SLCAP 2700

Civil Aviation Authority of Sri Lanka

SEARCH AND RESCUE MANUAL

First Edition 2010

Issued under the authority of the Director General of Civil Aviation

SEARCH AND RESCUE MANUAL

Control Number - 001

FORWARD

The prompt provision of Search and Rescue Services is paramount to the assistance rendered to persons in distress and the term Search and Rescue (SAR) refers to a process of searching for and providing rescue service to persons who are or are believed to be in imminent danger of losing their lives or limb. The two services conducted under Search and Rescue operation depend on the size and complexity of the mission and on the availability of staff and facilities. This does not include salvage or the saving of property.

The Search and Rescue function is a State's responsibility with respect to obligations that Sri Lanka has accepted under the Convention of International Civil Aviation. This manual serves as a standard reference document for use by all authorities and agencies involved in the search and rescue functions and provide guidelines on methods of coordination, procedures and techniques employed for conduct of Search and Rescue operations in Sri Lanka. It has been developed in accordance with the convention on international Civil Aviation (Annex-12) and guidance provided in the International Aeronautical and Maritime Search and Rescue (IAMSAR) Manuals Volume I, II, & III.

The primary purpose of this manual is to provide guidelines and does not preclude SAR personnel from taking initiative and using their discretion in providing SAR response in circumstances where these procedures are considered inadequate. However, in exercising that discretion, the SAR personnel's actions should comply as closely as possible with the instructions contained in the manual pertinent with the circumstances and keeping informed all the parties involved.

As no set of instructions can apply to every SAR situation, the manual may be interpreted for such situations as a guide line. The Rescue Co-ordination centre while developing its plans should ensure that the procedures are developed as far as practicable in accordance with the provisions in the manual.

This Manual has the approval of the Chairman, Board of Directors, of the CAA & the Director General of Civil Aviation & Chief Executive Officer.

Suggestion for improvement to the manual may be directed to:

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Civil Aviation Authority of Sri Lanka
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24th April 2018

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1. Table of Contents

INTRODUCTION

Search and Rescue Manual has been developed in pursuance to Civil Aviation Act No 15 of 1950 Part I, Para3, Sub Para (a) & Civil Aviation Act No 34 of 2002 Part II, Section 7, Rule (e) and (h). The primary purpose is to assist Sri Lanka in meeting the Search and Rescue (SAR) needs and the obligations accepted under the Convention on International Civil Aviation.

This Manual serves as a standard operational reference document for use by the Rescue Coordination Centre in the planning and execution of aeronautical and Maritime search and rescue operations primarily within the Sri Lankan Search and Rescue Region. The manual must be interpreted with sound judgment as no set of instructions apply to every search and rescue situation. Rescue Coordination Centre should however ensure the planning of search and rescue operations are not in conflict with this manual. The users of the manual should be adequately trained and competent to react to SAR requirements.

Glossary of Terms

1. Word meanings
   1.1 "shall" means a procedure is mandatory,
   1.2 "should" means a procedure is recommend,
   1.3 "may" means a procedure is optional,
   1.4 "will" means futurity, not a requirement for the application of a procedure,
   1.5 "SAR Personnel" mean any competent RCC personnel regardless of his/her official rank.

Definition

When the following terms are used in the SAR manual for search and rescue, they have the following meanings:

- **Alerting post.**
  Any facility intended to serve as an intermediary between a person reporting an emergency and a rescue coordination centre or rescue sub centre.

- **Alert phase.**
  A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

- **Distress phase.**
  A situation wherein there is a reasonable certainty that an aircraft and its occupants are threatened by grave and imminent danger and require immediate assistance.

- **Ditching.**
  The forced landing of an aircraft on water.

- **Emergency phase.**
  A generic term meaning, as the case may be, uncertainty phase, alert phase or distress phase.

- **Joint rescue coordination centre (JRCC).**
  A rescue coordination centre responsible for both aeronautical and maritime search and rescue operations.

- **Operator.**
  A person, organization or enterprise engaged in or offering to engage in an aircraft operation.

- **Pilot-in-command.**
  The pilot designated by the operator, or in the case of general aviation, the owner, as being in command and charged with the safe conduct of a flight.

- **Rescue.**
  An operation to retrieve persons in distress, provide for their initial medical or other needs, and deliver them to a place of safety.

- **Rescue coordination centre (RCC).**
  A unit responsible for promoting efficient organization of search and rescue services and for coordinating the conduct of search and rescue operations within a search and rescue region.

- **Rescue sub centre (RSC).**
  A unit subordinate to a rescue coordination centre, established to complement the latter according to particular provisions of the responsible authorities.

- **Search.**
  An operation normally coordinated by a rescue coordination centre or rescue subcentre using available personnel and facilities to locate persons in distress.

- **Search and rescue aircraft.**
  An aircraft provided with specialized equipment suitable for the efficient conduct of search and rescue missions.

- **Search and rescue facility.**
  Any mobile resource, including designated search and rescue units, used to conduct search and rescue operations.

- **Search and rescue service.**
  The performance of distress monitoring, communication, coordination and search and rescue functions, initial medical assistance or medical evacuation, through the use of public and private resources, including cooperating aircraft, vessels and other craft and installations.

- **Search and rescue region (SRR).**
  An area of defined dimensions, associated with a rescue coordination centre, within which search and rescue services are provided.

- **Search and rescue unit.**
  A mobile resource composed of trained personnel and provided with equipment suitable for the expeditious conduct of search and rescue operations.

- **State of Registry.**
  The State on whose register the aircraft is entered.

- **Uncertainty phase.**
  A situation wherein uncertainty exists as to the safety of an aircraft and its occupants.

- **Coordination.**
  The bringing together of organizations and elements to ensure effective search and rescue response. One SAR authority must always have Overall coordination responsibility and other organizations are to cooperate with this agency to produce the best response possible within available resources.

- **On-scene coordinator (OSC).**
  A person designated to coordinate search and rescue operations within a specified area.

- **Search and rescue**
  incident Any situation requiring notification and alerting of the SAR system and which may require SAR operations.

- **Search and rescue mission coordinator (SMC).**
  The suitably trained or qualified official temporarily assigned to coordinate a response to an actual or apparent distress situation.

- **Search and rescue stage.**
  Typical steps in the orderly progression of SAR missions. These are normally Awareness, Initial Action, Planning, Operations, and Mission Conclusion.

- **Possibility Area**
  The smallest areas containing all possible survivor or search object locations which it is physically possible for the aircraft to have reached.

- **Probability Area.**
  For a scenario, the probability area is the smallest area containing all possible survivor or search object locations which are consistent with the facts and assumptions used to form the scenario.

Abbreviations:

SAR	Search and Rescue
RCC	Rescue Coordination Centre
SRR	Search and Rescue Region
SRU	Search and Rescue Unit
SC	SAR Coordinator
SMC	SAR Mission Coordinator
RSC	Rescue Sub centre
INCERFA	Uncertainty Phase
ALERFA	Alert Phase
DETRESSFA	Distress Phase
ELT	Emergency Locator Transmitter
ELBA	Emergency Location Beacon
PLB	Personal Locator Beacon.
EPIRB	Emergency position indicating radio beacon.
JRCC	Joint Rescue Coordination Centre
LKP	Last Known Position
OSC	On Scene Commander
RU	Rescue Unit
SPOC	SAR Point of Contact
SOP	Standard Operating Procedure
DF	Direction Finding
ACC	Area Control Center
ATC	Air Traffic Control
ATSD	Air Traffic Service Department
ASD	Aviation Safety Department
IFR	Instrument Flight Rules
VFR	Visual Flight Rules
POB	Persons on Board
IAMSAR	International Aeronautical and Maritime Search and Rescue
INMCC	Indian Mission Control Centre
LUT	Local User Terminal
COSPAS SAR SAT	COSPASS Search & Rescue by Satellite Aided Tracking

1. Search and Rescue System

1.1. Organization and Arrangement

1.1.1. Global SAR System Organization

The International Civil Aviation Organization (ICAO) and the International Maritime Organization (IMO) Coordinate on a global basis.

1.1.2. National SAR system organization

1.1.2.1 Responsible Authority
Airport and Aviation Services (SL) Limited (AASL), under a ministerial directive have been vested in collaboration with the designated public, private, and military agencies the responsibility to ensure prompt and rapid aeronautical SAR services while Sri Lankan Navy has been entrusted the task for provision of maritime SAR services within Sri Lanka SRR. CAA SL shall ensure over sight and statutory obligations in conformity with national regulations and International commitments.

1.1.2.2 Search and Rescue (SAR) Coordination Committee
1.1.2.2.1 Background
In order to coordinate and resolve the problems which require attention of different ministries, local agencies and authorities taking part in the SAR organization, there is a need to have a high level "SAR Coordination Committee." It will comprise of representatives from respective organizations and will serve as the focal point for coordination and decision making.

1.1.2.2.2 SAR Coordination Committee

Civil Aviation Authority of Sri Lanka
Ministry of Transport & Civil Aviation
Airport & Aviation Services (SL) Ltd
SRI Lanka Air Force
Sri Lanka Navy
Merchant Shipping Secretariat
Sri Lanka Coast Guard
Disaster Management Centre
Department of Meteorology
Sri Lanka Army
Sri Lanka Police
Ministry of Health Services
Airline operators Committee
Ministry of Ports and Shipping
Ministry of Foreign Affairs
Ministry of Defence

1.1.2.2.3 Objectives
The establishment of the SAR Coordinating Committee is intended to accomplish the following:

a) provide the forum for promulgating a harmonized national SAR plan.

b) provide an interface with other national, regional, and international organizations involved with the provision of emergency services;

c) promote close co-operation and coordination between civilian and military authorities and organizations for the provision of effective SAR services;

d) ensure SAR standards are maintained and harmonization between Aeronautical & Maritime SAR Systems.

e) determine other ways to enhance the overall effectiveness and efficiency of SAR services.

f) standardize SAR procedures, training and equipment where practicable,

The SAR Coordinating Committee will meet annually to review the SAR system.

(A) In the event of emergency, the SAR Coordinating Committee shall meet immediately to:

i) coordinate implementation of SAR plan
ii) review matters relating to the plan affecting more than one agency, including recommendations for plan revision or amendment;
iii) encourage national, local and private agencies to develop procedures and acquire equipment to enhance national capabilities for implementing the plan; and
iv) promote a coordinated acquisition and development of all national resources for SAR purposes.

(B) Representative from the effected airline shall be included in the sittings.

(C) The committee shall review the accident and incident, decide the course of action to be taken and provide guidance to the Rescue Coordination Centre, Ratmalana If Required

(D) The Committee's meeting will generally be conducted within the premises of Civil Aviation Authority of Sri Lanka. It will chaired by the Director General of Civil Aviation. When SAR operation is needed, the Rescue Coordination Centre is activated in accordance to the SAR Plan.

1.1.2.3 Address of the SAR Responsible Authority of the State

Director General Civil of Aviation
Civil Aviation Authority of Sri Lanka
No. 152/1, Minuwangoda road
Katunayake.
AFTN: VCCYAYX
Tel: +94 11 2257137 Fax: +94 11 2257154
Email: sldgca@sltnet.lk

1.1.2.4 Delineation of the Area of Responsibility
Search and Rescue Service will be provided within Colombo Flight Information Region which is also the Colombo Search and Rescue Region (VCCC SRR) as per the regional air navigation agreement. Rescue Coordination Centre (RCC) established at the Ratmalana aerodrome and shall be responsible for Aeronautical SAR while the RCC established at the Naval Headquarters shall be responsible for Maritime SAR.

1.1.2.4.1 Address of ARCC

1.1.2.4.1.1 Rescue Coordination Centre, Colombo
(aeronautical) Colombo Airport Ratmalana.
Tel: 2635106 Fax 2635106
AFTN VCCCYCYX,

1.1.2.4.2 Address of MRCC

Naval Headquarters
Colombo

1.1.2.5 Types of Services

Details of the Rescue Coordination Centre and related supporting rescue units are given in the Para1.48 under Search and Rescue Units. In addition, various other elements of the State Army, Police Department, Disaster Management and the Department of Fisheries are also available for SAR Missions, when required. The aeronautical and public telecommunication services shall be available for coordination to the SAR Organization.

