SME	Subject Matter Expert
SMS	Safety Management System
SOP	Standard Operating Procedure
SRU	Search and Rescue Unit
USAR	Urban Search and Rescue

Overview



The Managing the Initial Response course (MTIR) provided you with knowledge and a basic skill set enabling you to participate meaningfully in the incident management team in the initial response phase of a search and rescue operation. Key topics covered for the initial response included: operational pre-planning; search urgency assessment; information gathering; lost person behaviour theory; initial actions; establishment and confinement of the initial search area and decision points and assigning search and rescue resources.

Search operations that progress beyond the initial response phase require a well-developed and structured approach to search planning and implementation. This period of formal search planning has a specific framework that has been developed around key principles of search management. The **Extended Search Planning (Land)** course consists of five fundamental components; Operational Management, Search Area Determination, Search Implementation, Search Evaluation and Operational Review. This is presented as a cyclical process incorporating the NZSAR Response Guidelines (NZSAR, 2014).

Search Management involves a number of key principles that need to be recognised. Search and rescue is an emergency situation and therefore is time critical. If the ultimate goal of search and rescue is success in the shortest time possible, then attention should be paid to the two essential elements of a successful search;

1. Be looking in the right place
2. Be able to detect what it is you are looking for

To be successful in search and rescue it is important to recognise that both search and investigation are each vital components of the process. Search management should focus on manageable factors that are important and will influence search success.

Search and rescue should be evidence based and intelligence led.

- Good information gathering and management
- Confinement of the search area
- Searching for clues as well as the missing person
- Deployment of appropriate trained resources in a defined order

During the initial response period of a search and rescue operation, the systems and processes developed in a number of countries have resulted in a consistent (94%) success rate. However, internationally there remains a challenge with developing the extended search planning practices that are required beyond this initial response phase. Like New Zealand, many countries are seeking a more simplistic and intuitive approach to managing the extended phase component of search and rescue.

In this course, allocation of resources to the search areas are guided by probability based assessments for specific scenarios. The evaluation of search effort and reallocation of probability of area is redefined. Following multiple operational

periods, the decision as to where to search in order to enhance the probability of success is now based on information provided by field teams through the concept of likelihood of detection.

In Operational Management, we start by exploring the various phases of search management.

Search Management Phases

Search management is a process that is best considered in terms of a series of sequential phases.

a. Preplanning phase

A response plan outlines an overall approach to search and rescue operations and provides a useful management tool where information, guidelines and technical data are collated. The response plan provides a foundation for further specific planning of individual operations and is based on information that is researched and prepared in advance.

b. Initial Response Phase

Initial actions, which may be based on a response plan, often involve the rapid deployment of resources to likely spots and containment of the search area. These initial actions, based on the Land Search and Rescue Response Guidelines (NZSAR, 2014) will include;

- gathering information and start documenting search effort (includes subject description, search area, circumstances),
- conducting search urgency assessment
- investigation
- developing an initial action plan

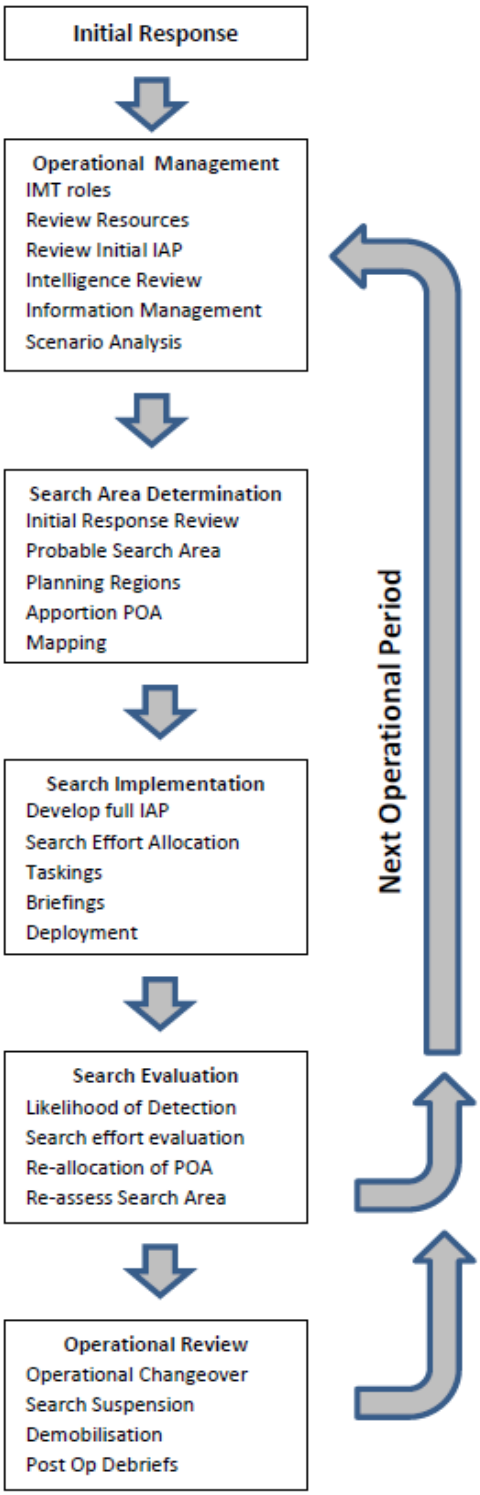
- search planning for initial actions
- resource allocation
- risk management
- team tasking

c. Extended Search Planning (ESP)

Following the initial response phase, if a search remains unresolved then it will transition into the formal search planning phase, the most detailed level of search planning. In this course this phase is described as extended search planning (ESP) and is based on analysis of initial actions and effective use of search theory by a management team that utilises consensus decision making. The actions taken during ESP are based on the Land Search and Rescue Response Guidelines (NZSAR, 2014) and include;

- scenario development and analysis
- expanding IMT
- establish probable search area
- create planning regions
- further investigation and information management
- incident action planning
- search effort evaluation
- reallocation of probability of area
- operational changeover
- search suspension
- demobilisation
- debriefing

Operational Management



Operational Management
CIMS: A review

The New Zealand Coordinated Incident Management System (CIMS) provides a model for command, control and coordination of any emergency response. This is the agreed model for managing SAR incidents in New Zealand (New Zealand Government, 2014).

CIMS structure is based on ten key principles:

Common structures, roles, and responsibilities

Common structures, roles, and responsibilities make it possible for agencies to work effectively alongside each other, and for personnel to interchange roles. They facilitate information flow and understanding by creating parallel structures and appointments.

Common Terminology

Common terminology is essential in any incident management system. When agencies have slightly different meanings for terms, confusion and inefficiency can result. CIMS terminology is standard and consistent among all of the agencies involved.

CIMS was reviewed in 2014 and the second edition replaces the published 1998 document. Download this latest resource from; http://www.civildefence.govt.nz/assets/Uploads/publications/CIMS-2nd-edition.pdf

Modular and scalable

The structure is flexible and can be applied to all responses and all levels within a response. Agencies may adapt their response structures prior to a response to suit their specific needs, and during a response to reflect changing circumstances

Responsive to community needs

All responses aim to mitigate and manage the consequences for the affected community. This requires response personnel to effectively communicate with communities, understand their needs, and base their response and recovery actions on these needs. Community response actions need to be coordinated with the official response.

Integrated response coordination

Integrated response coordination is the organisation of the responding agencies into a single, cohesive response.

Consolidated action planning

Action plans describe response objectives, agency and team tasks, and the measures needed to coordinate the response. They are proactive, seeking to pre-empt hazard impacts where possible, and to resolve the situation as quickly as possible. A multi-agency action plan must have input from all support agencies to be effective.

Integrated information management and communications

Integrated information management and communications enable effective information sharing and wider situational awareness. It aims to establish a common operating picture and requires a common communications plan, standard procedures, clear text, common communication means, and common terminology.

Resource Coordination

Resource coordination organises resources across all response agencies. Lead agencies monitor resource information, and may set priorities for allocating critical resources.

Designated Response Facilities

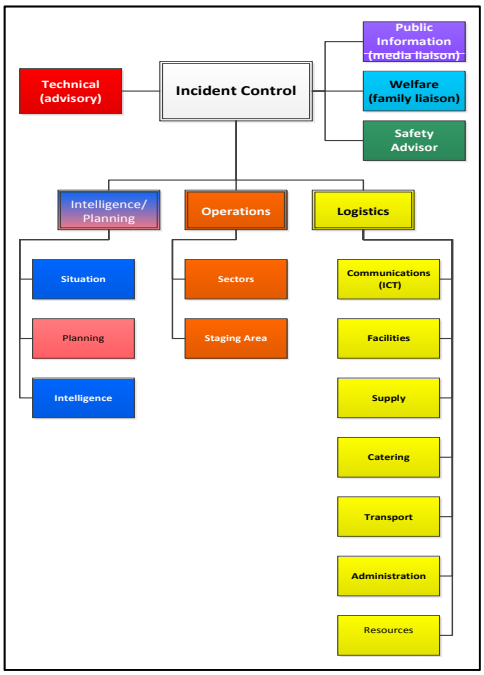
Designated response facilities that are strategically located with clearly defined functions assist in effective incident management

Manageable Span of Control

This is defined as the number of individuals or functions a person can effectively manage. This falls in the range of two to seven resources – five is the optimum.

IMT Structure

The members of the incident management team in a single agency incident level response are all from one agency, so command and control are relatively simple - there is one line of command.



However, moving into an extended search planning phase requires a greater level of structure than the initial response. The multi-agency incident level structure, adapted for LandSAR is shown in the diagram to the right.

The responsibilities for each of the functions are summarised in the table below.

Function	Responsibilities
Control	Coordinates and controls the response
Intelligence	Collects and analyses information and intelligence related to context, impact and consequences; also distributes intelligence outputs
Planning	Leads planning for response activities and resource needs
Operations	Provides detailed direction, coordination, and supervision of response elements on behalf of the Control function
Logistics	Provides personnel, equipment, supplies, facilities, and services to support response activities
Public Information Management	Develops and delivers messages to the public, directly and through the media, and liaises with the community if required
Welfare	Coordinates the delivery of emergency welfare services and resources to affected individuals, families/whānau, and communities

Coordination, Command and Control

The lead agency has control of all response agencies and is established by legislation or an emergency action plan. In search and rescue, this lead agency role is usually taken by NZ Police or RCCNZ. Command, however, remains with each response agency (such as LandSAR, Alpine Rescue, USAR, Westpac Rescue, Coastguard). This allows each agency to assign their own team members and equipment as well as managing their own safety and welfare. Command and control is about identifying who has the authority to make decisions and what the parameters of that authority are. Command and control assist with coordination to ensure a unified, consistent and effective response.

External Influences

There are several external influences that must be considered and managed by the Incident Controller and IMT. These influences may include;

- media
- social media
- politicians
- clairvoyants
- untrained searchers
- family

Although these groups can offer relevant and useful information for the search effort, if not properly managed by the IMT these external influences can be a significant drain on manpower and resources.

Risk Management

This is the process of analysing exposure to risk and determining how best to manage that exposure. The specific risk management considerations depend on the objectives of the response (New Zealand Government, 2014, p25). Risk management considerations may include:

- safety for response personnel and members of the public
- legal issues
- the reputations of the associated response and governance organisations.

Although the Incident Controller has overall responsibility for ensuring effective risk management practices, each team should have their own risk assessment and management plan. The Land Search and Rescue Response Guidelines (NZSAR, 2014) suggest;

- a safety advisor should be appointed
- risks are identified and risk management strategies developed
- emergency procedures considered in case of emergency
- all safety points, emergency procedures and rescue plans should be documented in the Safety Plan form of the Incident Action Plan (IAP) for each operational period.
- all agency safety management safety systems processes should be implemented and appropriate documentation used.