All search aircraft and aircraft normally engaged in operating their own commercial flight which when required by RCC can be engaged in search operations. This information shall be made available to the RCC, who shall select the aircraft in coordination with the operators for carriage of survival equipment- mainly consisting of first aid, emergency rations, communication equipment's and blankets. Search aircraft shall be selected according to their capability. Once a probable detection area has been plotted Search aircraft shall be

allocated search areas. It must be understood that searches will generally commence at First light and terminate at Last light subject to endurance. The progress shall be provided to the DGCA through "SITREPS" (Situation Reports) to apprise the - SAR Coordination Committee for taking action as deemed appropriate.

1.1.2.6 The SAR System
The SAR system is an arrangement of components activated, as needed, to efficiently and effectively assist persons in distress.

1.1.2.6.1 Components of the SAR system
The SAR system has the following components:

A. **Organization**	The structure of the SAR process.
B. **Resources**	The personnel and equipment that undertake one or more stages of the SAR system.
C. **Communications**	The media through which early detection, alerting, control support, and coordination are maintained throughout the SAR system.
D. **Emergency Care**	Emergency medical treatment at the distress scene and life support enroute to a medical facility.
E. **Documentation**	The collection and analysis of SAR case information.

1.2. SAR system organization

1.2.1. Responsible Authority

The search and rescue service in Sri Lanka by law is the responsibility of the Civil Aviation Authority of Sri Lanka. By Power vested in Airport & Aviation Services Sri Lanka Ltd by the Hon Minister Of Ports & Aviation, together with agreements with the Sri Lanka Navy & Sri Lanka Air force the main recourse personal, shall be responsible for making the necessary facilities available for Search & Rescue. The Director General of Civil Aviation Sri Lanka is responsible for the overall coordination of the Search and Rescue Service for Aircraft Emergencies within the search and rescue region (SRR) of Sri Lanka .The main components for a Search required by the ARCC will be SRU's with competent crew. All recourses shall be at the disposal of the Search & Rescue Mission Coordinator in an Aeronautical Search.

All Maritime Rescue will be the responsibility of the Sri Lanka Navy by Powers given by the Director General of Merchant Shipping., conforming with requirements of SLOAS & IMO standards & in maintaining the MRCC in coordination with the Director General of Civil Aviation, All SRU's in this case shall be at the disposal of the Maritime SMC in charge of the search

Airport & Aviation Services Sri Lanka Ltd, shall man the ARCC & shall be fully responsible for its function on a 24 hour basis. While the Sri Lanka Navy Shall man the MRCC Sri Lanka. & shall be fully responsible for its operation & function on a 24 hour basis.

1.3. Components of the SAR System

The SAR system has the following components:

A. **Organization** The structure of the SAR process.

B. **Resources**-The personnel and equipment that undertake one or more stages of the SAR system.

C. Communications-The media through which early detection, alerting, control support, and coordination are maintained throughout the SAR system.

D. **Emergency Care**-Emergency medical treatment at the distress scene and life support en route to a medical facility.

E. **Documentation**-The collection and analysis of SAR case information.

1.4. SAR Stages

The designated SAR stages define the nature of SAR assistance provided at any particular time. A mission may not necessarily include each and every stage, or the stages may overlap. The major stages are:

A. Awareness- Knowledge by any person or agency that an emergency situation exist.

B. Initial Action- Preliminary action taken to alert SAR facilities and obtain amplifying information. This stage may include evaluation and classification of the information, alerting of Relevant SRU'S, Preliminary communication checks (PRECOM), extended communication checks (EXCOM), and in urgent cases, immediate action from other stages. Checks of Intercom (INTERCOM)

C. Planning- The development of operational plans, including plans for search, rescue, and final delivery. This planning will vary if a maritime search is involved.

D. Plan Execution Search Area Allocations according to the requirement & Sending SRUs to the scene, conducting searches, rescuing survivors, assisting distressed aircraft, providing necessary emergency care for survivors, and delivering casualties to medical facilities.

E. Mission Conclusion Return of SRU's to a location where they are finally debriefed, refueled, replenished, re manned, and prepared for other missions, and completion of documentation of the SAR mission by all SAR facilities. This facility may take several days at the end of which when **beyond reasonable doubt** there are no more survivors to be found or and or further search is futile the SMC will notify the coordinating committee to terminate the Search. This in turn is conveyed to the DGCA who will call off the search. It must be emphasized that a massive quantum of work exists between D) & E)

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1.6.

Function	Authority Responsible
Coordination of overall SAR Operation	Director General CAASL
Provision of SAR Services	Head of SAR Ops (AASL) (SAR MISSION COORDINATOR)
SAR Coordinating Committee	Representatives according to Para. 1.1.2.2.2. Of Chapter 1.
ARCC Chief	Senior Manager SAR 7 Safety
Activation of SAR Units	Officers In charge of the rescue unit at SLAF Bases/ SLN Bases

1.7. SAR System

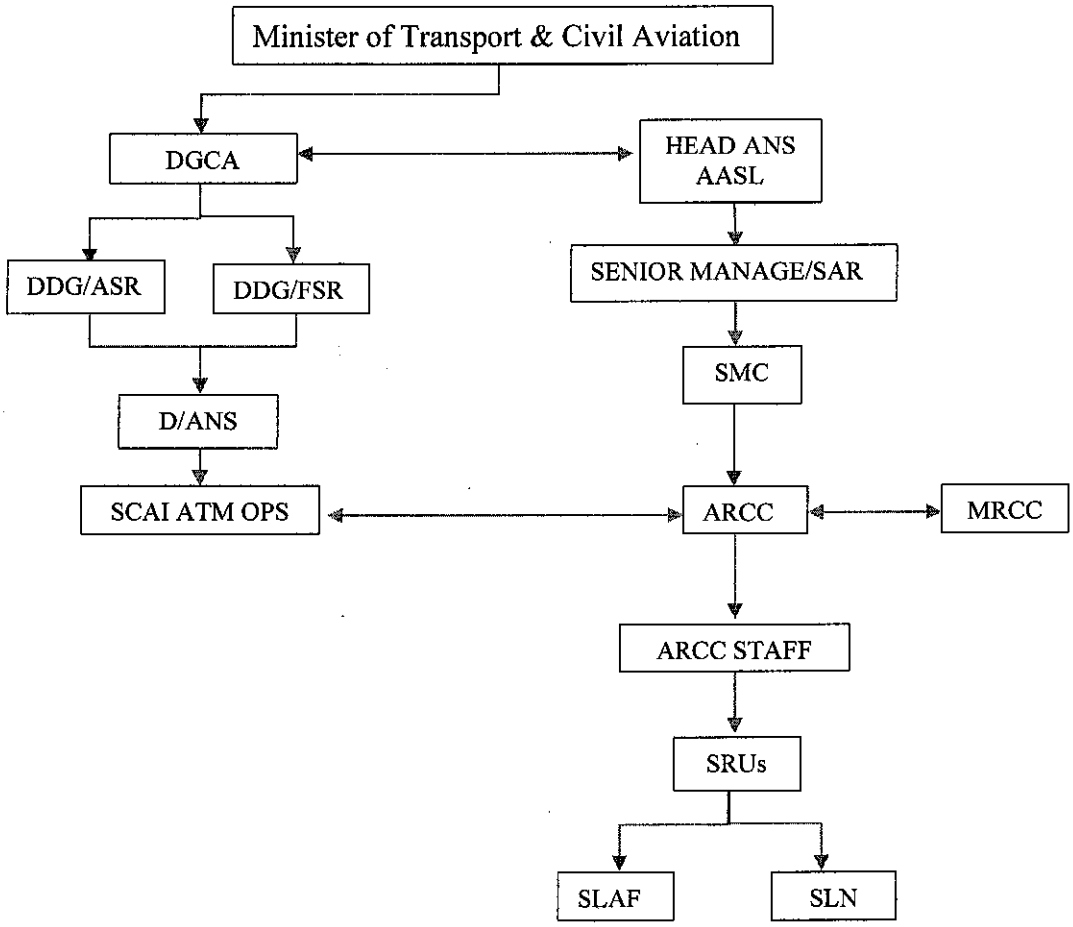

Figure: 1.1

1.8. Search and Rescue Region (Colombo VCCC)

The Sri Lankan SRR is bounded by the following coordinates

1. 6 N 78. 00 E — 6N 92.00E
2. 2S 78.00 E — 10N 82.00 E
3. 2S 92.00 E — 10N 80E

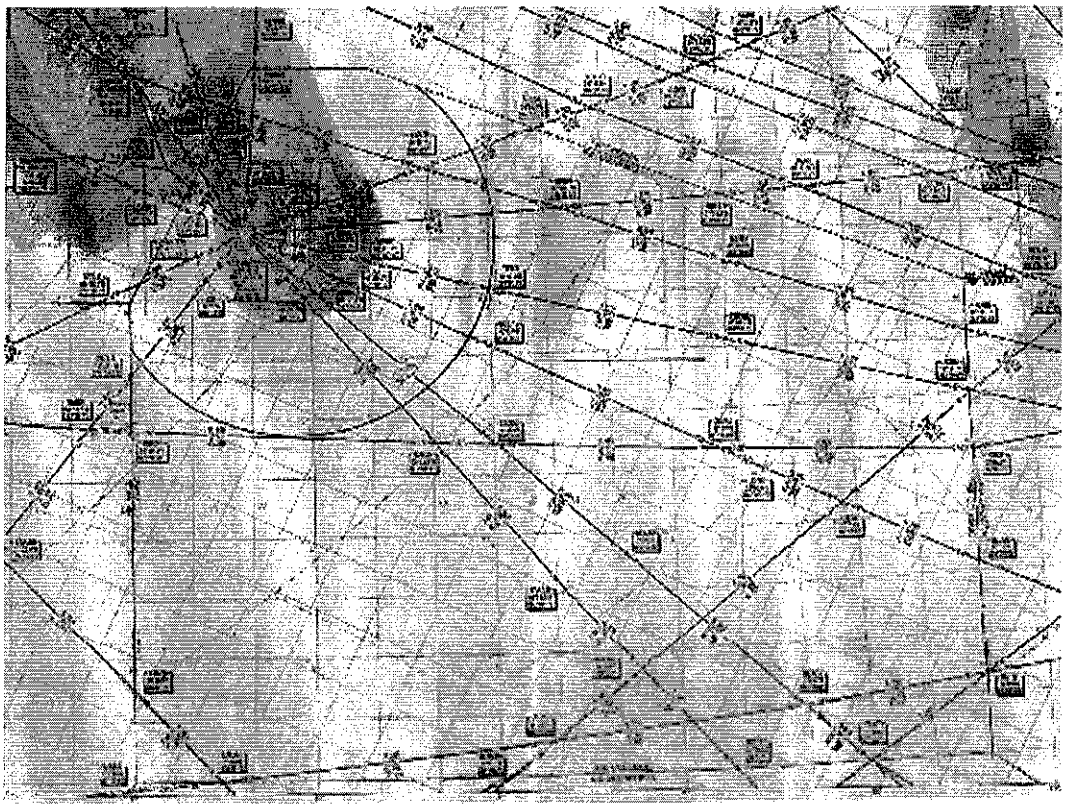

Fig 1-3
COLOMBO SRR

1.9. Staffing

The main operational unit of SAR service is the Aeronautical Rescue Coordination Center (ARCC) from which a SAR operation is coordinated and directed. When direct liaison between RCC and the facilities in a sector of an SRR is not effective because of communication and other logistic reasons, a Rescue Sub-center (RSC) may have to be established in that sector. This is an intermediate unit which will operate under the authority of the RCC.

Each SAR operation is carried out under the direction and supervision of a SAR mission coordinator (SMC). This function exists only for the duration of an operation or exercise and is normally carried out by the RCC chief or a trained designee.

RCC Colombo situated at Ratmalana will be manned on a 24-hour basis, whenever the situation warrants, and is responsible for:

a. coordinating SAR in respect of civil registered aircraft;
b. providing assistance to other SAR agencies to fulfill their obligations; and
c. providing assistance to other emergency-response authorities to meet their obligations in regard to SAR responses.

Inland Land Search:
Often the Datum will be known for a search over land in Sri Lanka. During the hours of daylight the wreckage will be found in a few hours. The terrain to encounter will be Hilly, Jungle (tropical) or Marshy area. The first to react will be the local Police of the area who should endeavor to cordon off the area from curious onlookers. Bounty hunting & thieving must be prevented as soon as possible. Every part of the Wreckage will be vital as clues later on. Should an aeronautical Search be needed over land, an initial search be conducted by one or more helicopters dispatched by the SRU.

1.10. Air Traffic Services Units

All Air Traffic Services (ATS) units will function as alerting posts in the SAR system. They shall be responsible for the declaration of SAR phases to classify the severity of emergency and alert Colombo RCC. It is likely that the ACC will receive a COSPAS SAR SAT distress alert from the INMCC Bangalore. These alerts shall immediately be communicated to the ARCC and MRCC. ATS units are responsible for providing in–flight emergency response (IFER) services. ATS units are required to refer incidents likely to culminate in a forced landing or crash to RCC and MRCC as early as possible.

ATS units, subject to their primary duties are required to provide communications between the search aircraft and the responsible SAR Authority. This normally involves the relay of requests, instructions and information between the responsible RCC and the aircraft. The appropriate ATS authority is responsible for the declaration of Restricted or Danger Areas during search and rescue operations when appropriate.

1.11. Other Agencies/Authorities

A number of organizations have a special interest in emergency operations. They provide helpful ancillary services or have SAR facilities that may be of assistance in special cases.

1.12. Meteorology Department

The Department of Meteorology Sri Lanka provides routine or special weather forecasts, wind history and a description of past and present weather reports and when required ditching reports.

1.13. Sri Lanka Police Force

The National Police are the SAR authority in their respective police divisions within the Island. This will be their responsibility accordance with the interdepartmental agreements. They are mainly responsible for the provision of Initial search and rescue services, securing the area of distress aircraft and also to implement administrative and law enforcement procedure, to prevent unauthorized persons from desecrating the crash site

1.14. Volunteer Organizations

Volunteer rescue organizations are located throughout the country and their focus is primarily one of promoting safety and carrying out local rescues for land based operations. The police are responsible for the coordination and control of operations conducted by the volunteer organizations during search and rescue operations.

1.15. Commercial and Private Organizations

a) There are certain commercial and private organizations that are capable of providing assistance during SAR incidents. Some of these organizations have facilities that are immediately suitable for use as SAR units; others have facilities that have been adapted by way of providing them with extra equipment or training. Other organizations that might volunteer to assist in a SAR operation include commercial airlines, general aviation operators and flying schools.

1.16. Training of SAR personnel

The head of SAR service is responsible for ensuring that the personnel engaged in all search and rescue units are properly trained and maintain a high level of competence as regards their functions in the SAR Organization. The chief of these facilities and services are in turn responsible for the training of their own personnel in the specialized techniques and procedures assigned to them while each individual must assume the responsibility of being able to perform competently the role assigned to them.

1.17. Function of RCC and staff

The staff of an RCC performs duties in the event of search and rescue operations, in addition they have responsibility for maintaining the RCC in a continuous state of preparedness. The RCC staff shall consist of personnel who are experienced and/or trained in SAR operations. When a period of heavy activity is anticipated or during major SAR incidents, the regular staff may be supplemented as required.

Agencies and authorities that may be involved in providing services to an RCC in the event of an incident are to be alerted as early as practicable so that staffing can be managed. The number of personnel required to staff an RCC will vary with local requirements, such as traffic density, seasonal conditions etc.

1.1.3. List of actions by the ARCC when an emergency has been declared

1. Actions to be taken in all types of alerts:
Actions by ARCC

1.1 At all types of alerts, the ARCC staff shall:

a. Initiate documentation;
b. Prepare material, maps, etc. for plotting;
c. Check up on SAR resources; and
d. Obtain information on;
    1. Origin of alert;
    2. Type of incident;
    3. Possibility to contact alerting person;
    4. Position and/or route, flight plan, last position reported and radio frequency used
    5. Time of incident;
    6. Aircraft;
    7. Persons on board;
    8. Type of cargo;
    9. Assistance requested if any;
    10. Intentions;
    11. Communications;
    12. Verify weather (previous, present, prognosis);
    13. Rescue equipment required;
    14. Clothing required for land parties; and verify information received and endeavors to obtain further information.

15 In case Maritime SAR is involved the details collected by the ARCC will be immediately passed to MRCC and assistance as required will be provided to MRCC.

1.18. RCC Equipment

Rescue Coordination Centers usually functions to control and coordinate the SAR operations within an assigned SRR, requesting assistance from other agencies as needed. The RCC should be equipped with the following:

a. Legal Documents such as ICAO Annex 12, 6, 9, 10, 11,13, Search and Rescue Manual, Internal Agreements Sunrise/ Sunset Tables and AIP of Sri Lanka etc;
b. Maps and Charts of different scales, Plotting Overlay Sheets.
c. Computer Facilities so as to retrieve and display of information previously stored;
d. Record books pertaining to RCC and adjacent RCCs;
e. Search and Rescue Units locations
f. Rapid and Reliable SAR Communications systems with various units/agencies;
g. distress frequencies
h. Plotting Equipments;
i. Air Almanac
j. A copy of International Code of Signals;

1.19. Responsibility of Officer in Charge of the RCC

The role of RCC Chief is to ensure that when an incident occurs the SAR operation can be promptly performed. The RCC Chief shall:

a. Ensure that, when an incident occurs, the search and rescue operation is promptly initiated and thoroughly executed;
b. Maintain RCC equipment, including primary lines of communication, in good operational order;
c. Take measures to ensure that RCC receives timely notification from providers of facilities as to service ability of change in location;
d. Ensure that information of serviceability, readiness and other particulars facilities is suitably recorded or displayed in the RCC;
e. Ensure that all operations are entered in a log and that they are reviewed and appraised;
f. Submit a report to the Head of SAR Service upon the termination of a SAR incident;
g. Upon the occurrence of an emergency, assume the responsibility as SAR Mission Coordinator or appoint another officer to that function.

1.20. RCC Supervisor

The supervisor RCC shall during ATS operational hours:

a. Maintain RCC equipment in good operating order;
b. Keep listening watch on the VHF emergency frequency 121.5 Mhz;
c. Remain informed on weather situation through out the SRR;
d. Make sure all the communication facilities are available;
e. Maintain displaying facilities;
f. Keep the records of all SAR telephone directory up-to-date;

1.21. Qualification of RCC personnel

To assume the duties as supervisor RCC and /or SAR Mission Coordinator shall have a minimum of 5 years experience as an ATC Officer in ATC Units and shall satisfactorily have passed an established basic SAR course or a SMC Course.

The basic SAR course for RCC personnel shall include those mentioned in the document of ICAO Annex 12 which is a guidance material for the establishment of SAR Organization and Management, Mission Coordination and SAR Facilities.

1.22. SAR Mission Coordinator

SAR Mission Coordinator (SMC) shall be designated for each SAR operation. The role of the SMC may vary between SAR Authorities depending on their command arrangements. They must understand the extent of their authority and responsibility and must be capable of taking immediate and adequate action. The decisions taken will be based on their knowledge, logic and good judgments. This is a temporary function and one that may be performed by the RCC chief or a designated SAR duty officer, assisted by as many staff as may be required. Since a SAR operation may continue over a prolonged period of time, the designated SMC for the sake of continuity shall remain in charge of the operation until its conclusion. As per duty rooster being relieved periodically for rest.

An SMC is in charge of a SAR operation until a rescue has been affected or until it has become apparent that further efforts would be of no avail. It is essential that the plan of operations gives the SMC the freedom to employ any facility to request additional ones and to accept or reject any suggestions made during the operation.

1.23. Qualifications of SMC

The SMC must have completed appropriate SAR training and must review and maintain proficiency as per the organizational procedures. The SMC must be capable of performing all SAR functions required by the SAR Authority.

To fulfill the foregoing requirements, the SMC must have a good knowledge of the communications available, the geographical features of the region, and the capabilities and limitations of SAR assets. The SMC must use initiative and be inquisitive in the search for information, cross-checking the sources in doubtful cases.

1.24. The Responsibility of the SMC

The SMC is responsible for efficiently respond to a SAR incident using the assets available. The SMC is responsible for all stages of the SAR system. Their responsibilities include the prompt dispatch of appropriate and adequate SAR assets and the conduct of SAR operations until rescue has been completed or chance of success is no longer a reasonable possibility.

The SMC is responsible for ensuring that the following duties are carried out depending on the SAR incident and local circumstances:

a) Obtaining and evaluating all information pertaining to the incident, including emergency equipment carried by the person or craft in distress.
b) Classifying the SAR incident into the appropriate emergency phase (Uncertainty, Alert/Urgency, or Distress).
c) Alerting appropriate SAR assets and SAR organizations that may be of assistance during the incident.
d) In consultation with other SAR Authorities, confirm which Authority will exercise overall coordination.
e) Dispatching initial SRUs if situation warrants.
f) Conducting initial communications checks. If unsuccessful, making an extended communications search to obtain additional information on the incident, personnel involved and equipment carried by the aircraft or person in distress.

g) Calculating the search area. Preparing optimum plans and promulgating attainable plans;
h) Obtaining past/present/forecast weather,
i) Providing for SAR crew briefing, dispatching of appropriate SRUs, or other assets.
j) Making arrangements for appropriate communications.
k) Plotting of progressive position of distress position.
l) Maintaining a continuous, chronological record or log of the search effort, including actions taken in relation to intelligence, SRUs employed, sorties, hours flown/underway, sightings, results obtained, message traffic, briefing notes, telephone calls, daily evaluation of progress.
m) Consideration should be given to arranging for announcements to be made over radio and TV networks.
n) Maintaining liaison with the next of kin, owner, agent or management of the missing craft or persons.
o) Keeping all authorities involved fully advised of SAR incident progress with timely and regular situation reports (SITREPs). SITREPs should be sent in a numbered sequence.
p) Making recommendations in relation to the continuation or suspension of searches.
q) Issuing news media releases on the progress of incidents in accordance with the local SAR organizational procedures and policies.
r) Providing debriefs of SRUs, cancel alerts, release SAR assets and organizations involved, and issuing the final SITREP to all concerned.
s) Acting as required to cope with unique, unusual or changing circumstances of the emergency.
t) Arrange for supply dropping to sustain survivors.
u) Notify accident investigating authority.
v) Recommend abandonment of search when this becomes advisable.

Where a SAR Authority has overall coordination of a SAR operation, the SMC shall give particular attention to the following matters as relevant to the search:

a). In conjunction with the meteorological office, keeping a watch on weather conditions in the probability area, routes used by SAR units in transit to and from the search area and at aerodromes used as bases or alternate aerodromes for search aircraft.
b). Planning so as to minimize conflict between search aircraft in adjoining areas.
c). Provision of regular information to those agencies responsible for land search units about actual and forecast weather conditions which may affect their operations.
d). Ensure that all search units are kept informed about actions and developments affecting their operations.
e). Make effective use of personnel from other SAR authorities, medical agencies, public relations, company representatives and marine authorities.
f). Keeping other authorities, which have been given coordination of search assets, informed of overall search progress and strategy.

1.25. Assistant SAR Mission Coordinator (ASMC)

As the title implies, the A/SMC assists, and is subordinate to the SMC assigned to a particular SAR mission.(OPTIONAL)

1.26. Qualifications

Officers performing A/SMC duties should, as a rule, hold SMC qualifications, but requirements vary within the structure of the SAR organization. Generally, the title A/SMC refers to the SAR qualifications held by a particular officer, e.g. an officer rated as A/SMC may serve in any capacity within the SAR organization, except in the position of SMC. Officers rated as SMC may, on the other hand, be allocated A/SMC duties. As a general guide, the objective of any SAR organization should be to ensure that staff employed in the management of SAR operations should be qualified to perform the highest level of duties i.e. SMC.

1.27. Authority

The ASMC is under the direct supervision of the SMC and therefore has the full operational authority of the SMC when carrying out specific duties assigned.

1.28. The Responsibilities and Duties of ASMC

The A/SMC is responsible for routine documentation, allocation of SRUs and presentation of the search plan under the direction of the SMC. Each SAR Authority will recognize specific duties applicable to the A/SMC function.