A health and safety plan is a plan to keep all the people involved in search planning and implementation safe. The rescue plan is the plan that would be implemented should the rescuers need rescuing - it is a contingency plan in the event that the health and safety controls are insufficient to keep searchers safe in the field.

The priority in risk management is ensuring responder safety.

Operational Management
Incident Action Plan: A Review

An incident action plan (IAP) is a document that describes how the response will be managed and how activities are integrated to achieve the response objectives for an operational period. It states the goal and objectives of the operation where the goal is the desired outcome of the operation and the objectives are specific, measurable, achievable, realistic and timely (SMART).

An IAP for an initial response includes the following key elements:

- Situation summary
- Command structure – individuals named using the CIMS structure
- Goals, incident objectives, strategies and resource needs
- Actions or operational taskings
- Communication plan
- Safety plan

For an extended search the IAP is developed is for a multi-period and in addition to the information contained in the initial response IAP it also includes;

- Detailed situation report
- Missing person summary
- Incident objectives for a specified operational period. These include strategies.
- More complex IMT structure where required, including Public Information Management - Media liaison identified and a plan in place for interacting with media.
- Sector assignments.
- Detailed safety plan that includes the management of safety and hazards during the operational period
- A rescue plan to ensure the safe rescue of all individuals in the field.
- Medical plan.
- Weather information – a continuously updated weather forecast for the search area.

The main purpose of the IAP is to ensure that the objectives are aligned both in the IMT and in the field. It is the responsibility of the Incident Controller to ensure that there is an IAP – this is usually developed by the IMT team.

Management by Objectives

Management by objectives (MBO) is used to plan and track progress towards the identified goal in a structured and aligned manner. To achieve the goal, objectives are identified (what needs to be done), strategies decided (how will it be done) and assignments or taskings assigned (who will do it).

Management of the situation is driven by the goal, which in all search and rescue operations is to locate the missing subject.

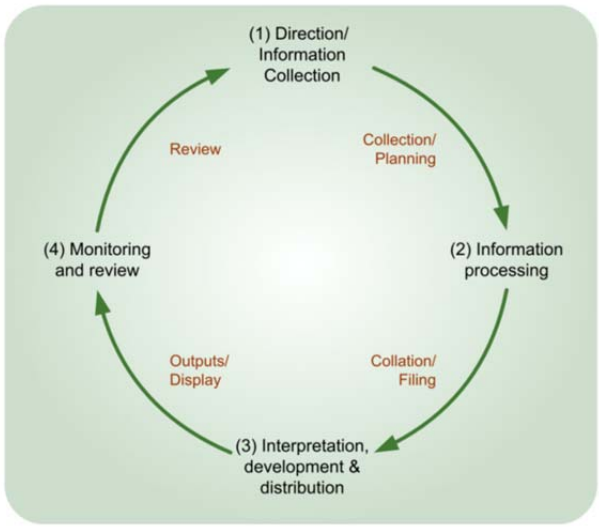
To achieve the goal a number of objectives have to be derived – the aim of the objectives is to achieve the goal. Each objective will require a number of different strategies to ensure that the objective is achieved. Each strategy will require one or more assignments – this is the operational detail. This can be represented by a pyramid – where the focus is around the Goal at the apex.

Operational Management
Intelligence Review

A SAROP is an intelligence driven and evidenced based operation.

"*Effective intelligence contributes to situational awareness and gives the CC [Coordination Centres] an understanding of how the incident can be expected to progress, allowing the development of proactive plans to mitigate, manage, and eventually resolve the incident.*" (New Zealand Government, 2014, p31)

The intelligence function is responsible for collection and analysis of response information. The application of an appropriate intelligence cycle [see diagram below for an example (New Zealand Government, 2014, p32)] will support the effective operation of the intelligence function.



In multi-period search operations it is important to determine what information is missing. This can be identified through gap analysis which is a simple tool to help identify the gap between the current situation and the future situation that you want to reach. A simple gap analysis may include;

For multi-period search operations determine what information is missing.

- Identifying the future situation. In this case the operation goal might be the future situation.
- Analysing the current situation. What information do you have and where.
- or who has the knowledge you need? What is the best way to collect this information? Consideration can be given to interviews, review of current documentation, observations and field team debriefs.
- Identifying how to bridge the gap. Do you need more field teams, more interviewers, further internet searches?

Information analysis should be a component of the IAP and will feed into objectives and strategies. What information is required, where it can be sourced, and who is capable of sourcing it, should be considered. It is important to;

- consider tangential enquiries
- always seek corroboration from independent sources and avoid relying on a single source of information
- analyse all information received for reliability and accuracy.

Types of information may include:

Type	Examples	Positives	Comment
Testimonial	Obtained through interview. Variety of people may be asked (friends, relatives, peers, eye witnesses, experts)	Often greatest source of information, most available form of information	Can be contradictory, often unreliable, open to misinterpretation. May be incomplete
Physical	In the field and may include vehicles, clothing, artefacts, hard evidence left by subject	Often corroborates other types of evidence, least likely to be misinterpreted	
Documentary	Logs, registrations, permits, hut books, bank records	Can help pinpoint a location, time and presence of subject. Used to corroborate other types of physical evidence	
Statistical	International SAR statistics e.g. Koester, Grampian Police Reports, local statistics	Provides broad spectrum of information	Use of eco regions for presenting Lost Person Behaviour (LPB) data

Operational Management
Information Management

Information gathered during a SAROP can be overwhelming and therefore it must be organised and managed to ensure that the correct information reaches the right people in a timely fashion. Information that is properly managed will support the establishment of an effective IAP.

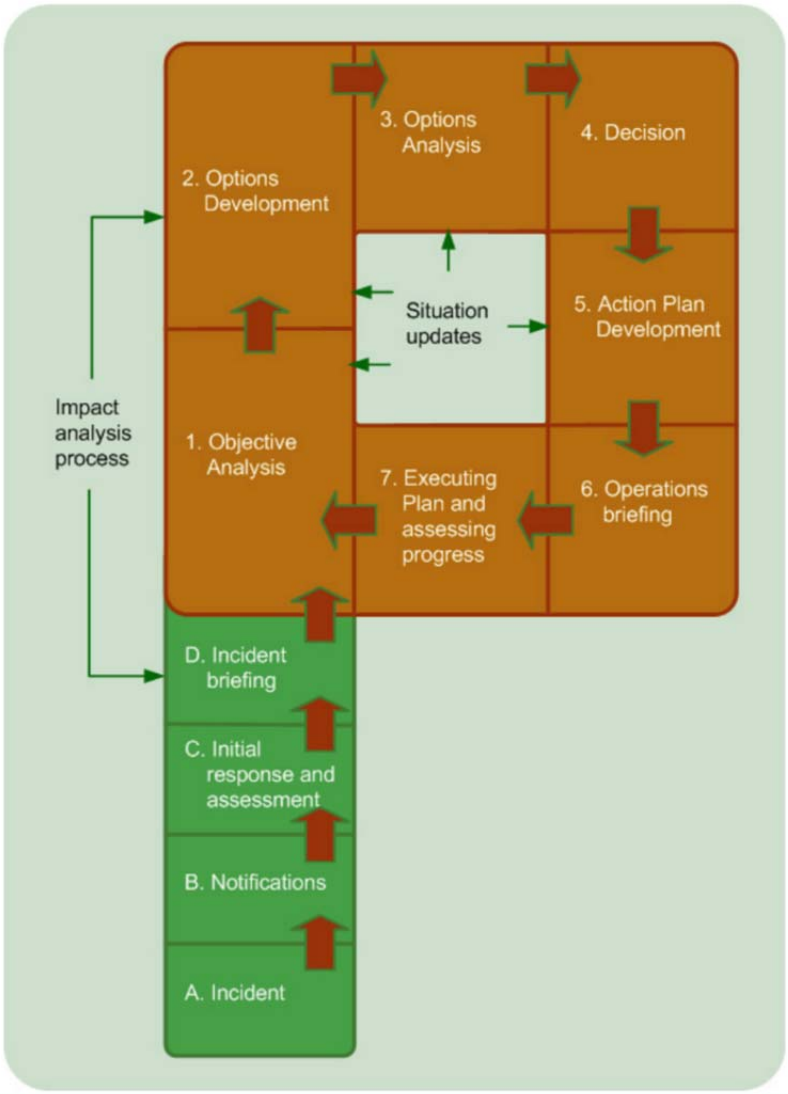
In order to ensure information flow through the IMT, systems and processes must be established to allow:

- All information to be documented, processed and analysed
- All relevant information to be disseminated e.g. briefings, wall charts, maps, displays
- All documents to be collated and stored

Operational Management
Planning Process

Cyclical process

Search management is repetitive and cyclical. In formal search planning there is need to pause and evaluate response at the end of each operational period. We will look at how the initial response and then the extended search planning phase sits within the planning process model. The planning process model shown, is based on one used by NZ Defence Force and NZ Police and is outlined in the NZ CIMS guide. The initial response phase is identified as steps A-D shown in green on the diagram and is only carried out at the start of the response.



Operational Management
Scenario Development and Analysis

When commencing investigative function as part of an initial response to a SAROP, plausible scenarios are developed. In order to decide where to search, what to search and how to search we need to decide on plausible scenarios. Scenarios should be evidence based and must consider what has happened, where it happened and how that has impacted on the subject's behaviour (where are they now).

As more information becomes available, intelligence analysis will be used to determine the accuracy and relevance of the information and therefore the plausibility and likelihood of scenarios. Scenarios will be developed and then analysed using information from the missing person profile, incident history, map and local knowledge and most likely behaviour (LPB information). When determining scenarios it is important that they;

- fit with the known facts (subject profile, technical advice)
- are realistic
- consistent with statistical LPB
- fit the terrain analysis and should be consistent with the specific area of geographic terrain (i.e. the scenario should match where it happens)

In the first stages of extended search planning a number of plausible scenarios need to be identified. It is important to review the scenarios as more information becomes available.

The process of scenario analysis by **consensus management** is used as it is important to recognise both diversity in opinion and expertise in the subjective analysis of usable data. It requires a group of people with a wide range and variety of experience to work collectively to develop possible scenarios based on the data.

Consensus management is used as it will;

- reduce dominant personalities - this may be more pronounced in situations where power balance relationships may affect decisions
- reduce arguments - as it is a shared process
- result in unbiased decision making by aggregating opinion - this allows for subjectivity but extreme opinions can be moderated through aggregation

Consensus management can be explained as a process of decision making through the foresight of many. In his description of this type of decision making, James Surowiecki (2005) identifies this theory as the "wisdom of crowds'. He states that masses are better problem solvers, forecasters and decision makers than any one individual. He identified a number of conditions required for crowd wisdom to be successful. These were;

Have a look at 'Wisdom of Crowds'. TED talk
http://tinyurl.com/phy572o

- diversity – where individuals may have some private information or their own interpretation of known facts.
- independence – meaning freedom from the influence of others.
- decentralisation – encourages individuals to make important decisions, not just in one location based only on one specific type of information, but dispersed through a variety of locations from where local knowledge is drawn and shared.
- aggregation of varying opinion can provide a solution more likely to be smarter than even the smartest person's answer

The process of a group making decisions regarding plausible scenarios for a search and rescue operation needs to take into account the following;

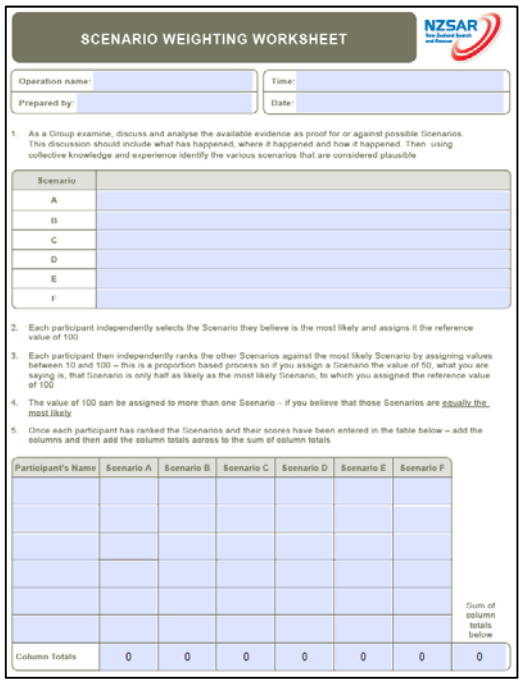
- **diversity of opinion** – who to use in the group
- **access to intelligence** – all members of the group are required to have access to all of the information available
- **independence** – ensure each member of the group has the opportunity to make decisions irrespective of others in the group
- **uninterrupted time for discussion** – allows for sharing of ideas, discussion of opinions

Scenario analysis by proportion based consensus

The process of scenario analysis is led by the IMT. When assembling a number of individuals that are to contribute to scenario analysis by consensus management, it is advisable to include a wide range of people from various agencies who do not necessarily need to be SAR experts. These individuals may have local area knowledge, understanding of the type of activity engaged by the subject (e.g. hunting, tramping), first aid knowledge, environmental knowledge (weather, terrain), experience of search and rescue and other experience.

NZSAR Forms: http://nzsar.org.nz/Resources/NZSAR-Forms

The **NZSAR 'Scenario Weighting Worksheet'** is used to determine a number of possible scenarios based on the available evidence.



SCENARIO WEIGHTING WORKSHEET

NZSAR

Operation name: Time:

Prepared by: Date:

1. As a Group examine, discuss and analyse the available evidence as proof for or against possible Scenarios. This discussion should include what has happened, where it happened and how it happened. Then using collective knowledge and experience identify the various scenarios that are considered plausible

Scenario	
A	
B	
C	
D	
E	
F	

2. Each participant independently selects the Scenario they believe is the most likely and assigns it the reference value of 100
3. Each participant then independently ranks the other Scenarios against the most likely Scenario by assigning values between 10 and 100 – this is a proportion based process so if you assign a Scenario the value of 50, what you are saying is, that Scenario is only half as likely as the most likely Scenario, to which you assigned the reference value of 100
4. The value of 100 can be assigned to more than one Scenario – if you believe that those Scenarios are equally the most likely
5. Once each participant has ranked the Scenarios and their scores have been entered in the table below – add the columns and then add the column totals across to the sum of column totals

Participant's Name	Scenario A	Scenario B	Scenario C	Scenario D	Scenario E	Scenario F	
							Sum of column totals below
Column Totals	0	0	0	0	0	0	0

Identify scenarios

During the initial response period a number of scenarios may have already been identified and used to give rise to taskings for the initial response. It is important that when developing further scenarios from available information,

these initial scenarios are revisited. A number of scenarios are determined by the group that fit with the known facts (subject profile, technical advice), these must be realistic, consistent with statistical LPB, fit the terrain analysis and should be consistent with the specific area of geographic terrain. These are recorded on the worksheet. Try to come up with at least three scenarios.

Applying weightings

Each member of the group independently selects the scenario they believe is the one that has most likely occurred. They assign it the reference value of 100. Each member then independently ranks the other scenarios against their most likely scenario. This process of proportion-based analysis is designed to rank the likelihood of each scenario against the one scenario that you have identified as most likely to occur. The values allocated to the remaining scenarios are from 10 to 100.

The value of 100 can be assigned to more than one scenario if you believe that those scenarios are equally the most likely.

Therefore if a scenario is given the value of 50 you have identified that it is only half as likely to occur as the most likely scenario that you assigned a reference value of 100.

Ranking the scenarios

Steps for ranking the scenarios are as follows:

1. Tabulate the values assigned to each scenario by each group member.
2. The total value for each scenario is calculated.
3. The total sum of all the scenarios is calculated.
4. To determine the ranking, the value for each scenario is divided by the total sum for all scenarios and multiplied by 100.

This will give a weighted percentage ranking for each scenario as determined by proportional based consensus.

Point (ICP) for all to see. During the extended search planning phase scenarios are used to help establish the probable search areas and planning regions. The allocation of probability of area (POA) will be based on scenario plausibility. These scenarios should be reviewed following search effort evaluation and reallocation of POA.

Check your recall of Operational Management

1. What are the two (2) essential elements of a successful search?

2. The missing words are?
   A search and rescue operation should be evidence _____ and _____ led.

3. The Land Search and Rescue Response Guidelines (NZSAR, 2014) specify a range of actions to be undertaken as part of the Initial Response phase of a search. List four (4) of these initial actions.

4. The Land Search and Rescue Response Guidelines (NZSAR, 2014) specify a range of actions to be undertaken if a search remains unresolved after the initial response phase. List four (4) of those actions.

5. Which management phase does the following statement best describe?
   "Analysis of initial actions and effective use of search theory by a management team that utilises consensus decision making."

6. List three (3) ways that the New Zealand Coordinated Incident Management System (CIMS) provides a model of commonality across agencies managing SAR incidents in New Zealand.

7. What is the main purpose of an Incident Action Plan (IAP)?

8. How can *gap analysis* be used to assist a search and rescue operation?

9. In order to decide where to search, what to search and how to search you need to decide on what type of scenarios?

10. The following are criteria for which aspect of operational planning?
    - Fits with known facts
    - Realistic
    - Consistent with likely behaviour (LPB)
    - Fits terrain analysis and consistent with specific area of geographic terrain.

11. Which scenario analysis process is being described in these bullet points?
    - Recognises diversity in opinion and expertise in the subjective analysis of usable data
    - Reduces dominant personalities
    - Reduces arguments
    - Results in unbiased decision making by aggregating opinion
    - Allows independence from the influence of others
    - Allows for sharing ideas and discussion of opinions.

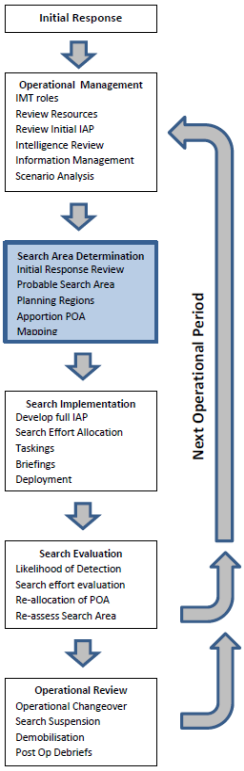
12. How can the NZSAR Scenario Weighting Worksheet be used to allocate probability of area (POA)?

Answers on the next page.

1. Be looking in the right place. Be able to detect what it is you are looking for.
2. based, intelligence.
3. Any four of the following:
   - Gathering information and start documenting search effort (includes subject description, search area, circumstances),
   - Conducting search urgency assessment
   - Investigation
   - Developing an initial action plan
   - Search planning for initial actions
   - Resource allocation
   - Risk management
   - Team tasking.
4. Any four of the following:
   - Scenario development and analysis
   - Expanding IMT
   - Establish probable search area
   - Create planning regions
   - Further investigation and information management
   - Incident action planning
   - Search effort evaluation
   - Reallocation of probability of area
   - Operational changeover
   - Search suspension
   - Demobilisation
   - Debriefing
5. Extended Search Planning (ESP).
6. Commonality in -
   - Roles and responsibilities
   - Response structures
   - Action planning
   - Information management and communications
   - Resource coordination
   - Designated response facilities
   - Manageable spans of control.
   - Terminology
   - Community response coordination
7. - Ensures that objectives are aligned both in the IMT and in the field.
   - Describes how the response will be managed and activities integrated
   - States the goal and objectives of the operation.
8. - To analyse the current situation, including what information you have and don't have.
   - To identify how to source information that the operation requires.
9. Plausible scenarios.
10. Scenario development/analysis.
11. Consensus management
12. - Initial scenarios are developed by the group.
    - Each member of the group independently assigns a value to/ranks each scenario (10 to 100).
    - The total values assigned to each scenario are calculated (total scores added, divided by number of scenarios, multiplied by 100) to produce a weighted percentage for each.

Search Area Determination

Initial Response Review / Constructing the search area for an extended search



In the initial response phase, the process to define the initial search area (the space where you employ initial actions) is

Establish key planning points

These may include the initial planning point (IPP), last known position (LKP) and position last seen (PLS).

Initial search area

An initial area with a radius of 300m is identified around the IPP. This area around the IPP is considered clue rich. Identify close in phenomena, which may not be within the 300m radius circle or linked to LPB. The shape of the initial search area will also be influenced by geographical terrain and linear features.

Terrain analysis

Explore the terrain in order to identify:

- Likely linear features
- Hot spots and attractants
- Any major decision points on map
- Hazards for subject/s and searchers

Theoretical distance

Calculate the theoretical travel distance in the time elapsed. Use the LPB data (Koester, 2008). The distance travelled is calculated using statistical travel distances from LPB data. The search areas for 25%, 50%, 75% and 95% are recorded on the map.

The 300m circle is an arbitrary distance and has evolved from consideration of the LPB data.

Containment

Prevent the probable search area from growing by determining appropriate containment points. Containment can also identify potential witnesses from which to gather more information.

Constructing the search area for an extended search

The initial search can be defined as the search area first determined in which the initial resources are deployed. In determining the search area for an extended search evidence or information collated during the initial phases is used to make informed decisions. It is important to approach the identification and development of the extended search area in a measured way.

The four methods of estimating the search area in the extended planning stage are described below. An outline of the search method and those aspects that may influence the use of the method to determine search area or impact on its effectiveness are highlighted. In the final analysis, the search area is most often determined using a combination of these methods.

i) Theoretical Area

This is the area identified by the distance the subject could have travelled from the IPP. The distance travelled is calculated as the time elapsed (h) since the subject was missing multiplied by the speed over ground the subject is capable of (Km/h).

Naismith's Rule, devised to estimate time to cover distances in the mountains states 'allow 1 hour per 5km walked and 1 hour for every 600m ascended'. Refer to MSC (2011) Bushcraft Manual.

As the subject may travel in any direction from the IPP, the search area is identified as a circle whose area can be calculated as πr^2 (where $\pi = 3.14$ and r is the distance travelled). There are guidelines (such as the Mountain Safety Council Bushcraft Manual) for determining the various average speeds over different types of terrain.

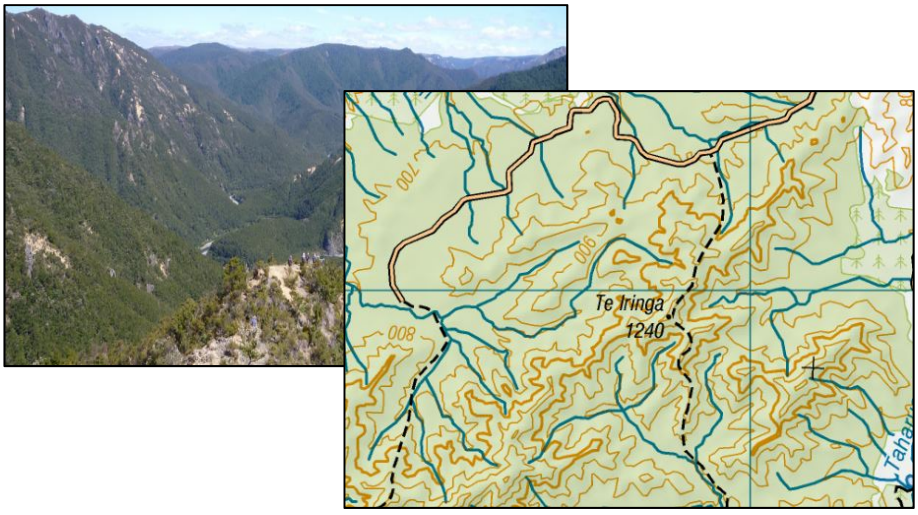
There are a number of considerations that should be taken into account when calculating theoretical search area. These are:

- **Misjudging subject capabilities** – which include factors that can affect subject ability to travel (e.g. injury, health, mental state).
- **Time delay** – discrepancies between the assumed and the actual elapsed time may result in over or under-estimating the distance travelled by the subject.
- **Terrain** – will influence speed over ground. There are guidelines that can be used to provide an indication of the effect of terrain type on subject speed.
- **Transport** – different or multiple modes of transport may have been used by the subject.
- **Lost person strategies** – subjects that become disorientated may employ one of a number of methods to try to find something familiar. Koester (2008) refers to this as different strategies for getting 'unlost' that are employed by subjects.