Actions by ASMC

The ASAR Mission Coordinator shall personally:

a. Evaluate all information and;
    1. Estimate size of operation;
    2. Estimate the development;
    3. Estimate risks for;
        - SAR units;
        - Aircraft in distress;
        - Persons on board aircraft in distress;
        - Other air traffic;
        - The general public; and
        - The environment; and
    4. Estimate present situation;
b. in any type of emergency phase;
    1. Decide on a general plan
    2. Specify directives
    3. Decide on priorities
    4. Estimate on requirements personnel, SAR units, equipment); and
    5. Make a requisition for the resources and dispatch them as required; and
c. In border cases, agree with other RCC on who will coordinate the SAR mission.

1.29. Recorder

A Recorder, if required, shall maintain an accurate and up–to–date chronological record of the SAR action, together with other necessary records, messages and details of telephone calls and radio logs.

1.30. Briefing Officer

A Briefing Officer shall be responsible for briefing and debriefing search units.

1.31. On Scene Coordinator

When a number of SAR assets are working together on the same SAR mission in the same location, there may be an advantage if one unit is assigned to coordinate the activities of all participating assets. The SMC will designate this role to an On Scene Coordinator (OSC), who may be the person in charge of an aircraft participating in the search or someone at another nearby facility in a position to handle OSC duties. The OSC should be the most capable person available, taking into consideration SAR training; communications capabilities of the asset. The OSC becomes the extended mouth piece of the SMC. The OSC will not take independent decisions as far as possible.

An OSC prosecutes the SAR Mission on scene using resources made available by the SMC, and should safely carry out the SAR action plan. If the SMC does not provide a sufficiently detailed SAR action plan, the OSC completes SMC duties for on scene operations, notifying the SMC. The unit designated as OSC retains responsibilities from the time of designation until relieved or until mission is completed (**Also refer 6.5.2**).

Duties that the SMC may assign to the OSC, depending on needs and qualifications include:

a) Assuming operational coordination of all SAR facilities on scene;
b) Receiving the search action plan from the SMC;
c) Modifying the search action plan based on prevailing environmental conditions and keeping the SMC advised of any changes to the plan (in consultation with the SMC when practicable);
d) Providing relevant information to the other SAR assets;
e) Implementing the search and rescue plan where required;
f) Monitoring the performance of other assets participating in the search;
g) Developing and implementing the rescue plan (when needed);
h) Providing regular SITREPS to the SMC.

1.32. Cooperation with Foreign Rescue Coordination Centers

When the area of SAR operations is near or straddles the border between international search and rescue regions (SRR), RCC Colombo is to be informed and will take overall coordination, except for SAR involving military forces which requires special authorities. RCC Colombo will liaise with neighboring foreign RCCs in accordance with the relevant International SAR Arrangements. In general the following procedures reflect the SAR arrangements in place.

When the position of a party in distress is known, the responsibility for initiation of SAR action will be that of the International RCC in whose SRR the party is located.

The International RCC to assume responsibility for conduct of a SAR action when the distressed craft's position is unknown shall be the RCC responsible for:

a. the SRR in which the craft was operating according to its last reported position; or
b. the SRR to which the craft was proceeding if the last reported position was at the boundary of two SRRs; or
c. the SRR to which the craft was destined if it was not equipped with suitable two-way radio communication equipment or not under obligation to maintain radio communication.

If, after a SAR action has been initiated, it is determined that the area of probability lies across the boundaries of two or more adjoining SRRs, the initiating RCC shall normally remain the responsible SAR Authority.

Alternatively, where search areas are extensive, it may be agreed that RCC Colombo coordinates search efforts with the adjacent International RCC.

1.33. Transferring Overall Coordination Responsibility

1.33.1. Early initiation of effective response

It is essential that the SAR Authority with functional responsibility for a target type initiate early and effective response.

Accordingly, the SAR authority should evaluate all available information and intelligence and make an initial assessment of the probable search area and assets required. If the required response is assessed as being beyond the capacity of the authority then that authority should request assistance at an early stage. Delaying requests for assistance, may lead to reduced chances of survival and/or significant increase in the size of the search area.

The coordinating SAR authority may request neighboring SAR authority to assist with the provision of SAR advice, including drift calculations, at any stage of the search.

1.34. Accepting overall coordination from another SAR Authority

Where a SAR Authority accepts overall coordination of an incident, the SMC shall ensure that full responsibility for the event is accepted, in which case:

a. The SMC shall ensure that all aspects, including air and surface search, are coordinated by their RCC.

b. If an aspect of the search (e.g. surface search) is to be coordinated by, or remain with another SAR Authority, then the terms for the coordination shall be made clear and that Authority shall be required to report progress and keep the SMC with overall coordination informed as to developments.

1.35. Accepting coordination for a component of the SAR event from another SAR Authority

Where an Authority decides to accept coordination for a component of an event (e.g. air search) from another SAR Authority, the SMC shall ensure that responsibility for specific functions (e.g. air search) is accepted, in which case:

a. the SMC shall operate within the terms of the agreed responsibility and report progress to the SAR Authority with overall coordination; and

b. conduct the specific functions in accordance with accepted standards, procedures and practices.

1.36. Transfer of coordination after suspension of SAR action.

When a SAR action is suspended, the authority with overall coordination at the time shall inform all authorities, units and facilities that have been activated and/or alerted.

Where a search is suspended for a target that is the responsibility, under the terms of **Appendix B.** (SAR Functions & Responsibility), of the authority with overall coordination at the time of suspension, SAR coordination shall not be transferred to another SAR authority. Rather, SAR agencies, should be informed that search has been suspended pending the availability of further intelligence. The Police may then investigate further.

1.37. Military Requests for Civil Assistance

A Military SAR will not involve any civil authorities unless called upon to do so. It will be carried out by the Military.

1.38. Search and Rescue Resources

Overview

The Sri Lankan SAR organization is based on the use of aircraft & Naval Ships and land facilities which are can be made available to form part of the SAR effort.

Resources available for SAR response include any SRU, Station, Operational activity, or other resource that can be used during a SAR mission. SAR coordinators organize them to provide the most effective response. SMC normally select resources from those listed in the SAR plan, but may request other resources during a SAR mission. An SRU is any craft, vehicle, or team that can operate independently. The use of any SRU depends on SMC judgment, and is governed not only by the SRU'S ability to reach the distress scene, but also by other SRU capabilities, training and experience. While many resources exist, the SAR Manual details only resources commonly available.

1.39. Provision for entry of foreign aircraft during SAR operations

Overview

RCC Colombo shall take responsibility for organizing the entry into and departure from the Sri Lanka of foreign aircraft engaged in SAR operations. If another SAR authority becomes aware of a foreign aircraft being tasked to conduct SAR operations in the Sri Lankan region, they should inform RCC Colombo immediately, who then will organize approvals and diplomatic clearances as necessary.

1.40. Public Relations

Overview

Search and Rescue operations for missing aircraft generate considerable publicity. By virtue of its nature, an RCC is a source of news and this is especially true during SAR incidents. The public should be informed during SAR operations, within the limits of confidentiality, of SAR actions. The potential benefits of early release of information include:

a. additional information from the public, leading to more effective use of SAR resources;
b. fewer time-consuming requests from the news media; and
c. reduction in inaccurate public speculation about the SAR mission.

RCC staff should be governed by their parent authority's public relations procedures when dealing with the media. It is important that a relationship between the media and an RCC is established such that:

a. the media's legitimate interest in an incident of concern and the public's "right to know" is respected;
b. information reaching the public is factual and as complete as possible;
c. the operational functioning of an RCC is not prejudiced; and
d. benefit is derived from publicity of an incident and from media broadcasts for information made at the request of SAR staff.

Public Relations Officers (PRO's)

SAR Authorities usually have a designated PRO. The PRO, or the officer nominated, should have knowledge of search and rescue and the techniques of disseminating information to the public.

The authority of the PRO will be covered by organizational policies and procedures. The commercial distribution of news is highly competitive and therefore news releases must be impartial. Specifically, the PRO will perform the following duties:

a. receive briefings from the SMC, RCC personnel, SITREPs, SAR log and interviews with rescued personnel if available;
b. make proper and full use of existing news media such as press, radio, television and wire services to disseminate information;
c. establish liaison with media sources early in the mission in order to prevent the SMC from being flooded with requests for information as the mission progresses;
d. keep well informed on the procedures and techniques being used in the search and in which stage the SAR system is functioning at any particular time; and
e. process and review for news-worthiness all photographs taken of mission activities.

1.41. Press Releases

The early release of information will frequently aid in preventing time-consuming requests from news media concerning the operation. In cases where extensive searches are being conducted release of information to the public may bring important leads to the SMC.

News releases should be written following the time-proved format of who, what, where, when, why and how. In drafting a release all six of these items should be covered in paragraph one. Subsequent paragraphs can provide additional detailed information concerning one or more of these questions. By drafting releases in this fashion the news media will be able to chop portions of the release in order to meet their space requirements without damaging the overall story. The release of names can be a sensitive issue and organizational policies and procedures should be established in accordance with privacy guidelines.

A good news release will be well written, factual and newsworthy. It should not contain personal opinion, judgments, elaboration, coloring or any classified material.

SAR officers shall not disclose to the media:

a. the names of any crew or other missing persons;
b. any personal judgments pertaining to any persons involved in the incident;
c. any comments on the judgment, experience or training of persons involved in the incident;
d. degrading opinions on the conduct of the SAR operation or personalities involved;
e. personal opinions and theories;
f. names of those associated with the search;
g. names of persons who have given information relating to the incident.

Nor should SAR Officers comment on behalf of other SAR Authorities or organizations.
Media releases may include the following information:

a. type of aircraft, factual detail of the flight
b. reason for the SAR operation, eg. aircraft overdue, report of impending crash landing; weather situation; beacon activation
c. owner of the aircraft (subject to consent)
d. number of missing persons
e. area being searched
f. number and types of assets engaged in the search;
g. arrangements for the search;
h. details of other authorities participating in the search; and/or
i. reinforce the positive aspects relating to safety and survival.

As the operation progresses, releases should be made periodically to keep the public updated on the progress that is being made. A final release should be made when the case is concluded. This release should summarize the activities conducted during the operation, giving full particulars on the efforts expended to locate and rescue the distressed persons. The final release should be a complete summary of the incident and detail:

a. the number of aircraft missions, total hours flown;
b. auxiliary land search, if applicable;
c. the reasons for termination;
d. any other information relevant to the incident that should be made public.

1.42. Requesting Public Assistance

The SMC may enlist the news media to access information from the general public. In sparsely populated areas, information from the general public may be sought through the media, requesting members of the public to contact the RCC. An RCC telephone number should be included as part of the release.

1.43. Liaison with Relatives

Information that may significantly affect the conduct of a search may be obtained from relatives and friends of missing persons. Information relating to the personal history and possible courses of action taken by the missing persons should be collected by officers trained in investigation methods and competent to describe the current and proposed search plan in a reassuring manner.

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As the operation progresses, releases should be made periodically to keep the public updated on the progress that is being made. A final release should be made when the case is concluded. This release should summarize the activities conducted during the operation, giving full particulars on the efforts expended to locate and rescue the distressed persons. The final release should be a complete summary of the incident and detail:

a. the number of aircraft missions, total hours flown;
b. auxiliary land search, if applicable;
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d. any other information relevant to the incident that should be made public.

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The SMC may enlist the news media to access information from the general public. In sparsely populated areas, information from the general public may be sought through the media, requesting members of the public to contact the RCC. An RCC telephone number should be included as part of the release.

1.43. Liaison with Relatives

Information that may significantly affect the conduct of a search may be obtained from relatives and friends of missing persons. Information relating to the personal history and possible courses of action taken by the missing persons should be collected by officers trained in investigation methods and competent to describe the current and proposed search plan in a reassuring manner.

1.44. Notification of Next Of Kin

The SMC should be aware of the concerns of the relatives of the missing persons. During a search, it is recommended that one staff member should maintain regular contact with the relatives to provide information and outline plans. If appropriate, relatives should be encouraged to visit the RCC to enable them to see the search effort. Next of kin/relatives should be advised at an early stage of any SAR operation, to ensure where possible that the timing of associated media releases) does not cause them undue concern.

In any event, before a search is suspended or terminated SAR management should ensure that the next of kin are consulted as far as possible. They should be fully briefed on the complete search effort, conditions in the search area, and the reasons for proposing the termination of the search. Relatives are more able to accept the SMC's decision to suspend or conclude search operations if they are privy to the processes.