These may include:

- Random travelling – theoretical calculation assumes a linear direction of travel, however lost persons may move more erratically.
- Route travelling – the lost person decides to follow a trail or route in the hope they come across familiar terrain.
- Direction travelling – moving in direction whilst ignoring trails or paths.
- Route sampling – travelling down a number of trails at an intersection point in search of something familiar before returning back to the intersection point.

- Direction sampling – where a landmark or feature is used as a base and travel is from that feature in various directions.
- View enhancing – the subject attempts to find familiar or noticeable landmarks through climbing a hill or tree.
- Backtracking – the subject attempts to reverse their route to follow the same track back out.
- Staying put – remaining in one place.



ii) Statistical Area

This is the area calculated from data derived from previous searches that identify distances travelled from the IPP by subjects of similar categories.

The main data source used to determine statistical search area is 'Lost Person Behaviour' (Koester, 2008), however there are other resources available such as the Grampian Police Study (Gibb & Woolnough, 2007) which contains statistics derived from a number of UK incidents involving missing children and persons with various mental disorders, plus some observations on their behaviour. There are a number of considerations that should be taken into account when calculating statistical search area. These are:

Lost person behaviour statistics

These provide generalities. As the search data provided is based on subject categories, it is important to develop a comprehensive subject profile which is unique to the subject of the search. There is a need to consider any local lost person behaviour data that might be available.

For each subject category, Koester (2008) provides a reference value for the distance travelled within which 25%, 50%, 75% and 95% of the cases were found.

The distance travelled is categorised into three distinct groups; temperate domain, dry domain and urban areas.

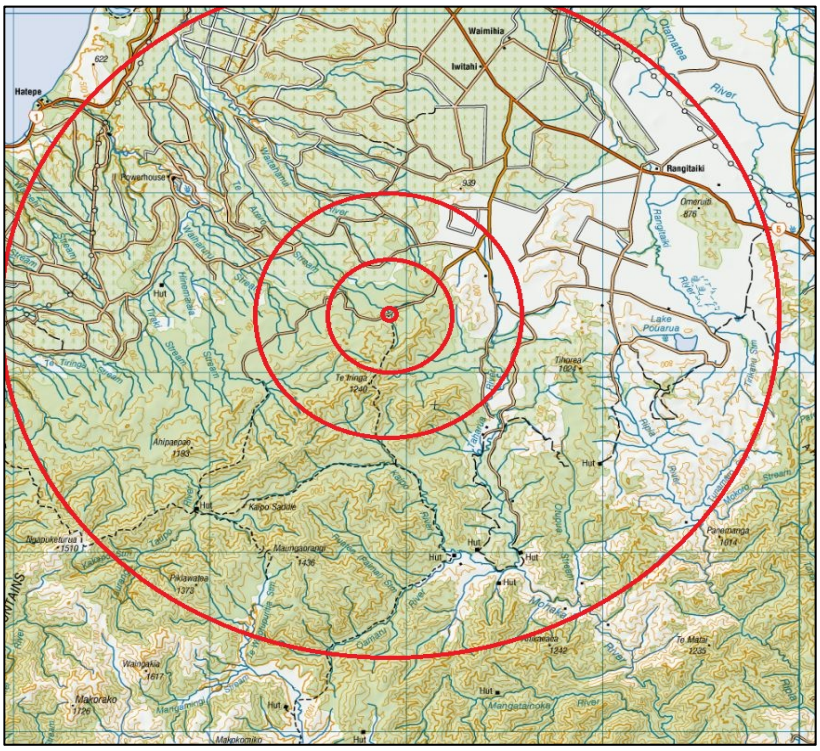
Hiker

Distance (horizontal) from the IPP (miles)					
	Temperate		Dry		Urban
	Mtn	Flat	Mtn	Flat	
n	**568**	**274**	**221**	**58**	**8**
25%	0.7	0.4	1.0	0.8	
50%	1.9	1.1	2.0	1.3	1.6
75%	3.6	2.0	4.0	4.1	
95%	11.3	6.1	11.9	8.1	

Distance (horizontal) from the IPP (kilometers)					
	Temperate		Dry		Urban
	Mtn	Flat	Mtn	Flat	
n	**568**	**274**	**221**	**58**	**8**
25%	1.1	0.6	1.6	1.3	
50%	3.1	1.8	3.2	2.1	2.6
75%	5.8	3.2	6.5	6.6	
95%	18.3	9.9	19.3	13.1	

Barbara Adcock examined NZ Police records of searches from 2004 onwards and established that genuinely lost subjects are likely to travel longer distances than the complete data set would suggest. She found that when she compared lost person data of New Zealand hunters to data from overseas, New Zealand hunters are likely to travel significantly longer distances).

The distances are calculated for 25%, 50%, 75% and 95%. These are then drawn on the map as circles whose radius is the distance travelled.



Search data

The search data collected is very dependent on the context of the search and may not translate to the New Zealand context for the current search. Statistical data is predominantly derived from America using the International Search & Rescue

Incident Database (ISRID) and only 5% of the ISRID data is derived from New Zealand. The size of the data set used to generate the statistical data for LPB varies both within categories and between databases, depending on the number of searches the data was taken from. This may influence the accuracy of the information.

If only the 50% quartile is searched, then there is still a 1 in 2 chance that the subject is not in that area. Searching within the 75% distance still provides a 1 in 4 chance that the subject is not in that area. The 95% distance is useful for establishing early containment; beyond this distance are the statistical outliers.

iii) Subjective Area

25% of all subjects are found within 300m radius of the IPP.

A subjective analysis of data can be used to determine a likely search area. This is the search area where SAR planners believe the subject they are searching for is most likely located given **their** assessment and evaluation of the available information. The shape and size of this search area will be influenced by a whole range of factors. These may include:

- Careful consideration of subject intent, mobility (including physical and mental limitations of the subject) and possible behaviour.
- Most likely spots – these are locations that may offer some appeal to the missing subject in terms of shelter, food, water, ease of movement.
- Terrain analysis – which should be combined with the subject profile.
- Clues – those left by the subject. Sign cutting is used to search for clues, tracks and any other sign that the subject is or has been in the area. Then binary strategy can be considered as a process for reducing the size of the search area by eliminating the area the subject has not passed through. It is based on 'yes' or 'no' decision-making using sign cutting.
- Intuition – experience may provide 'insight' into likely behaviour based on the planning team's experience.
- Case study – historical data can be used to help identify behaviours. Lost person behaviour data (including local information) and the use of previous situations of a similar nature to the current search can also be used to predict possible scenarios.

There are a number of considerations that should be taken into account when determining the search area using subjective analysis. Those individuals that contribute to search planning will bring with them a wealth and variety of prior experience.

This will include their personal feelings, experiences and opinions. These emotional factors will influence search planning and it is important that this is acknowledged.

Equally, the group's experiences, or lack of it, may also be a limiting factor to developing the search area. It is therefore important to seek input from a number of people and thus draw on a greater pool of experience. Utilise SMEs and experienced

searchers as well as those with local knowledge or people who share the interests or inclinations of the lost person. Consider different perspectives when constructing the area to be searched.

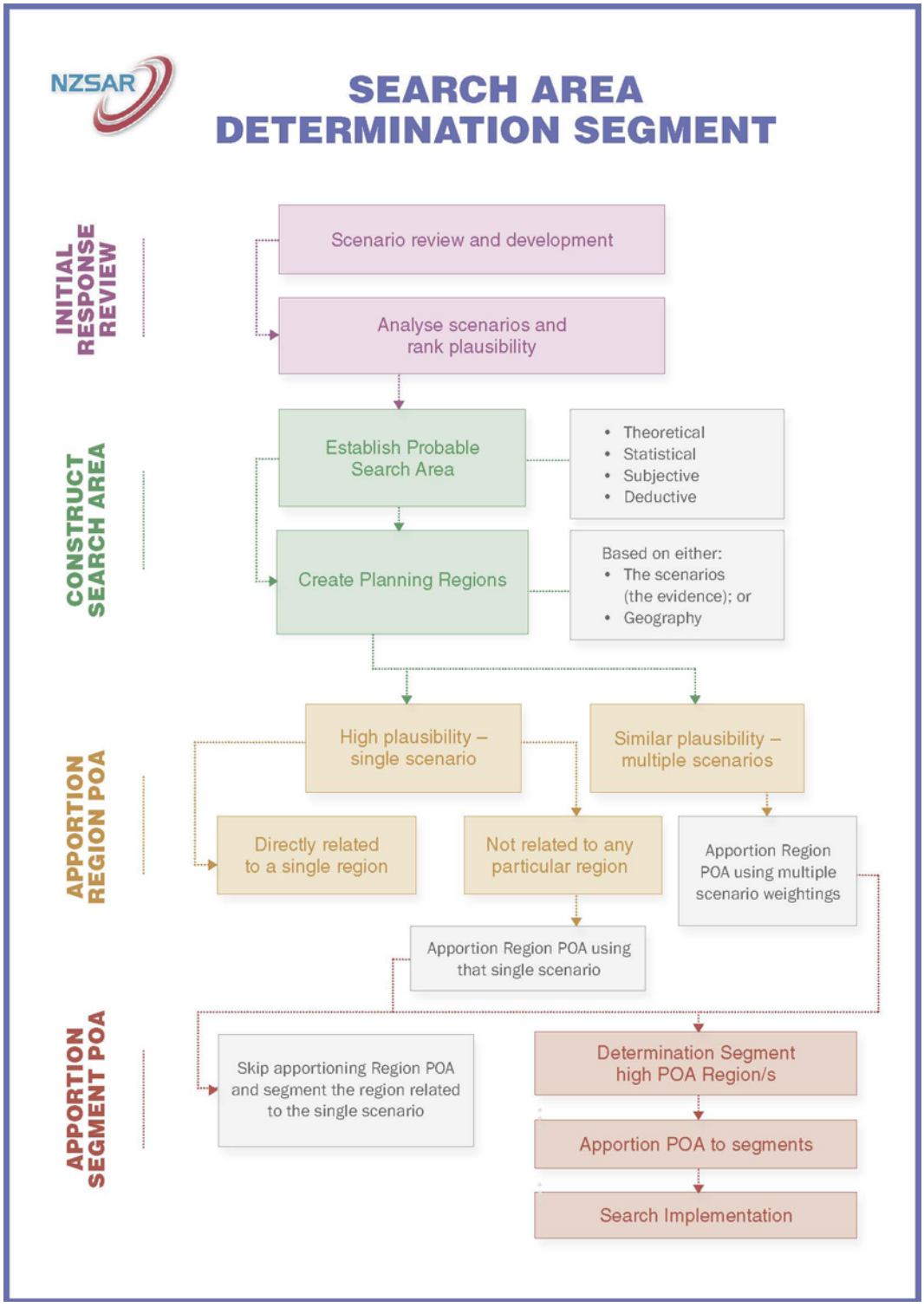
iv) Applying Deductive Reasoning to the Search Area

Consensus developed scenarios help to counter bias or particular mindsets.