Whenever foreign nationals are the subjects of a search and rescue action, the Department of Foreign Affairs should be informed.

The Defense Force is the sole authority for releasing any information to next of its kin of DF members

1.45. Casualties

State SAR Authorities will be responsible for the releasing the names of civilian casualties. The names of military casualties of a SAR Incident are only to be released by the DF or the appropriate national authority for visiting military units.

The names and addresses of survivors shall not be released until a positive check and identification has been accomplished. Generally, survivor information should not be released prior to the release of casualty information, although circumstances may dictate some departure from this procedure. Survivors shall be encouraged to contact their own families as soon as possible and all reasonable assistance towards accomplishing this shall be provided. Controlling the dissemination of information by survivors is difficult and requires tactful briefing. Whenever possible the PRO should brief survivors on what information may be released. The Director General of Civil Aviation shall take reqired steps to inform foreign missions about foreign nationals involved when required.

1.46. Search and Rescue Facilities

It is crucial for the SMC to be aware of the available units in or close to the SRR. Therefore, there must be an asset register in the RCC. Ideally, for easy regular updating, it could be available in electronic format/online. It may then appear as a separate document. However, if it is not the case, at least a list of available assets should be maintained.

The SMC shall arrange for the provision of suitable search units. The terms SAR unit or SAR facility are used to describe one or more types of air and/or land-based facility.
The selection by SMC of available SAR units to be used in any particular operation should be based on the following:

a. They shall be able to reach the scene of the distress incident as soon as possible;
b. They should be suitable for at least one of the following operation:
    i. Conduct of search primarily by air but with the assistance of coordination of land SAR units where applicable.
    ii. Carriage of supplies to the scene of an accident and if necessary delivery by dropping.
    iii. Effecting a rescue generally by land SAR units but with possible aid from helicopters guidance or parachutists.

SMC may authorize the diversion of enroute civil aircraft for search purposes.

1.47. Airborne SRU'S

The main stay of the Sri Lanka SAR are airborne SRU'S of the SLAF,

a. Srilankan Airlines
b. Any the other private operators registered in Sri Lanka.

1.48. Search and Rescue Units

The list of the aircrafts and the concerned operators available in Sri Lanka for search and rescue purposes are listed in **Appendix K.**

RCC Colombo requires ensuring that all aircraft participating in SAR operations carry survival equipment, consisting of medical supplies, emergency rations and survival radio equipment. Aircraft and ground rescue

teams are equipped to communicate on allocated SAR frequencies.

The selection of aircraft facilities to be used from those available operators shall be made by SMC after consideration of the following factors:

a. Type of search
b. Terrain Condition
c. Type of Navigation involved
d. Need of the dropping supplies
e. Disposition of aircraft with respect to search area
f. Weather conditions at and enroute to search area

Non-radio equipped aircraft should not be used on SAR operation.

To search on for survival beacon signals, use should also be made of relatively fast and high level aircraft.

Where the terrain is such that contour search is necessary, preference should be given to light maneuverable twin engines types.

Helicopters will prove particularly advantageous in searches over mountainous areas and also to achieve the rescue much earlier than could be done by land units.

The aeronautical and public telecommunication services are also available to the search and rescue organization.

1.49. Land Rescue Units

In Sri Lanka, Commandos trained in Jungle Survival & rescue from the SLAF, Special Task Force, Army including Civil Police will undertake the responsibility of land SAR activities under the general guidance of RCC Colombo. In cases where considerable land search effort is necessary the RCC should call on other authorities to provide additional units. Authorities together with the concerned operator undertake the initial rescue of the survivors. After the initial rescue, the security of the accident site, subsequent evacuation process, civil administration, accident formalities and any liaison process thereafter, must be handed over to the police authorities.

For most efficient and successful SAR operation the need for coordination between land rescue units and search aircraft should be considered and plans should cater for the need for two way radio communication. In remote areas there may also be a need to keep land units supplied with fuel, water and food by means of air drops.

After location of survivors, RCC in coordination with land rescue team should aim at the most expeditious means of returning them to a suitable location and should consider surface transport (Ambulances, Buses and other means of transport).

Personnel utilizing animals, vehicles and other equipment may be used as land SRUs to penetrate inaccessible areas to provide immediate emergency medical care and subsequent evacuation of survivors, or to track survivors. Although search by land SRU's alone is usually impractical for large search areas, it can be conducted in most weather conditions, and can provide complete coverage of the area searched.

Land SRUs are numerous, and vary widely. Many personnel are trained in land search operations, providing an excellent source of SRUs for incidents requiring large numbers of personnel and equipment.

It is not possible to list individual land SRUs. However the RCC should have rapid and reliable communication with:

- The SLAF Commandos
- The Special Task Force
- The Sri Lanka Police Force
- The Sri Lanka Army
- City Fire and Rescue Services (Subject to the location)
- Parks and Forest Department Trackers & Labour
- Local Volunteer Organizations
- Local Red Cross unit & Volunteers.

1.50. Parachutists

Parachute units of the armed Forces may be used for SAR purposes. The SMC in coordination with the SLAF should discuss the proposed operation and deployment if any.

1.51. Training of SAR Facilities

A regular training of crew members assigned to units taking part in the SAR Organization should be provided and they should have a good knowledge of:

- The SAR Organization
- The Search and Rescue Manual
- Coordination and Cooperation Procedures
- Communication Procedures within the SAR Organization
- The Techniques of flying different search patterns (Electronic and Visual)
- Supply dropping from the aircraft

1.52. SAR Agreements

Formal SAR agreement exists between the Government Sri Lanka and Three adjacent States except India where the final draft agreement is being reviewed by the Indian authorities. However, facilitation of entry for SAR purposes is coordinated on the AFTN and inter- area speech circuits with neighboring RCC and ATS Centers.

Requests for the entry of aircraft, equipment and personnel from other States to engage in search for aircraft in distress or to rescue survivors of aircraft accidents should be transmitted to the RCC. Instructions as to the control which will be exercised on entry of such aircraft and/ or personnel will be given by RCC in accordance with the standing plan for the conduct of search and rescue in its area.

Also there should be copies of agreed documentations with RCC having agreements between interdepartmental agencies and local SAR facility provider that can participate in SAR operation.

Agreements must be sufficiently detailed and delegate authority to assure immediate action. Specimen of the agreements is listed in **Appendix C.**

1.53. Conditions of Availability

The SAR service and facilities in Sri Lanka are available without charge to neighboring States on opportunity basis and upon request to the Civil Aviation Authority of Sri Lanka, the RCC Colombo or Colombo Air Traffic Control Centre. They will be available when they are not engaged in search and rescue operations in their home territory.

2. Communication

2.1. Overview

Good communication are essential to the success of SAR operations in order to ensure the alerting information is disseminated promptly and the rapid contact between search aircraft, rescue units and RCC can be maintained during the operation. SAR communications occur between the distressed unit and the SAR system and between the components of the SAR system.

Distress traffic includes all messages relating to immediate assistance required by persons, aircraft in distress, including medical assistance. Distress traffic may also include SAR communications and on-scene communications. Distress calls take absolute priority over all other transmissions; anyone receiving a distress call must immediately cease any transmissions that may interfere with the call and listen on the frequency used for the call.

Distress and safety communications require the highest possible integrity and protection from harmful interference. Any interference that puts at risk the operation of safety services degrades, obstructs or interrupts any radio communications, is harmful. Some frequencies are protected, in that they have no authorized uses other than for distress and safety. SAR personnel should be particularly careful not to cause harmful interference, and should co-operate with authorities to report and stop incidents of interference.

The objective of search and rescue (SAR) communications is to make possible the conduct of SAR Operations. Communications must allow for:

a. rapid transmission of distress messages from aircraft including for medical assistance;
b. rapid communication of distress information to the authorities responsible for organizing and effecting rescue;
c. coordination of the operation of the various SAR units; and
d. liaison between controlling/coordinating authorities and SAR units.

2.2. Distress and Emergency Signals

There are many signals that can be used to indicate a distress or other emergency.
Personnel involved in SAR operations must be familiar with the types of signals they can expect to encounter in order to evaluate their meaning correctly and take appropriate action.

These emergency signals may be made by radio, radar (e.g. transponders), flags, pyrotechnics, flashing light, smoke, sounds, (**Appendix D.** list the more common signals and terminology in use).

2.3. RTF Distress Signal

The distress signal is used to indicate that a craft or person is threatened by grave and imminent danger and requires immediate assistance. It has precedence over all other communications. The distress message is preceded by the word MAYDAY spoken three times.

2.4. RTF Urgency Signal

The urgency signal is used to indicate that the calling station has a very urgent message to transmit covering the safety of a ship, aircraft or person. It has precedence over all other communications

, except distress traffic. The urgency message is preceded by the words 'PAN PAN' spoken three times.

2.5. Fixed Networks

The most rapid and reliable point to point network is the AASL's AFTN which should be used for fixed traffic as far as possible.

In cases where AASL's AFTN cannot affect ultimate delivery, message should be routed to the most expeditious from other channel such as the direct hotlines system from which it can be delivered or relayed either to another network to the addressee. The other fixed networks to be used are:

a. Colombo Radio Ship to shore.
b. Sri Lanka Telecom
c. Sri Lanka Army
d. Sri Lanka Police
e. Meteorology Department,
f. Forest Department

g. Fishries Department Radio Network
h. Dissaster Management Network.

Details of such networks and their hours of operation are to be listed separately.

2.6. Air-Ground Communications

The frequencies to be used for communications between ATS units and search aircraft will usually be the normal VHF or HF channels as shown in the Sri Lanka AIP GEN 3.4 COMMUNICATION SERVICE

However, if aircraft employed for search operation are more and spare frequencies are available, it will be preferred to have the SAR communications conducted on channel not being used for normal air-ground traffic.

In case aircraft are equipped with VHF only and conducting low level search at a considerable distance from the location of RCC, it may be necessary to use a relay aircraft flying as high as possible in an area between the RCC location and the search area.

2.7. Air-Air Coordination

It is desirable to arrange for communication between search aircraft and a scene of action frequency should be nominated. This will normally be a VHF channel available in all the aircraft which is International Standard Frequency for the purpose is 123.1 MHz.

2.8. HF Frequencies

When HF is required to be used at scene of action frequency Two HF frequencies shall be nominated and employed. One should be 2182KHz. The international Distress Frequency.

2.9. Communication between search aircraft and rescue units/ Land Rescue Units

When it is necessary for coordination and guidance purposes, arrangements should be made for communications between search aircraft and land rescue units. This may be done by use of portable communication facilities. The frequency to be used is normally 121.5 MHz to make communications with SAR aircraft possible. For communications between an RCC and a permanent base and, if possible, a temporary base in the field, use of fixed service would be appropriate. The same kind of communication facilities also can be employed for communications between land rescue units.

2.10. Communications in support of SAR operations

2.10.1. Overview

The SMC is responsible for designating specific frequencies for on-scene use during SAR operations, and for establishing reliable communications with adjacent operation centers. When appointed, the Coordinator Surface Search (CSS) or the On Scene Commander (OSC) is responsible for establishing reliable communications between all participating search units and the RCC.

The SMC is responsible for informing all SAR participants of the specific frequencies selected for an operation. The SMC should designate a primary and secondary frequency in the appropriate frequency bands (HF, VHF and UHF) for use as on-scene channels.

2.10.2. SAR Frequencies

The unit in distress or a station that has been assigned controlling responsibility by the unit in distress, controls distress traffic. However, for cases involving international civil aviation, the station addressed by the distress message controls distress traffic. Once communications are established with a distressed unit, they should be maintained on the same frequency.

The following frequencies have been authorized for use in SAR operations:

a. 2182 KHz is the international voice distress, safety and calling frequencies for radio telephone and can be used by aircraft. This frequency can be used for Air- Surface SAR communication.

b. 121.5 MHz the international voice aeronautical VHF distress frequency for aircraft and those aeronautical stations primarily concerned with the safety and regularity of flight and having

equipment in the 118-136 MHz VHF band. This is used as alarm signal on ELT and continuously monitored by international aircraft.

c. 3023.5, 5680 kHz. These frequencies may be used for communications between mobile stations when employed in coordinated search and rescue operations, including communications between these stations and participating land stations.

d. 243 MHZ is the international military aeronautical distress frequency used as voice channel

e. 123.1 MHz. The international voice SAR on-scene frequency for use in coordinated SAR operations.