Deductive reasoning is the process of making inferences based on gathered facts and circumstantial evidence, in order to determine a probable conclusion. Through this process a hypothesis is developed. The hypothesis is then tested (proved true or false) through team taskings. The result of the search then validates, or does not validate, the hypothesis and the process is then revised and repeated. There are a number of considerations that should be taken into account when using deductive reasoning to determine the search area. These include;

- Consensus developed scenario analysis – which may guide the deductive process by ensuring a number of people provide different scenarios.
- Bias or particular mind-sets can limit or distort the plan. This is countered by including consensus-developed scenarios.
- Understanding the role that subjectivity and search planners personalities have in influencing deductive reasoning and how these can be used to best effect.
- There may be a lack of resources to gather facts or evidence to prove or disprove a hypothesis.
- The possibility that individuals are too tied up with the details and management of the search to consider the bigger picture (situational awareness). This can result from people involved with an initial hasty search being drawn into the IMT for the extended search planning phase.
- Cognitive limitations and analytical complexity – searches can become very complex very quickly. The quantity of data generated, or required, needs careful analysis. The thorough understanding of search theory needed may also become quite intellectually challenging.

- Scenario plausibility – Some scenarios may not be possible for the lost person given where they most likely are. Therefore it is important to conduct a 'reality check' for each scenario before progressing with search planning.


NZSAR
SEARCH AREA DETERMINATION SEGMENT
INITIAL RESPONSE REVIEW
Scenario review and development
Analyse scenarios and rank plausibility
CONSTRUCT SEARCH AREA
Establish Probable Search Area
Theoretical
Statistical
Subjective
Deductive
Create Planning Regions
Based on either:
The scenarios (the evidence); or
Geography
APPORTION REGION POA
High plausibility – single scenario
Similar plausibility – multiple scenarios
Directly related to a single region
Not related to any particular region
Apportion Region POA using multiple scenario weightings
Apportion Region POA using that single scenario
APPORTION SEGMENT POA
Skip apportioning Region POA and segment the region related to the single scenario
Determination Segment high POA Region/s
Apportion POA to segments
Search Implementation

Search Area Determination
Create Planning Regions / Apportion POA

Scenarios have been developed from the available evidence then analysed and ranked. The probable search area is constructed using a combination of methods; theoretical, statistical, subjective and deductive. Planning regions are then identified within the probable search area. These regions are then evaluated to determine which ones have high POA and these are further subdivided into smaller sections called segments. Finally, POA is apportioned to the segments. Those with the highest POA are then prioritised for searching within the IAP.

The area to be searched may be defined by both the geography of the region, the likely scenarios or a combination of these factors. In either case, the area is likely to be too large to search therefore it is broken down into smaller areas to make it more manageable.

So, what is the difference between a planning region and a region of probability?

A **planning region** is an area defined by geography or terrain. If there is no scenario then a planning region is identified.

A **probability region** is an area that relates to scenarios determined during scenario analysis, geographical features and lost person behaviour statistics. A region of probability can be considered as those areas defined by the likelihood the subject is present yet limited by geographical boundaries that are determined by subjective analysis.

When examining the literature regarding search theory, it appears that the terms planning region and region of probability are interchangeable. A manageable number of regions is limited to probably no more than 6-10 per search area. Within the planning region or region of probability, the likelihood of the subject being present in the search area, or probability of area (POA), is then determined.

Apportion POA

In order to determine in which region to focus the search effort, the probability of locating the subject is now calculated for each region. This probability of area (POA) is the probability or chance that a lost or missing person is in the particular region, either based on the scenarios, the geography or other information available.

High plausibility / single scenario

The single scenario may be either:

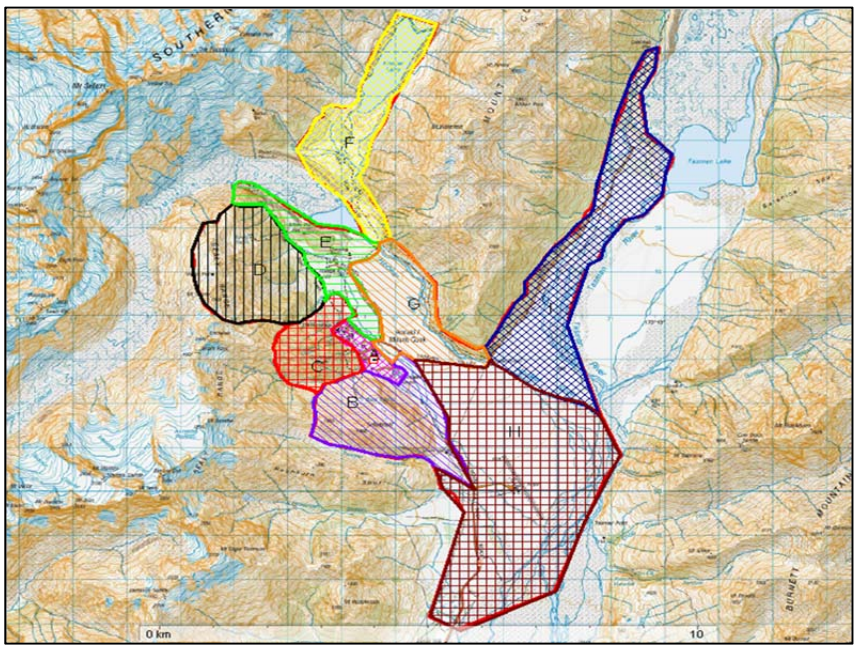
a. directly related to a single region, or
b. not related to any specific region.

When it is associated with a single region, there is no need to apportion region POA and instead the region is segmented in relation to that single scenario and segment POA apportioned.

If the single scenario is unrelated to any specific region, then region POA should be apportioned using a single scenario approach with the Region POA Consensus Worksheet tool. The most likely region(s) are then identified and segment POA can be apportioned.

Similar plausibility / multiple scenarios

When no particular scenario is identified as outstanding through the scenario weighting process, then region POA is calculated for each scenario. The Combined Region POA Weighting Worksheet tool is used and allows a POA allocation for each scenario.



The next stage in apportioning POA to regions using multiple scenario weightings is to develop an overall POA allocation for all regions that takes into account all scenarios, but has been weighted by the likelihood of each scenario occurring. The most likely region(s) are then identified and segment POA can be apportioned.

Segments

The planning region that has the highest POA is subdivided into smaller, searchable areas. This is the process of segmentation. These segments are defined by a number of factors and consist of 'searchable areas' for the operational period. If more than one planning region is identified that has very high, yet similar POA, then all these may be included in the process of segmentation. However, this may lead to greater complexity as the number of segments could increase quickly and may exceed the number of field teams available to search them. Further analysis is then required to best allocate search effort.

Segments are 2D therefore caves, mines, shafts and under snow etc. are seen as separate segments. Until these are identified they are essentially outside the search area - e.g. if a body is covered under snow and you are only searching the surface of the snow, the body is essentially outside the search area.

Segments are divided up on the basis that they each have a size that can be searched within the allocated period by a single resource (for example, a search team or an air scenting dog). Stoffel (2006) identifies segment size as being limited by the size that the assigned resource can search to the desired coverage within 4-6hrs. In order to ensure that field teams can properly identify and search allocated areas, segment boundaries should be chosen that are clearly defined by natural or man-made features. Within a segment there should be no internal barriers to restrict searcher movements.

The search boundaries should be set on the basis of a realistic area to search in the allocated time in the prevailing conditions. This will be influenced by terrain, vegetation cover and weather. If segments are too large, or the area is perceived as being hard to search, searcher morale can be adversely affected.

Dividing segments so that the areas to be searched are roughly even in terms of the time required to search them, (i.e. small areas for difficult terrain compared to larger areas for more open terrain) will reduce the likelihood of waiting for an area to be completed before implementing the next phase of the search plan. It is difficult to manage left over, unfinished areas within segments, therefore defining segments to avoid this is important in this phase of search planning.

Segments identified on the map need to be easily located by searchers in the field. Careful selection of segment boundaries is important to avoid gaps in the area searched or duplication of resources in the field. The segments most likely to contain the missing person for each of the most likely scenarios are then identified.

Apportion Segment POA

The relative probabilities of locating the subject are calculated for each segment using the proportional consensus method. Overall segment POA allocation is calculated that takes into account all scenarios but has been weighted by the likelihood of each scenario. This provides a description of the relative differences between segment POA.

Choices can then be made as to which segments to search first. These are based on the POA decisions made by consensus and the resources available to search. Search effort will be initially focused on high POA segments. Large areas of low probability cannot be excluded from the search area, so these will be identified, mapped and their POA recorded.

Check your recall of Search Area Determination

1. Describe one of the following four methods for estimating the search area in the extended planning stage of a search and rescue operation?
   - Theoretical area
   - Statistical area
   - Subjective area
   - Deductive reasoning

2. What are two (2) considerations that should be taken into account when determining theoretical search area?

3. Recent New Zealand studies have found that genuinely lost subjects are likely to travel ____ distances than the complete data set would suggest.

4. What proportion of subjects are found within a 300 metre radius of the IPP?
   a) 5%
   b) 25%
   c) 50%
   d) 75%

5. When determining a subjective search area, which of the following factors are valid considerations?
   a) intuition
   b) prior experience of planners
   c) the mental state of the lost person
   d) historical data
   e) terrain analysis

6. A _____ region is an area defined by geography or terrain. A _____ region is an area that relates to scenarios determined during scenario analysis, geographical features and lost person behaviour statistics.

7. In a situation where probability of area (POA) is being determined for multiple scenarios with similar plausibility, why would each scenario be weighted using the Combined Region POA Weighting Worksheet tool?

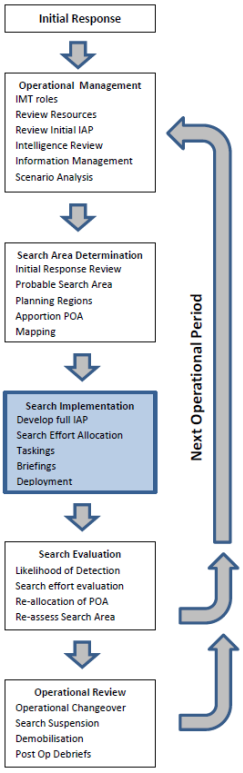
8. Dividing a planning region with the highest POA into smaller, searchable areas is known as _____.

Answers on the next page.

1. *Theoretical area:* The area identified by the distance the subject could have travelled from the initial planning point (IPP). Calculated as the time elapsed since the subject was missing multiplied by the speed over ground the subject is capable of..
   Statistical area: The area calculated from data derived from previous searches that identify distances travelled from the IPP by subjects of similar categories.
   Subjective area: The search area where SAR planners believe the subject they are searching for is most likely located given their own assessment and evaluation of the available information.
   Deductive reasoning: Consensus developed scenarios based on gathered facts and circumstantial evidence are used to determine a probable outcome. A hypothesis is developed, tested through team taskings, and evaluated for validity. The process is then revised and repeated.
2. • The subject's capabilities – health, injury, mental state.
   • Time delays between the assumed and actual elapsed time – may result in over- or under-estimating the distance travelled.
   • Terrain – which influences speed over ground.
   • Transport – different or multiple modes of transport may have been used.
   • Lost person strategies – subjects that become disorientated may employ one of a number of methods to find something familiar and become 'unlost'.
   • Assumptions about direction and/or route of travel.
3. Greater/longer.
4. B: 25%
5. All are correct / should be selected.
6. Planning. Probability.
7. To allocate a probability of area/likelihood for each scenario.
8. Segmentation.

Search Implementation

Search operations that progress beyond the initial response phase require well developed and structured search planning and implementation. A SAR readiness plan can streamline and expedite the deployment of resources into the field in the initial response phase. It can also form a good basis of information to feed into an extended, multi-period incident action plan.



SAR Incident Action Plan (multi-period)

The Incident Action Plan is a document that describes how the response to a search will be managed and how response agencies will integrate their activities to achieve the response objectives (New Zealand Government, 2014).

In response to a search, an initial action plan will focus on immediate lifesaving activities, mobilisation of response assets and information collection (New Zealand Government, 2014). Therefore, the planning document (**NZSAR Incident Action Plan – Initial Response**) is based on short timeframes contingent on the action planning process. In the case of a land search, it may focus on responses such as hasty teams, containment and the completion of a comprehensive missing person summary.

In order to implement an extended search, a comprehensive **NZSAR Incident Action Plan (multi-period)** is required. This plan has the same format as the NZSAR Incident Action Plan (initial response), however it is more comprehensive in terms of timeframes and specified operational periods and detail.


NZSAR

Operation name: Time:

Prepared by: Date:

Operational Period

From: To:

SAR INCIDENT ACTION PLAN (MULTI PERIOD)

The items checked below are included in this Incident Action Plan

☐	Situation Report	Plan/Intel
☐	Missing Person Summary	Plan/Intel
☐	Incident Objectives	IMT
☐	Incident Management Team	IC
☐	Sector Assignment/s	Ops
☐	Safety Plan	IC
☐	Medical Plan	Logs
☐	Communications Plan	Logs
☐	Weather Forecast *(print and attach)*	Plan/Intel
☐		
☐		
☐		
☐		
☐		
☐		

In the following sections each component of the SAR Incident Action Plan (multi-period) is discussed. Each section is the responsibility of one part of the IMT team, this is shown on the right of the first page.

Situation Report

A. Situation

This is a statement of what has happened. The situation report should draw together any facts or conditions that may be relevant to the missing person, their specific situation and the particular circumstances around their disappearance.

B. Action taken by responders

This section needs to consider two very basic questions;

- What is happening?
- What has happened?

The results of the initial search effort, or previous operational period, are the key considerations that inform the development of the IAP. This may include clues found, scenario(s) and probability of area (regions and segments) and team debried information. These are the actions taken by the responders.

The actions are usually collated using the IAP (initial response) and log of actions. These actions can also be represented on a map with markers showing location of clues found, containment sites and areas (segments) searched by field teams. Each subsequent IAP (multi-period) will build on the previous one(s).

C. Factors impacting on planning

These may include aspects such as;

- mobility
- levels of response
- detectability
- survivability
- LPB
- weather
- terrain
- resources
- timeframes

D. Contingencies and long term planning

This relates to how the incident may develop and is often referred to as 'predicted incident development'.

Missing Person Summary

This section collates information regarding the subject profile. This process is continuous and it is important to be continually gathering and investigating the subject - 'dig deep'!

A subject profile should be as comprehensive as possible. It will include basic information about the physical appearance of the missing person, their general state of health, disposition and their normal patterns of behaviour. It will include details of the subject's health status and state of mind in the immediate lead up to their disappearance.

Consider the following questions as the subject profile is developed; Is the person likely to be aware that they have been reported missing and that a search has been initiated? Do they wish to be found? How has this person responded to their previous experiences?

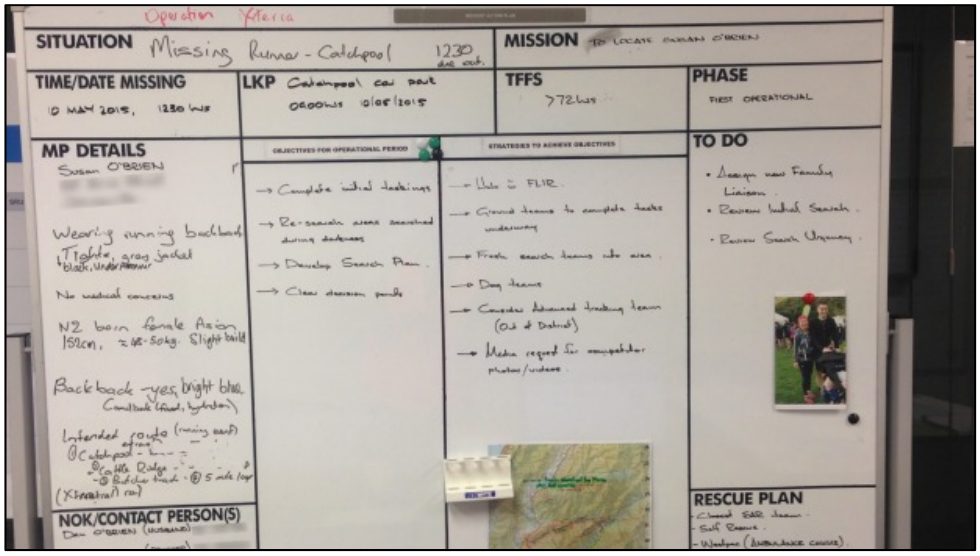
Building a detailed picture of the likely thought process and behaviours of the missing person is critical to the process of developing appropriate scenarios. Scenarios are constructed around the question of 'What may have happened?' as well as 'If this did happen to this particular subject, what would they do?' The Missing Person Summary is continually added to as the search process is executed and further information and clues are sought, found and recorded.

Incident Objectives

This section summarises those tactical decisions that have been made in order to meet the operational objectives. The objectives describe how the goal (or aim) of the IAP will be met.

Goal

Asks why are we here and what is the desired outcome for the operation. It is a clear statement of intent, which in most cases for Land SAR is always 'to find the missing subject'.



Objectives

Incident objectives ask the question, 'What do we want to achieve in this operational period?' Incident objectives should be SMART. That is;

- **S**pecific for the operational period,
- **M**easurable within the a specific time period,
- **A**chievable and
- **R**ealistic to the goal,
- **T**ime related

An example of this might be to search all segments in planning region 'A' by 18:00 hours.

Strategies

This is where the methods and options for achieving the outlined objectives are described and will help to determine, or prioritise, taskings (assignments). When planning strategies there is a need to consider;

- Determining the area/s of highest POA within the search area (regions or segments) in order to deploy resources and attain a high probability of success (POS)
- Search effort allocation to maximise POS
- Use of binary search method as a means of reducing the size of the search area, therefore maximising POS.

Examples of different strategies could be to use a quad bike to search the beach or have a leaflet drop along the roadside.

Incident Management Team

The incident management team assist the Incident Controller by providing advice, specialist knowledge and handling detailed work (New Zealand Government, 2014). The CIMS functions are outlined in this section. In developing the IMT, careful consideration should be given to individuals prior experiences and dispositions for Land SAR in order to develop an effective, well-rehearsed team.

Once an IMT is established a lot of activity ensues relatively quickly. The body of information is constantly increasing as is the number of people and resources involved. The CIMS principle of a 'Manageable Span of Control' comes into play in this dynamic expanding environment. Failure to regularly review the span of control

each of the leaders in the IMT have can quickly result in a lack of control and, ultimately, reduce the effectiveness of the search planning effort.

Search success is influenced by how well the IC and key leaders maintain a clear vision of the progress and developments within the various groups. Structured meetings and reporting are one means to achieve this, however these tools are best not used alone. Incident management effectiveness can be improved by deliberate unstructured interaction.

Management By Walking Around (MBWA) is a management tool that is particularly useful in the IMT environment. This involves leaders wandering at random, in an unstructured manner, through the IMT, to establish the current status of ongoing work. This type of interaction is known to have a positive influence on morale and team engagement which in turn drives productivity and alignment in the team purpose and objectives – particularly in the context of maintaining situational awareness.

The great leader Abraham Lincoln employed the MBWA technique by informally inspecting the Union Army troops in the early part of the American Civil War.

Sector Assignments

The NZSAR multi-period IAP includes sector assignments. When sectors are created, the taskings for those sectors will develop from each sector assignment with the taskings being managed by a Sector Supervisor.

Sectors can be determined in a number of different ways, for example;

- by **geography**, particularly for a large search area
- by **terrain** e.g. bush or alpine
- by **capability** e.g. field team v Alpine Cliff Rescue
- by **agency** e.g. sea / land / air (Coastguard, LandSAR, USAR, Police, Rescue Helicopter)
- by **activity** e.g. following the Canterbury earthquake sector assignments were for specific activities such as cordons, checking buildings, searching, rescue
- by **task** e.g. police divers, cavers, dealing with concerned friends or family

The response may be sectorised by environment (e.g. marine, land, air etc), by agency capability (e.g. Coastguard, CAP, LandSAR etc).

Safety Plan

All SAR missions involve some degree of risk. During an extended search the Incident Controller (IC) has responsibility for the overall safety of the incident. This will include maintaining a situational awareness of the whole incident and developing measures to ensure the safety of all personnel involved at all times. A safety advisor should be appointed to maintain the priority of safety objectives as the operation develops.

Taskings are recorded or logged using the NZSAR Combined Team Tasking and Field Safety Assessment Form.

Operational risks are those risks that will cause harm to an individual during a SAR incident. Risk management is a systematic way of identifying, assessing, treating and monitoring these risks. Operational risks may include;

- meteorological hazards – weather phenomena (snow, heavy rain, high winds, heat)
- terrain hazards – landforms, powerlines, rivers
- physical hazards – machinery (helicopters, vehicles), search dogs, other people in area
- human hazards – training, experience, physical and mental state (e.g. hunger, thirst, fatigue, anxiety, confusion, cognitive tiredness)

Each search team has a responsibility to ensure any risk they are exposed to is managed and should follow their established risk assessment procedures and manage risks according to their own agency specific policies.

Risk Management – Health and Safety

A meeting of the New Zealand Search and Rescue Strategic Occupational Health and Safety Committee Meeting was held on Thursday 21 August, 2014. At this meeting there were representatives from nine

LandSAR have a Safety Management System (SMS) that covers safety management for training, SAREX, operational and other activities of LandSAR volunteers and staff.

different sector agencies and Worksafe NZ. The focus of this group was to explore Health and Safety as it relates to Search and Rescue operations. Some key ideas were developed and these included;

- the acknowledgement by Worksafe NZ that in terms of a SAR operation there is no expectation that all risk can be eliminated
- the sector acknowledges that, during SAR operations, it is important to evaluate individual health and safety plans to ensure they are adequate and fit for purpose
- opportunities for further training such as case studies should be used where possible to ensure that they meet required standards
- the need to emphasise the importance of agency collaboration and cohesion during a given search in order to ensure workplace health and safety responsibilities are adhered to
- people completing tasks in the field should be adequately prepared for any health and safety risk, and the role of the IMT from initial reporting of emergency calls to taskings should include clear understanding of risk factors and assessment that can form the basis of the Safety Plan.

Health and Safety in an IMT is overseen by the IC. The Safety Advisor has a key role in identifying hazards and recommending appropriate mitigating steps.

Within the IMT one person will be tasked with the role of Safety Advisor. This may be the IC themselves, or someone else tasked by the IC. The role of the Safety Advisor is to ensure;

- risks to personnel (accidents, injuries or losses) are identified and reviewed
- review the causal or contributing factors to health and safety or hazards (people, equipment or environment)
- to review risk management strategies (eliminate, isolate or minimise) by IMT and teams.

Rescue Plan

In developing a rescue plan, consideration should be given to the four phases (identified by the acronym LAST);

Locate	Find the subject
Access	Consider how to get to the subject's location. What are the issues? Are there safety risks?
Stabilise	Consider how to identify real injuries as well as potential (preventable) ones.
Transport	How to recover the subject? What are the potential hazards? Identify routes prior to transportation – plan ahead.

Consideration should be taken regarding the safety and welfare of the rescuers and a plan put in place should the need arise to evacuate them. It is important when planning a rescue that emergency procedures are reviewed should things go wrong.

Medical Plan

The medical plan will consider the availability of services, the need for technical expertise or type of service required, and the transport of subject and medical personnel. It is also important to consider the needs of the searchers.

Search Implementation
Search Implementation

Effort Allocation and Probability Density

The IMT objective is to focus resources on the segments of higher POA. Probability of Detection (POD) is defined as 'the chance that a clue or the missing person will be, or would have been detected (*in retrospect*) by a search action'. POD refers to a measure of performance or sensor effectiveness and is typically expressed as a percentage (%). Search effectiveness (POD) is then used to inform search management decisions in order to increase POA. These may include decisions around where to search next, what resources to deploy or when to suspend the search operation.