2.10.3. SAR Frequencies

Purpose	Frequency	Period	Watch Unit
International Distress Frequencies	121.5 Mhz	HJ	ATS/RCC
	243.0 Mhz	HJ	SLAF
Scene of Search	123.1 Mhz Or Alternate	As required	RCC
	HF Suitable Alternate	As required	RCC

Note:
Direct Speech circuits exist between all ATS Units within Colombo FIR and also with neighboring countries

2.11. Emergency Signaling Devices

People in a craft in distress may use any possible means of alerting others to their situation. These devices range from emergency radio beacons to mirrors.

2.11.1. Daylight Devices

Reflective mirrors, used by survivors to reflect the sun's rays towards a SAR unit, are an effective daylight device. Mirrors have been detected as far away as 45 miles and from as high as 10000 feet, although the average distance is about 10 miles. Fluorescent material (known as retro-reflective tape) that reflects a large percentage of sunlight is usually sewn on one side of lifesaving craft coverings and has been detected as far away as 5 miles with an average of 3.5 miles.

Orange smoke generating signals have been sighted as far away as 12 miles with an average of 8 miles. Smoke signals are most effective in calm wind conditions and open terrain. The effectiveness of smoke signals decreases rapidly with an increase of wind speed above 15 knots.

Pyrotechnic flares may be used in daylight; however their detectable range is only about 10 per cent of the night-time range.

2.11.2. Night-time Devices

On land, fires are arguably the most effective night time signal that survivors may use. Fires have been sighted as far as 50 miles away, with the average range varying with the size of the fire and the absence of other light sources on the earth's surface.

Flashing strobe lights are an effective compact night signaling device available for individual survivors. Strobe lights have been sighted as far as 20 miles away with an average of 3.5 miles.

2.12. Radar/IFF

Besides the obvious radar target of the distressed craft itself, IFF (Identification Friend or Foe) may be used not only to indicate distress but also to increase the detectable range by radar.

The user can dial codes into the transponder to signal a message to the interrogator operator. **Code 7700** indicates a distress, **Code 7600** a communication failure and **Code 7500** an unlawful interference with the aircraft.

2.13. Radio and Distress Beacons

In addition to the obvious uses of standard radio for transmitting emergency signals and messages, there are a variety of types of emergency equipment designed for use by survivors.

The Emergency Position Indicating Radio Beacon (EPIRB) and the Emergency Locator Transmitter (ELT) are small emergency radios that may be fully automatic, semi-automatic or hand activated. These include:

a. 406 MHz distress beacons;
b. EPIRBS which operate on 121.5 and 406 MHz transmit for at least 24 hours;
c.121.5 MHz distress (ELT) beacons.

2.14. COSPAS-SARSAT Distress Beacon Detection System

2.14.1.
Overview

COSPAS-SARSAT is a satellite system designed to provide distress alert and location data to assist SAR operations, using spacecraft and ground facilities to detect and locate the signals of distress beacons operating on 406 MHz . The responsible COSPAS-SARSAT Mission Control Centre (MCC) forwards the position of the distress and other related information to the appropriate RCC authorities. Its objective is to support all organizations in the world with responsibility for SAR operations, whether at sea, in the air or on land.

The COSPAS-SARSAT System provides distress alert and location data to RCCs through ground stations (Local User Terminals - LUTs), for 406 MHz beacons activated anywhere in the world.

A transmitter operating on 121.5 MHz can be located to be within a radius of approximately 20 Km.

The location of an emergency transmitter operating on 406 MHz may be pinpointed to be within a radius of 5 Km from the given position.

2.15.
Purpose

The primary purpose of this system is to detect, positively identify and provide the positions of 406 MHz EPIRBs, ELTs and PLBs anywhere in the world.

2.16. World wide system

The worldwide system comprises:

a. Low orbiting satellites in near polar orbits;
b. Satellites in geostationary orbit;
c. Local User Terminals (LUTs), which are ground stations that receive and initially process the raw distress signal data relayed by a satellite;
d. Mission Control Centres (MCCs), which are responsible for the final processing and appropriate distribution of beacon detections; and
e. Frequency stable 406 MHz beacons, each with a unique identification code and capable of transmitting for 24 or 48 hours depending on their use.

2.16.1.
Satellites

The satellite constellation is made up of search and rescue satellites in low earth orbit (LEOSAR) and Geostationary Orbit (GEOSAR).

Each LEOSAR satellite makes a complete orbit of the earth around the poles in about 100 – 105 minutes. The satellite views a "swath" of the earth of approximately 4000 km wide as it circles the globe, giving an instantaneous "field of view" about the size of a continent. When viewed from the earth, the satellite crosses the sky in about 15 minutes, depending on the maximum elevation angle of the particular pass.

Satellites are not equally spaced and hence do not pass over a particular place at regular intervals. In view of this, pass schedules are computed for each LUT every day. On average a satellite will pass over continental Australia every 90 minutes but, because of the irregularity of passes, there could be up to 5 hours between passes.

The current GEOSAR constellation is composed of two satellites provided by the USA, GOES 8 and GOES 10, and one satellite provided by India (INSAT-2B). These satellites provide continuous global coverage for 406 MHz beacons with the exception of the Polar Regions. To take full advantage of the real-time alerting capability the beacon must be designed to transmit, in its distress message, position data derived from a satellite navigation system such as GPS.

2.16.2.
Beacons

There are three types of COSPAS-SARSAT distress beacons:
a. Emergency Locator Transmitters (ELT) used by aviators;
b. Emergency Position Indicating Radio Beacons (EPIRB) used by mariners;
and c. Personal Locator Beacons (PLB) used on land

Aviators often carry PLB as personal back up devices to ELTs and EPIRBs.

WEF 01 February 2009, the COSPASS-SARSAT Satellite Aided Tracking System ceased to detect the 121.5 MHz and 243.0 MHz beacons. Users of 406.0 MHz beacons that are coupled with the 121.5 MHz frequency will be able to use the 121.5 MHz for homing purposes only by search units.

A separate search and rescue point of contact unit need to be established for the receipt and disseminate of distress data. In Sri Lanka this point is the Colombo ARCC.

2.17. SAR Call Signs

The Following Call signs shall be used in SAR missions. Rescue - 001-100(SLAF)
Rescue – 101-200(Private Civil)
Rescue - 201-299(Foreign Aircraft)

2.18. Procedures and Signals Used

There are some of the international visual signals that can be used for Search and Rescue purposes by aircraft and survivors. Please see **Appendix D.**

Transmission and reception of distress messages within the Colombo Search and Rescue Area are handled in accordance with Annex 10, Volume II, 5.3.

For communications during search and rescue operations, the codes and abbreviations published in ICAO Abbreviation and Codes (Doc 8400) are used.

The frequency 121.5 MHz is guarded continuously during the hours of service at all ATS units.

2.19. Communication Aircraft

A dedicated communication aircraft should be used when communications are expected to be poor in the search area and:
a. HF is the only means of communication;
b. It is a large scale search;
c. It is necessary to improve information feedback into the RCC;
d. It is necessary to improve information flow to SAR units;
e. Search aircraft are operating without contact with a ground station; or
f. It is the best method of maintaining communications with survivors/ground search units and ground rescue units.
A communications aircraft will normally be a suitably equipped SAR Unit aircraft or a Military aircraft, have a minimum crew of pilot and radio operator, and have good on scene endurance.

3. Awareness and Initial Action

3.1. Awareness and Notification

3.1.1. Introduction

When the SAR system first becomes aware of an actual or potential emergency, the information collected and the initial action taken are often critical to successful SAR operations. It must be assumed that in each incident there are survivors who will need assistance and whose chances of survival are reduced by the passage of time. The success of a SAR operation depends on the speed with which the operation is planned and carried out. Information must be gathered and evaluated to determine the nature of the distress, the appropriate emergency phase, and what action should be taken. Prompt receipt of all available information by the RCC is necessary for thorough evaluation, immediate decision on the best course of action and a timely activation of SAR assets to make it possible to:

a. locate, support and rescue persons in distress in the shortest possible time; and

b. Make use of any contribution, if any from the survivors who may still be able to make towards their own rescue while they are still capable of assisting others.

Experience has shown that the chances for survival of injured persons decrease by as much as 80% during the first 24 hours, and those for uninjured persons diminish rapidly after the first three days. Following an accident, even uninjured persons who are apparently able-bodied and capable of rational thought are often unable to accomplish simple tasks and are known to have hindered, delayed or even prevented their own rescue.

3.2. SAR Incidents

Whenever possible, SAR incident data should be collected from the reporting source, with the most important information gathered first in case communication is lost. If, while information is being gathered, the need for an immediate response is indicated, SRUs should be dispatched. There are many different types of incidents reported to the SAR system that must be evaluated and resolved. Most of these incidents may be grouped by the type of craft involved, the environment, and in the case of individuals, by the type of difficulty being encountered.

In general a SAR incident is considered imminent or actual when it is apparent that persons are, or may be, in distress or when a request for assistance has been received.

3.2.1. Aviation SAR Incident

SAR alerting action is based upon the type of notification and flight procedures adopted by an aircraft, ie:

a. aircraft that comply with full reporting procedures where a continuous communications SAR watch is maintained;
b. aircraft that have nominated a SARTIME where alerting action commences at the time of expiration of the SARTIME;
c. aircraft that have not submitted flight notification where alerting action is commenced on the receipt of incidental information from any source which leads to doubt as to the aircraft's safety. This includes notification from a person or organization holding a Flight Note.

An aircraft SAR incident is considered imminent or actual when:

a. a SARTIME for an aircraft has not been cancelled;
b. an aircraft fails to report arrival or if it has failed to report position, when ATS declare an ALERFA;
c. information is received that an aircraft on which no flight notification has been lodged is missing, including notification from a person or organization holding a Flight Note;
d. an aircraft, which has been given approach or landing instructions, fails to land;
e. fuel on board is considered to be exhausted or to be insufficient to enable an aircraft to reach safety;
f. information is received which indicates that an aircraft is about to make or has made a forced landing, or has ditched or crashed;
g. Information is received which indicates that the operating efficiency of an aircraft has been impaired to the extent that a forced landing is likely; or
h. An ELT is reported to be radiating.

3.3. Emergency Phases

Declaration of emergency phases indicates the seriousness of the incident, dictating certain actions. Emergency phase may be assigned by an aircraft pilot, operator, an ATC, a SAR facility initiating SAR action, an RCC and an agency exercising operational control over the craft.

Emergency phases are based on the level of concern for the safety of persons or aircraft. Upon initial notification the notified SAR authority or ATS unit classifies the SAR incident as being in one of the three emergency phases:

a. Uncertainty Phase (INCERFA);
b. Alert Phase (ALERFA); or
c. Distress Phase (DETRESFA).

The emergency phase may be reclassified by the SMC as the situation develops The current emergency phase should be used in all communications about the SAR incident as a means of informing all interested parties of the current level of concern for the safety of persons or craft which may be in need of assistance.

3.4. Alerting Procedures

All the ATC and AFIS units have been designated as alerting posts, and are responsible for the declaration of the appropriate SAR phase whenever they became aware of an aircraft emergency.
All ATC units/FIC and Colombo Radio serves as a collecting point of all information's relating to the state of emergency of an aircraft operating within VCCC SRR.

3.4.1. Actions to be taken by officer on duty at Alerting Post other than ATS Unit

When information's is received related to an aircraft emergency for (or other emergency) the officer on duty at the alerting post shall:

- Interrogate the person giving the information thoroughly, if possible using the sighting/observation report form;
- Notify to the RCC with the best available means of communication;
- Keep in close liaison with the RCC and explore any further information
- Locate the information on the map, and

After receiving the information from the alerting posts RCC shall complete the initial report form, briefing and debriefing report form mentioned in **Appendix M.**

3.5. Uncertainty Phase

The uncertainty phase is assigned any time doubt exists as to the safety of a craft or person because of knowledge of possible difficulties, or because of lack of information concerning progress or position. The keyword is DOUBT.