In recent times there has shift towards using effort allocation and POD in terms of probability rather than percentage values. This in turn affects how POS is arrived at.

In a 2015 report by the Training and Development Manager of LandSAR, Pete Corbett explained some of the reasons why the NZ Police decided to dispense with POD(%) as a means of expressing search effort, instead using Likelihood of Detection (LOD). The driving force behind this decision was to try to simplify the process, removing the complex mathematics, and acknowledging the role of the intuitive decision making process.

The role of the IMT is to focus on ensuring the area to be searched is covered effectively and that resources are chosen and suitably deployed to ensure the maximum possible detection. This means considering how to apply the available resources (effort allocation) and where to apply them (probability density) within a given search area.

Effort Allocation

Effort allocation is defined as the effort required to search a given area. This is determined by the number of resources used and how the resources search the area. This will be influenced by the complexity of the search area or the detectability of the subject.

Effort allocation means that there are a number of variables that can be manipulated to accomplish the tasks in a rapid, efficient manner to bring about success in the shortest time. It is important to;

- Identify and determine the availability of resources, including those available from the wider area. Then consider what are the most appropriate, available resources to conduct the search
- Optimise resource allocation so that resources are assigned to maximise the chances of finding the subject in the least amount of time
- Define clear strategies that utilise the available resources most efficiently. In order to do this resources must be clearly prioritised and allocated.
  - consider the length of time resources are available
  - the length and complexity of the search
  - seek authorisation for assets (i.e. RCC asset number)
  - consider the search health and safety plan as this may impact on resource use

Probability Density

Probability density is determined by considering the ratio between the POA of a given area and the size of that area.

Probability density is determined by considering the ratio between the POA of a given area and the size of that area**.** It is the ratio of segment POA to its size. If POA is high and area searched is small then probability density will be high. When

planning a search, consideration should be given to the size of the area and the POA for that area as this will influence resources allocation, tasking priority and transport requirements.

Tasking

Once the SAR Incident Action Plan (IAP) has been completed the next step is the implementation of the assignments in order to achieve the goals of the operation.

Note that 'assignments' is interchangeable with the word 'taskings'.

Team taskings are developed and recorded using the **NZSAR Combined Team Tasking and Field Safety Assessment** form. Alternatively SARNET (web conferencing software administered by NZSAR for this purpose) may be used to record and pass on taskings in the form of a PDF attachment. Key information recorded on the form includes;

1. Details of the search area (or segment)
2. Tasking assignment (including the required search method)
3. Decision points
4. Hazards
5. Communications
6. Previous searches in the area.

Refer to 'Take-Five'-safety-briefing-form-for-field-teams on LandSAR's website.

An updated **NZSAR Missing Person Summary** form should be included with the NZSAR Combined Team Tasking and Field Safety Assessment form. The field safety assessment and safety briefing is identified on the form, ensuring consideration is given to providing the field teams with a safety plan as identified in the IAP. The LandSAR 'Take Five - safety briefing form for field teams' can also be used by the team leader as a guide for structuring team safety assessments for taskings and safety briefings.



It is important to remember that although taskings have been carefully planned in relation to the search objectives and strategies, it is important to allow search teams discretion in the field as to how the taskings are conducted. Often decisions around implementation in the field will be made by the team leaders and will be dictated by the terrain and environment at that time. There will be opportunity for team leaders to update the IMT regarding evaluation of search effort during debriefing.

Briefings

Briefings give the direction, instructions and orientation to performing any action in the search effort. It brings managers together with those in the team and allows for a face-to-face discussion so that information can be delivered, questions asked and feedback on decisions collected. The goal of a team briefing is to ensure a shared understanding of the goal, situation, mission, execution (including safety and risk assessment), administration, command and communication.

Briefings will happen at different levels within the IMT, between CIMS function managers, team leaders, sector supervisors and other agencies. There is some discretion as to how the briefings should occur - in most cases the Operations section manager will brief the team leaders and then the team leaders will brief their teams.

The **GSMEAC** briefing is a format that is widely used and ensures all essential details are covered in logical sequence during the briefing (NZSAR, 2014).

Ground

Setting the scene. This is a 'big picture' orientation or the 'where did it happen' element.

Situation

Contains accurate information about what has happened, what the situation is now and why the team is involved.

Mission

This is the objective of the team in order to achieve the goal.

Execution

This is the strategy aspect of GOSA. It provides detailed information about how the mission will be accomplished and details the who, what, how, when, and where of the task to be carried out by the team. This section will also include safety information and any risk assessment details.

Administration

Information regarding logistics, i.e. resources required and record keeping.

Command and Communications

Who is in charge of what and whom, their location and how everyone is going to communicate with each other.

A conclusion or summary at the end is useful to reinforce key points. At the end of the briefing ensure that you ask if there are any questions from the group. You need to ensure that the briefing has been understood, so ask the group questions (these will be appropriate to the roles within the group) to check they have understood the briefing.

Deployment

At an IMT level, deployment of teams in the field requires **resource tracking** and **status monitoring**.

Resource tracking will note;

- Identify and determine the availability of resources, including those the resources that have been requested
- their ETA
- when they arrive
- which section they have been assigned
- when they have been stood down or left the operation.

Typically T cards are used for resource tracking. Status monitoring will require a whiteboard or sheet that notes each teams assigned area, segment, task, time

deployed, when 'on task', location at each sked and any other relevant information such as progress, condition of team and clues found.

Check your recall of Search Implementation

1. In what situation would a NZSAR Incident Action Plan (multi-period) be required?

2. Within an Incident Action Plan, a situation report will examine which of the following factors?
   a) What has happened (past)
   b) What is happening (present)
   c) What may happen (future)

3. Incident objectives should be S_____, M_____, A_____, R_____ and T_____.

4. Using the acronym LAST, what are the four phases of a rescue plan?

5. What is being described?
   The effort required to search a given area in terms of resource requirements, the complexity of the search area and the detectability of the subject. Can be used to optimise resource allocation and define search strategies.

6. The ratio between the POA of a given area and the size of that area is known as _____ density.

7. The implementation [or allocation?] of team assignments from within an IAP in order to achieve operational goals is known as _____.

8. What is the main benefit of a GSMEAC briefing format?

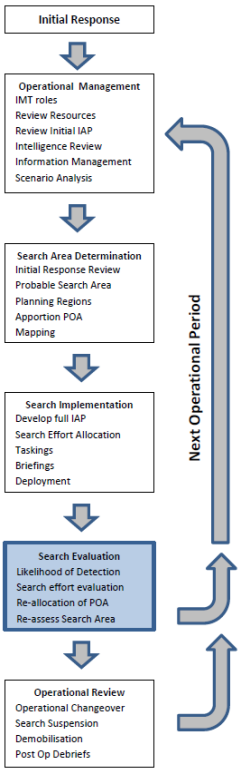
9. What are T-cards used for in the context of a search operation?

10. What are three (3) pieces of information used for monitoring the status of tracking teams?

Answers on the next page.

1. When implementing an extended search.
2. All are correct / should be selected.
3. Specific, Measurable, Achievable, Realistic and Time related.
4. Locate – find the subject.
   Access – how to get to the subject.
   Stabilise – identifying injuries.
   Transport – how to recover the subject.
5. The concept of effort allocation with regards to an IAP.
6. Probability.
7. Tasking.
8. Ensures all essential details are covered in logical sequence during a briefing.
9. Resource tracking.
10. Assigned area, segment, task, time deployed, when 'on task', location at each 'sked' and any other relevant information such as progress, condition of team and clues found.

Search Evaluation / Debrief



Likelihood of Detection

Search effort evaluation (SEE) is determined using a simplified scale of Likelihood of Detection ratings. The scale consists of four levels (high, medium, low or 'not searched') for each component part of the search area or segment. Using likelihood of detection ratings provides greater opportunity to identify and evaluate sub areas within the total search area. The process of determining the likelihood of detection rating includes the opportunity to provide a rationale for assigning the various ratings.

SAR Team Debrief

The form used during debriefing and allocation of SEE is called the **NZSAR Team Debrief** form. The format of the document encourages the use of 'free recall' – an investigative interviewing technique that promotes more complete, accurate and reliable information to be obtained. During the debrief, there is a stronger emphasis on those factors affecting detectability and coverage.

The form contains a number of key areas that should be used as prompts, or guidelines, for the debrief. These are;

- Search effort
- Techniques
- Detectability
- Clues
- Personnel factors (team effectiveness)
- Issues identified

The role of debriefer is important as they are required to gather information in order to make comment or recommendations regarding the search effort. The debriefer could be the sector leader or the Operations Manager, but should be an experienced field team member or leader with investigative interviewing training. Evaluation of likelihood of detection will be determined by the field team.

Prior to the debrief it is important to collate all necessary information that could support the determination of detectability and coverage. This should include GPS tracks (the map can be printed for the debrief) to confirm that the team was searching in the right area. This will also help identify any gaps in coverage.

Photos taken on the ground during the search can be downloaded, shared or printed. These images will allow a better estimation of visual sweep widths. They will also help the IMT managers and other intelligence personnel understand, or interpret, the teams likelihood of detection for the areas searched.

At the end of the debrief, the debriefer comments on the effectiveness of the search effort, summarises the more pertinent information such as gaps in coverage and makes recommendations for future search planning. This document is then checked by the Operations, Planning and Intelligence Managers. Consider how to present the information gathered from the SEE for each search segment.

Search Evaluation/Debrief
Analysis of Search Effort Evaluation (SEE)

Using the information gathered from the SAR Team Debrief, search planners can go through a process of POA reallocation. New information and a review of current information from previous search efforts, clues found, investigation, scenario analysis and subject profiling is vital in this process. It is important that everyone involved in the POA allocation (proportional consensus) has access to all of the same information and data.

It is important to realise that using Search Effort Evaluation (expressed as high, med, low or not searched) can influence the consensus weightings that will subsequently be used to calculate POA for segments based on different scenarios. A high search effort evaluation in an area without finding the subject may influence an individual's weighting when deciding which segment has highest likelihood for any one scenario. Some may assume a high search effort means it is now unlikely that the subject will be found there. However, others may say that it has the same probability, but planners will need to increase detection to increase likelihood of locating the subject.

Scenarios should be reviewed and a new scenario analysis conducted, based on the latest information and search effort evaluation data. POA can then be recalculated for region or segments based on the revised scenarios. Reanalysis of all available data may also indicate a need to expand or make changes to the search area, including the segmentation of another unsegmented region - in which case the above applies and the POA is recalculated.

Clues can be displayed on Clue Boards to provide up to date intelligence for all involved with search planning.

Successful adaptive search planning depends on properly accounting for clues found during the search. The significance and relevance of clues will need to be determined firstly by the debriefer and ultimately by the search planning team. Clues will provide evidence to prove or disprove scenarios and therefore they will ultimately affect the search plan and POA values for the next operational period. All clues found will need to be corroborated to avoid clue lock, where a major change in the search effort is not based on uncorroborated evidence.

Check your recall of Search Evaluation/ Debrief

1. Name one (1) purpose of the SAR Team Debrief process.

2. Briefly explain how the use of Search Effort Evaluation (SEE) might influence the consensus weightings (POA) assigned to different scenarios by search planners.

3. What is the missing word?
_____ awareness is crucial for ensuring that the IMT successfully manages the search response, planning and operational execution.

4. What is the missing word?
The _____ must be consulted prior to the termination or suspension of a search where it is believed that a person is likely deceased.

5. The missing word is?
The purpose of _____ is to ensure that personnel and resources are safely returned to their point of origin, and requires management decision making and careful planning.
   a) Debriefing
   b) Departure
   c) Demobilisation
   d) Reallocation
   e) Replacement.