An Uncertainty Phase is said to exist when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require dispatching of resources. When there is doubt about the safety of an aircraft and persons, the situation should be investigated and information gathered. For aircraft, an Uncertainty Phase is declared when:

a. no communication has been received from an aircraft within a period of thirty (30) minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier; or when
b. an aircraft fails to arrive within fifteen (15) minutes of the last estimated time of arrival last notified to or estimated by ATS units, whichever is the later, except when no doubt exists as to the safety of the aircraft and its occupants; and
c. The evaluation of other circumstances e.g. knowledge that the aircraft is experiencing difficulties, renders it advisable to declare the uncertainty phase.

3.6. Alert Phase

The alert phase is assigned any time apprehension exists for the safety of a craft or person because of definite information that serious difficulty exists which does not amount to a distress or because of a continued lack of information concerning progress or position. The key word is APPREHENSION.

An Alert Phase exists when an aircraft and persons are having some difficulty and may need assistance, but are not in immediate danger.

Apprehension is usually associated with the Alert Phase, but there is no known threat requiring immediate action. SRUs may be dispatched or other SAR assets diverted to provide assistance if it is believed that conditions might worsen or that SAR assets might not be available or able to provide assistance if conditions did worsen at a later time. For overdue craft, the Alert Phase is considered when there is a continued lack of information concerning the progress or position of aircraft. SAR resources should begin or continue communications searches, and the dispatch of SRUs to investigate high-probability location or hoverfly the aircraft's intended route should be considered. Aircraft passing through areas where the concerned aircraft might be located should be asked to maintain a sharp lookout, report all sightings and render assistance if needed. An Alert Phase is declared when:

a. following the Uncertainty Phase, subsequent attempts to establish communication with the aircraft and missing persons have failed or inquiries to other relevant sources have failed to reveal any news;

b. an aircraft has been cleared to land and fails to land within five (5) minutes of the estimated time of landing and communication has not been re-established with the aircraft;

c. information has been received which indicates that the operating efficiency of the aircraft has been impaired but not to the extent that a forced landing or distress situation is likely, except when evidence exists that would allay apprehension as to the safety of that aircraft and its occupants; and

d. an aircraft is known or believed to be the subject of unlawful interference.

3.7. Distress Phase

The distress phase is assigned whenever immediate assistance is required by a aircraft or person threatened by grave or imminent danger or because of continued lack or information concerning progress or position. The key words are GRAVE OR IMMINENT DANGER and IMMEDIATE ASSISTANCE.
The Distress Phase exists when there is reasonable certainty that an aircraft or persons are in imminent danger and require immediate assistance. For overdue craft, a distress exists when communication searches and other forms of investigation have not succeeded in locating the aircraft or revising its ETA so that it is no longer considered overdue. If there is sufficient concern for the safety of a aircraft and the persons aboard to justify search operations, the incident should be classified as being in the Distress Phase. For aircraft, a Distress Phase is declared when:

a. following the Alert Phase, the further unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress;
b. the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety;
c. information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely;
d. information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing, except when there is reasonable certainty that the aircraft and its occupants do not require immediate assistance; or
e. a report is received that a radio distress beacon has been activated or other visual distress signals have been observed.

3.8. Awareness Stage

When a SAR authority becomes aware of a possible SAR incident the SAR system is activated. The information is assessed and coordination is assumed or passed to the appropriate SAR authority for coordination.

Members of the public are encouraged to report any abnormal occurrence they have witnessed or heard about. Notification of an event may reach the RCC from any source including a member of the public, an ATS Unit or through a designated alerting post such as a police station.

For almost all emergency situations, action can be started as soon as the nature and general position of the emergency is known. Additional information, which might be helpful to the resolution of the incident, should be obtained after the initial action has been taken. Communications should be maintained with a aircraft or person reporting an emergency situation and they should be kept advised of the action being taken.

3.8.1. Evaluation of Reports

All reports relating to a SAR operation must be carefully evaluated to determine their validity, the urgency for action and the extent of the response.While evaluation of reports might be difficult and time-consuming, decisions must be made and action taken as quickly as possible. If confirmation of uncertain information cannot be obtained without undue delay, the RCC should act on a doubtful message rather than wait for verification.

The evaluation of reports on overdue or missing craft/persons should take account of:

a. **Communication delays**: In some areas of the SRR, communication delays may prevent timely reporting. This should be kept in mind when evaluating the significance of a report in order to prevent unnecessary activation of the SAR system while ensuring that the SAR response is appropriate should the circumstance be real;

b. **Weather conditions**: Adverse weather may contribute to communication delays or deviations from flight plan; and

c. **Habits of the individual**: Some individuals, including pilots, masters and hikers are known to react or may have been briefed to react in a certain manner in certain circumstances. Knowledge of these habits/company procedures may provide guidance in the evaluation of an incident and the subsequent planning and execution of search operations.

3.9. Distress Alerts

Distress alerts may be received by the RCC from various sources, eg:

a. aural reception of a distress beacon by an aircraft;
b. detection by the Cospas – Sarsat satellite system;
c. receipt through ATS Units;
d. receipt by the Inmarsat system, aeronautical or maritime;
e. direct communications from the public or the distressed craft; or
f. another RCC or SAR authority.

3.10. Notification by ATS Units

For aircraft communicating with ATS unit, then concerned ATS unit responsible will declare the appropriate phase and transfer the phase to RCC in accordance with the agreed procedure. ATS units receives notification of aircraft emergencies through its units in most instances as they are in receipt of information on most flights within their areas of responsibility and are periodically in contact with the aircraft. Each ATS unit has a responsibility to provide an alerting service to all flights known to it.

Air traffic controllers are responsible for providing in-flight-emergency response (IFER) to distressed aircraft with which they are in contact. Alerting procedures for emergency facilities requested by a pilot are an RCC responsibility. ARCC Colombo will be alerted to problems affecting a flight that could seriously jeopardize its safety while en-route through RCC

3.11. Contents of Notifications

The notification from ATS unit to RCC shall contain the following in formations:

a. INCERFA, ALERFA OR DETRESSFA, as appropriate to the phase of the emergency;
b. Agency and person calling;
c. Nature of the emergency;
d. Significant information from the flight plan;
e. Unit which made last contact and means used;
f. Last position report and how determined;
g. Colour and distinctive marks of aircraft;
h. Dangerous goods carried as cargo;
i. Any action taken by reporting office; and
j. Other pertinent remarks.

3. Awareness and Initial Action

3.1. Awareness and Notification

3.1.1. Introduction

When the SAR system first becomes aware of an actual or potential emergency, the information collected and the initial action taken are often critical to successful SAR operations. It must be assumed that in each incident there are survivors who will need assistance and whose chances of survival are reduced by the passage of time. The success of a SAR operation depends on the speed with which the operation is planned and carried out. Information must be gathered and evaluated to determine the nature of the distress, the appropriate emergency phase, and what action should be taken. Prompt receipt of all available information by the RCC is necessary for thorough evaluation, immediate decision on the best course of action and a timely activation of SAR assets to make it possible to:

a. locate, support and rescue persons in distress in the shortest possible time; and

b. Make use of any contribution, if any from the survivors who may still be able to make towards their own rescue while they are still capable of assisting others.

Experience has shown that the chances for survival of injured persons decrease by as much as 80% during the first 24 hours, and those for uninjured persons diminish rapidly after the first three days. Following an accident, even uninjured persons who are apparently able-bodied and capable of rational thought are often unable to accomplish simple tasks and are known to have hindered, delayed or even prevented their own rescue.

3.2. SAR Incidents

Whenever possible, SAR incident data should be collected from the reporting source, with the most important information gathered first in case communication is lost. If, while information is being gathered, the need for an immediate response is indicated, SRUs should be dispatched. There are many different types of incidents reported to the SAR system that must be evaluated and resolved. Most of these incidents may be grouped by the type of craft involved, the environment, and in the case of individuals, by the type of difficulty being encountered.

In general a SAR incident is considered imminent or actual when it is apparent that persons are, or may be, in distress or when a request for assistance has been received.

3.2.1. Aviation SAR Incident

SAR alerting action is based upon the type of notification and flight procedures adopted by an aircraft, ie:

a. aircraft that comply with full reporting procedures where a continuous communications SAR watch is maintained;
b. aircraft that have nominated a SARTIME where alerting action commences at the time of expiration of the SARTIME;
c. aircraft that have not submitted flight notification where alerting action is commenced on the receipt of incidental information from any source which leads to doubt as to the aircraft's safety. This includes notification from a person or organization holding a Flight Note.

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c. information is received that an aircraft on which no flight notification has been lodged is missing, including notification from a person or organization holding a Flight Note;
d. an aircraft, which has been given approach or landing instructions, fails to land;
e. fuel on board is considered to be exhausted or to be insufficient to enable an aircraft to reach safety;
f. information is received which indicates that an aircraft is about to make or has made a forced landing, or has ditched or crashed;
g. Information is received which indicates that the operating efficiency of an aircraft has been impaired to the extent that a forced landing is likely; or
h. An ELT is reported to be radiating.

3.3. Emergency Phases

Declaration of emergency phases indicates the seriousness of the incident, dictating certain actions. Emergency phase may be assigned by an aircraft pilot, operator, an ATC, a SAR facility initiating SAR action, an RCC and an agency exercising operational control over the craft.

Emergency phases are based on the level of concern for the safety of persons or aircraft. Upon initial notification the notified SAR authority or ATS unit classifies the SAR incident as being in one of the three emergency phases:

a. Uncertainty Phase (INCERFA);
b. Alert Phase (ALERFA); or
c. Distress Phase (DETRESFA).

The emergency phase may be reclassified by the SMC as the situation develops The current emergency phase should be used in all communications about the SAR incident as a means of informing all interested parties of the current level of concern for the safety of persons or craft which may be in need of assistance.

3.4. Alerting Procedures

All the ATC and AFIS units have been designated as alerting posts, and are responsible for the declaration of the appropriate SAR phase whenever they became aware of an aircraft emergency.
All ATC units/FIC and Colombo Radio serves as a collecting point of all information's relating to the state of emergency of an aircraft operating within VCCC SRR.

3.4.1. Actions to be taken by officer on duty at Alerting Post other than ATS Unit

When information's is received related to an aircraft emergency for (or other emergency) the officer on duty at the alerting post shall:

- Interrogate the person giving the information thoroughly, if possible using the sighting/observation report form;
- Notify to the RCC with the best available means of communication;
- Keep in close liaison with the RCC and explore any further informations
- Locate the information on the map, and

After receiving the information from the alerting posts RCC shall complete the initial report form, briefing and debriefing report form mentioned in **Appendix M.**

3.5. Uncertainty Phase

The uncertainty phase is assigned any time doubt exists as to the safety of a craft or person because of knowledge of possible difficulties, or because of lack of information concerning progress or position. The keyword is DOUBT.

An Uncertainty Phase is said to exist when there is knowledge of a situation that may need to be monitored, or to have more information gathered, but that does not require dispatching of resources. When there is doubt about the safety of an aircraft and persons, the situation should be investigated and information gathered. For aircraft, an Uncertainty Phase is declared when:

a. no communication has been received from an aircraft within a period of thirty (30) minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier; or when
b. an aircraft fails to arrive within fifteen (15) minutes of the last estimated time of arrival last notified to or estimated by ATS units, whichever is the later, except when no doubt exists as to the safety of the aircraft and its occupants; and
c. The evaluation of other circumstances e.g. knowledge that the aircraft is experiencing difficulties, renders it advisable to declare the uncertainty phase.

3.6. Alert Phase

The alert phase is assigned any time apprehension exists for the safety of a craft or person because of definite information that serious difficulty exists which does not amount to a distress or because of a continued lack of information concerning progress or position. The key word is APPREHENSION.

After evaluating all available information in every case, the RCC should declare the appropriate emergency phase (if not already declared), or review phase as appropriate.

3.12. SAR Incident Information other than ATS units Concerning Emergencies

Any authority or any element of the SAR organization having reason to believe that an aircraft is in emergency shall give immediately all available information to the RCC concerned. Notification that an aircraft has crashed, is overdue or in a state of emergency may therefore reach an RCC from any source, either directly or relayed through an ATS unit and/or an alerting post.

RCC shall, immediately upon receipt of information concerning aircraft emergency, evaluate such information and assess the extent of the operation required. The RCC should declare the appropriate phase of emergency and immediately inform the pertinent FIC / ACC.