6. What is being described in this statement?
'An individual's normal response to an abnormal situation'.

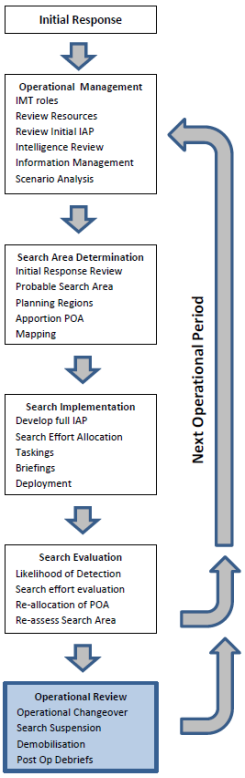
7. Name one (1) purpose of a post-operational debrief.

Answers on the next page.

1. • To obtain and share information from field teams.
   • Allow planners to evaluate search effort, techniques, detectability, clues, personal factors such as team effectiveness, and to raise any issues.
   • To identify gaps in coverage and make recommendations for future search planning.
   • To allocate search effort evaluation (SEE) / likelihood of detection ratings to search areas/segments.
   • To allow evaluation of scenarios.
   • To facilitate the reallocation of POA.
2. If SEE for a particular area/segment is high, but with no evidence or clues, search planners may reduce the weighting given to particular scenarios as they are seen as less plausible, but increase the weightings given to other scenarios.
3. Situational.
4. Coroner.
5. (c) Demobilisation.
6. Critical incident stress.
7. a) To develop, discuss and disseminate an overall picture of the SAR operation.
   b) Identify lessons learnt
   c) Identify and/or assign actions to be taken
   d) Build a data set for lost person behaviour
   e) Contribute to future training opportunities.

Operational Review

Operational Changeover / Search Suspension



Operational changeovers are a major factor in incident management effectiveness and efficiency (New Zealand Government, 2014). The changeover needs to be structured, managed and phased to ensure continuity of the IMT team and the search operation.

In order to be successful in managing the search response, planning and operational execution, it is imperative that the IMT maintains situational awareness - a predominant requirement for making decisions and taking action (DeGeorge, 2012). A key element required to accomplish situational awareness is the development of a rich knowledge base. This is derived from the accumulation of previous information, generation of new information and sharing of personal interpretations of that information (also called tacit knowledge).

Incoming personnel should be briefed by the personnel they are replacing. Outgoing personnel should not need leave until they have briefed their replacements. The responsibilities for the incoming and outgoing personnel are summarised below (New Zealand Government, 2014, p23);

Outgoing personnel	Incoming personnel
Set changeover time and locations, and inform incoming team	Receive briefing
Brief subordinate personnel	Manage changeover of subordinates
Brief replacement	Ensure Action Plan is understood
Leave	Plan the next changeover

It is important to set times for operational periods early in the operation so that changeovers can be scheduled, resource needs can be reviewed, and resource availability can be checked. Prior to a changeover all documentation needs to reviewed, completed and filed with Intelligence (or the Administration Unit under Logistics) by the current IMT.

The IAP must be created for the next operational period so the incoming team has a plan to work to. Their role is to plan for the following operational period, not the one they are walking into. The information contained in the IAP must be detailed enough to be understood, so that the intentions (objectives) of the outgoing IMT team can be followed.

Search Suspension

The final decision regarding search suspension rests with the coordinating authority.

During extended search operations if the subject has not been located, the IMT will be faced with the decision of either using a limited continuous search, scaling down the search or suspending the search.

Search suspension is one of the most difficult decisions to be made during a search operation and there are factors to consider prior to following this course of action;

- *Search Effort Evaluation.* Segments or regions have been allocated high likelihood of detection and therefore the likelihood POA of the subject being in the search area is low. This also includes a thorough analysis of available evidence, clues and information.
- *Searcher safety.* This is of paramount concern and if conditions in the field are deteriorating a decision to suspend the search may be needed.
- *Resource availability*. Will determine the extent of searching or the scaling back of the search.
- *Consultation.* Discussions with family, medical experts and coroner can be an important aspect of the decision process.

Terminating or suspending a SAROP

When all avenues of SAR investigation and search have been exhausted and the missing person has not been found, the IC, having consulted with the IMT and specialist advisors (as to factors such as person profile, likely behaviours, survivability, risk to searchers) may recommend terminating or suspending a search.

All aspects of the SAR investigation and operation must be documented and collated by the IC. This must then be peer-reviewed by a Police SAR Coordinator not involved in the SAROP. The Police SAR Coordinator may establish an IMT to assist in this review and may include external expert advice, such as the RCCNZ.

The Coroner must be consulted prior to the termination or suspension of a search where it is believed that a person is likely deceased.

Operational Review
Demobilisation

Planning

Effective demobilisation requires careful planning and will follow termination or search suspension. Although the process of demobilisation will be different for each of these situations, there are a number of key aspects that should be considered. It is important that resources are accurately managed, i.e. personnel and equipment should be logged and tracked throughout the search operation. The purpose of demobilisation is to ensure that personnel and resources are safely returned to their point of origin. This will require management decision making and careful planning.

When developing a demobilisation plan the following need to be carefully considered;

- Release priorities
  - who or what goes first. Consideration of searcher welfare is paramount, who are the most vulnerable? What are the logistics required?
- Release procedures
  - consider how to get resources out of the field safely. Refer to combined team tasking field safety assessment.
  - staff welfare issues including food, shower, dry clothes and sleep if necessary before driving off.
  - ensure communication is maintained until the demobilisation plan has been completed.
- Debrief
  - ensure all documentation has been completed and submitted i.e. hazard identification, incident/accident reports etc
  - information collation, including download of GPS tracks and photographs
  - consider conducting a 'hot debrief' of actions taken and record lessons learnt
- Return
  - all equipment e.g. GPS, radios, spare batteries
- Sign-out procedures
  - ensure all personnel are accounted for

Critical Incident Stress

Critical Incident Stress

It is important to realise that every mission has elements of stress associated with it and that this general stress is normal and can be managed. Stoffel (2006) identifies two categories of stress that can impact on the search operation, *normal* response and *abnormal or disruptive* response. Within the *normal* response category two types of stress can be identified, general stress and critical incident stress.

Critical incident stress is an individual's normal response to an abnormal situation. In order to manage searcher or personnel welfare it is very important that leaders and managers are aware of and responsive to the signs and symptoms of critical incident stress.

These symptoms can manifest themselves within the physical, cognitive, emotional and behavioural dimensions and, although often considered normal responses, can become dangerous if the symptoms persist for prolonged periods of time.

"Critical incidents put a great strain on the coping ability of those involved or in some way associated. The reactions experienced by individuals are typical stress reactions, more often than not labelled normal reactions to an abnormal event" (Australian Government, 2004).

Some general guidance to being aware of and ultimately managing critical incident stress (CIS) are:

Signs and symptoms

"Symptoms associated with excessive acute or sustained stress may include cognitive impairments such as diminished memory, decision-making capacity, and attention span; emotional reactions such as anger, irritability, guilt, fear, paranoia, and depression; and physical problems ranging from fatigue, dizziness, migraine headaches, and high blood pressure to diabetes and cancer. Self-destructive and antisocial behavior may also be triggered. Symptoms can vary depending on social factors, such as trauma severity, amount of social support, and additional life stresses."
http://en.wikipedia.org/wiki/Incident_stress)

There are numerous resources that can be referenced that can provide clear information regarding signs and symptoms of critical incident stress including material from EAP services, the Police CIS brochure (Trauma Policy) and NZ LandSAR Fieldguide 2010.

Management

Critical incident stress management is a specialised area. Team leaders, managers and searchers should be aware of tactics and strategies that can be employed to control or manage search stress. This can be achieved through specific training.

CIS debriefing

Following a mission, Critical Incident Stress Debriefing (CISD) as an intervention should be offered as part of a programme of critical incident stress management that is integrated and sensitive to the organisation. This may be achieved by using specific support agencies that offer employee assistance programmes (EAP services) or highly trained CISD teams.

Documentation

It is the responsibility and obligation of the Incident Controller to ensure detailed records are kept throughout the operation. This function may in turn fall to the Intelligence Manager to collate all documentation at a centrally accessible point using a standardised filing process (or during a large operation the Administration Unit would do this). All documentation must be retained because a coronial inquiry or a Police investigation may follow the search operation. This documentation may be used in evidence during these investigations.

Post-Operation Debriefs

Quality debriefs are an important part of any SAR operation and are an established tool in the continual upgrading and improvement of the SAR response. The time and the place of the debrief should be selected to maximise the value of the exercise.

Operational debriefs should be conducted within 21 days to ensure that relevant information is recalled and recorded.

It is important to develop, discuss and disseminate an overall picture of the SAR operation. This includes any lessons learnt and actions to be taken identified and assigned to the relevant person. It may be prudent to appoint an independent chairperson with SAR knowledge to run the debrief, particularly if aspects of the search did not go well.

Operational debriefs may exclude the subject and / or the next of kin as the focus is around the search effort, not what the subject did or didn't do. The subject and next of kin should be debriefed separately, in particular to gather information around actions they took and why. This information is critical for building a comprehensive data set for lost person behaviour. Consideration should be given to selecting an appropriate person to conduct the interview.

All findings should be circulated to all the relevant personnel so that mistakes are not repeated in the future and the lessons learnt can be used in future training opportunities.

References / Further Reading

Australian Government. (2004). Urban Search and Rescue, Capability Guidelines for Structural Collapse Response. Canberra, Australia: Emergency Management Australia. Retrieved from https://www.em.gov.au/Documents/Manual16-USARCapabilityGuidelinesforStructuralCollapseResponse.pdf

DeGeorge, A. (2012). *Observing the loss of Situational Awareness and Tacit Knowledge during personnel change-over in a U.S. Coast Guard command and control environment*. Retrieved from http://www.dtic.mil/dtic/tr/fulltext/u2/a567647.pdf

Gibb, G., & Woolnough, P. (2007). *Missing Persons. Understanding, Planning, Responding.* Aberdeen, Scotland: Grampian Police Force Headquarters. Retrieved from http://www.searchresearch.org.uk/downloads/ukmpbs/GGIbb_missing_person_report.pdf

Koester, R. (2008). *Lost Person Behaviour.* Charlottesville, VA: dbS Productions LLC

Mountain Safety Council. (2011). *BushCraft Manual - Outdoor Skills for the NZ Bush (5th edition).* Wellington, New Zealand: Mountain Safety Council

New Zealand Government. (2014). *The New Zealand Coordinated Incident Management System (2nd edition).* Wellington, New Zealand: New Zealand Government. Retrieved from http://www.civildefence.govt.nz/assets/Uploads/publications/CIMS-2nd-edition.pdf

NZSAR. (2014). *Land Search and Rescue Response Guidelines.* Wellington, New Zealand: NZSAR

NZSAR (2014). *Marine: Managing the Initial Response Course.* Wellington, New Zealand: NZSAR

Pack, M.J. (2012). Critical incident stress management: A review of the literature with implications for social work. *International Social Work, 56*(5), 608–627. doi: 10.1177/0020872811435371

Schreiber, S. & Allan, S. (2010). *Field Guide 2010*. Wellington, New Zealand: NZ Land Search and Rescue Inc. Retrieved from https://www.landsar.org.nz/wp-content/uploads/LandSAR-Field-Guide-2010.pdf

Stoffel, R. (2006). *The Textbook for Managing Land Search Operations*. Cashmere, WA: Emergency Response International, Inc.

Surowiecki, J. (2005, February). *The power and the danger of online crowds* [Audio podcast]. Retrieved from https://www.ted.com/talks/james_surowiecki_on_the_turning_point_for_social_media

The Royal Society of New Zealand. (2007). *Teacher Profiles (Barbara Adcock)*. Retrieved from http://www.royalsociety.org.nz/teaching-learning/science-teaching-leadership-programme/profiles/2007-recipients/barbara-adcock/

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