The following information, or as much of it as is required to address an emergency situation, should be obtained from the aircraft or the individual reporting the actual or potential emergency situation or incident. As many of the items should be obtained as circumstances permit.

3.13. Incident information

a. name, address, and telephone number or contact point of person reporting;
b. distressed craft (name/type/call sign/registration) or identification;
c. position of emergency (latitude/longitude or bearing/distance) from a known point or the last reported position and the next reporting position);
d. nature of emergency (fire, collision, person overdue, crash or missing etc.);
e. date/time of emergency occurrence;
f. date/time of notification;
g. for aircraft, altitude, attitude, heading, speed and endurance;
h. craft description (size, type, markings, hull, colour of cabin, fuselage colour, tail colour, wingtip colour, unusual features);
i. details of persons on board, persons involved (POB) including number of people involved, ages, state of health, injuries, intentions;
j. date, time and departure point, planned route, speed, ETA and destination;
k. radio frequencies currently in use, monitored or scheduled;
l. emergency radio equipment and frequencies;
m. actual weather conditions;
n. local action being taken or assistance required;
o. owner/agent of distressed craft and contact method;
p. possible route deviations;
q. navigation capabilities;
r. survival equipment including quantity of food/water and signalling devices;
s. other information sources, e.g. friends, relatives, associates, and aero clubs;
t. mobile phone numbers of any person.

3.14. Notification to States of Foreign Persons in Distress

If a foreign registered aircraft is subject to a Distress Phase, that is found not to be a false alarm or is involved in an accident or a foreign national is killed or injured in a SAR related incident, the relevant foreign State is to be notified through the CAASL. The SMC advice should be directed to the CAASL.

3.15. Recording of Events

The RCC shall maintain records for each incident in which all information should be recorded as it is received, either in full or by reference to other permanent records such as flight plans, forms, charts, hard copy messages, recorded radar data etc.

Details of all phases notified to the RCC and all information relating to action initiated by the RCC shall be recorded in chronological order.Where information is contained in other records, (messages, forms etc.), these shall be held in such a way that reference to them may be easily made throughout the operation. All hard copy information shall be retained for filing.

Each day's search activity shall be plotted. The total search area shall be subdivided into sections assigned

to each SAR unit showing individual search patterns, heights and other relevant details. A plot shall be kept of areas searched as well as those not searched.

Records may be kept of the actual hours of operation of search craft, showing individual transit times and times engaged in search and/or rescue activity. These records may be used for assessment of financial claims received from operators.

Records shall be kept of names of all volunteers used in SAR operations on assets tasked by the RCC usually in the form of a manifest

When a search has been terminated without locating a missing aircraft or its occupants, all records, charts etc shall be retained and be accessible to SAR staff to allow easy resumption of search activity should further intelligence be received.

Records relating to search and rescue operations, including air searches, on behalf of other organizations shall be retained.

Records should be retained for coroner's court/civil proceedings and for the possible access of other authorities.

3.16. Sequence of SAR Events

3.16.1. Overview

Since no two SAR operations follow the same pattern, it is not possible to develop comprehensive procedures to apply to all situations. The actions described in the following paragraphs should be interpreted with flexibility as many of the activities described may be performed simultaneously or in a different order to suit specific circumstances.

3.16.2. Uncertainty Phase Initial Action

When the situation of an Uncertainty exists the **ATS Supervisor** shall;

- Recheck ETA calculations
- Declare an uncertainty phase and notify Operator.
- Complete Initial Report Form and notify to RCC
- Maintain close liaison with RCC.

When a SAR authority has declared an uncertainty phase, the **RCC (SMC)** should:

a.) designate an appropriately qualified officer as SMC for that action and assume the responsibilities as SMC;

b.) verify the information received, considering the need to extend inquiries to:

i. landing areas including the aerodrome of departure and other locations close to the route where a subject aircraft might have landed;

ii. aircraft, including the subject aircraft, known to be on the same route, in the same area or within communication range, by way of ATS units, or radio contacts calling or listening out, including monitoring emergency frequencies; and/or

iii. Family, friends, operator of the aircraft, etc.

c.) when no flight plan has been filed or no information is available on the intentions of the captain, attempt to obtain information from which the route and departure, flight and arrival times of the aircraft or other craft may be determined;

d). establish close liaison with alerting units to ensure that:

i. confirm the information and try to get new information, (eg: obtained through widespread communication checks, requests to the public, review of weather factors, etc.), will be made immediately available to the RCC for evaluation, plotting, decision making etc.; and

ii. Duplication of action will be avoided;

e). make use of log and prepare a plot the route of the subject craft, making use of all available intelligence;

f). conduct a communications search and when required, notify other units initial report form) ;

g) determine actual weather conditions along the route and at the destination; and
h.) record all incoming information and progress reports, details of action as described below, subsequent developments and decisions;
i.) request the complete flight plan;
j.) when there is no flight plan, reconstruct the probable track by making use of information received;
k.) make a new evaluation of information received and, if necessary, declare an alert phase.

3.17. INCERFA Check list

The INCERFA check list attached in **Appendix R.** require to fill up by RCC/SMC officer while Declaring an Uncertainty Phase:

3.18. Communication search

The communication search can be conducted by two primary methods:

a.) attempting to communicate with the aircraft or other craft by all means of electronic communications through various paths; and
b) determining the target craft's most probable location by:
   i. making inquiries at aerodromes (including the aerodrome of departure) and other locations where an aircraft might have landed or at locations where aircraft might have stopped or called (including the point f departure); and
   ii. contacting other appropriate sources including persons who may have knowledge of the intentions of the pilot in command

Note: If the communication search indicates that a SAR operation is probable, the RCC should inform relevant SAR facilities and, as necessary, other RCCs.

3.19. Phase Transition

When the communications search or other information received indicates that the aircraft, or other craft is not in distress, the SAR authority will close the incident and immediately inform the operating agency, the reporting source and any alerted authorities, centers, or services. However, if apprehension regarding the safety of the aircraft and its occupants continues, the Uncertainty Phase should progress to the Alert Phase.

3.20. Alert Phase Procedures

When a notification of an alert phase is received from officer in charge of the unit or the supervisor ACC declares himself based on situation he shall:

- Notify RCC and communicate all the information received;
- Maintain close liaison with the RCC.
- Complete the Alert Phase Check list form and distribute to all concerned.

When an Alert Phase has been declared by the SAR Authority the **RCC Chief/SMC** should:

a. initiate or continue any appropriate actions normally performed during the Uncertainty Phase and in particular, ensure an SMC has been appointed and that all interested parties have been informed of the incident;
b. record all incoming information and progress reports, details of action as described below, subsequent developments and decisions;
c. verify the information received;
d. obtain information about the aircraft or from other sources not previously contacted, such as:
   i. communications stations associated with radio navigation aids, radar facilities, direction-finding stations any other communication stations that might have received transmissions from the aircraft;
   ii. all possible landing or stopping points along the intended route and other agencies and assets included in the flight or voyage plan that may be capable of providing additional information or verifying information;
e. maintain close liaison with relevant ATS units and, as appropriate, request that they:
   i. pass information to aircraft involved in the emergency;
   ii. inform aircraft operating in the vicinity of the subject aircraft of the nature of the emergency;
   iii. monitor and keep the RCC informed of progress of any aircraft whose operating efficiency is

impaired;

f. plot relevant details obtained through the actions described above on an appropriate map or chart to determine the probable position of the aircraft and its maximum range of action from its last known position and plot the positions of any aircraft known to be operating in the vicinity;
g. consider initiating en route diversions of other aircraft to attempt to locate or confirm the safety of the target aircraft subject to the agreement of the pilot-in-command/operator and there being no hazard due to weather or other factors including:
    i. the diverted aircraft's operator shall be advised whenever a diversion is undertaken,
    ii. the capabilities of the aircraft considered for diversion including its navigation integrity and range, terrain, weather conditions and any other salient operational factors;
h. thoroughly evaluate the plan, weather, terrain, possible communication aberrations, last known position, last radio communication and operator's qualifications and experience;
i. estimate time of fuel exhaustion and research the craft's performance under possibly adverse conditions;
j. determine all information, reports and orders given and start the plot of the most probable position of the craft and, if relevant, its maximum range of operation from its last known position;
k. alert SAR units and increase their readiness to the possible need for search and rescue action, obtaining relevant details of asset availability; if necessary placing assets on a higher level of readiness
l. notify other SAR authorities, as soon as possible where they are likely to be called upon to conduct search activity;
m. consider the need for military assistance where the situation is judged likely to be beyond the capacity of available civil resources;
n. ensure that the procedures for notification of next of kin of the occupants are implemented;
o. check whether ELT signals are heard in the relevant area and inform associated mission control center in the COSPASS-SARSAT system;
p. obtain recorded radar data from the Approach Control Office;
q. make appeal to the general public through radio, TV, etc,.. for information;
r. inform the operator of actions taken

3.21. ALERFA Check List:

The ALERFA checklist attached in **Appendix S.** require to be completed by RCC/SMC personnel while in ALERFA phase:

3.22. Phase Transition

When information received indicates that the aircraft is not in distress, the RCC will close the incident and immediately inform the operating agency, the reporting source and any alerted authorities, centers or services. If the craft has not been located when all efforts have been completed, or if the time of an aircraft's fuel exhaustion has been reached, whichever occurs first, the aircraft and its occupants should be considered to be in grave and imminent danger. The Alert Phase should then progress to the Distress Phase. The decision to declare the Distress Phase should be taken without undue delay and on the basis of past experience with similar situations.

3.23. Distress Phase Procedures

When a notification of distress phase is received from Officer In charge of ATS unit he or she shall:

- Take action to alert and send appropriate rescue unit;
- Notify and alert traffic in the vicinity of the distress traffic;
- Notify RCC Chief/SMC and RCC Supervisor;
- Maintain communication with the distress traffic if possible;
- Maintain close liaison with the RCC; and
- Complete the DETRESSFA Check list and send to RCC and other concerned units.

When a distress phase has been declared by a SAR authority **RCC/SMC** should:

a. initiate or continue any appropriate actions normally performed during the Uncertainty and Alert Phases;
b. ensure an SMC has been appointed and that all interested parties have been informed of the incident;
c. examine the detailed plans of operation for the conduct of SAR operations in the area;

d. determine the availability of SAR assets to conduct SAR operations and attempt to obtain more assets if a need for them is anticipated;
e. estimate the position of the distressed aircraft, estimate the degree of uncertainty of this position and determine the extent of the area to be searched and if a significant search effort is anticipated, use search planning techniques to maximize the chances of finding the survivors;
f. develop a search action plan or rescue planning as appropriate for the conduct of the SAR operation and communicate the plan to the appropriate authorities;
g. initiate action, activating SAR assets as appropriate:
   i. aircraft may be dispatched from their bases in accordance with the search plan; or,
   ii. aircraft may be diverted in-flight or en-route;
   iii. whenever practicable, aircraft dispatched early should carry droppable supplies (suitable for the environment in which the incident is occurring) unless these aircraft are unsuitable for dropping and/or an unacceptable delay would result to their departure on account of loading.
   iv. In the latter case, droppable supplies should be loaded on a suitable aircraft as soon as possible. Aircraft carrying droppable supplies must be configured in conformance with ICAO ANNEX 12 documentation;
h. amend the plan as the operation develops;
i. notify the State of registry of the target craft;
j. notify Flight Safety Department, as appropriate;
k. at an early stage, request aircraft and other relevant services to:
   i. maintain a listening watch for transmissions from the target aircraft, by voice, survival radio equipment and from an emergency beacon (ELT);
   ii. assist the target aircraft as far as practicable if found; and
   iii. inform the RCC of any developments;
l. maintain close liaison:
i. with appropriate agencies for onward transmission to the target aircraft (if possible) and for traffic coordination,
ii. with other RCCs along the planned route of the target craft as well as those whose SRRs are within the target aircraft's maximum radius of action as determined from its last known position (i.e. the possibility area), ensuring that any information they receive regarding the incident is conveyed to the coordinating RCC; and
m. inform community groups by way of radio and television broadcasts requesting sighting and hearing reports and any other intelligence regarding the whereabouts of the subject craft using established procedures for contacting designated personnel at broadcasting stations and specifying messages in precise form.

The actions to be taken by RCC Chief are;

When a distress phase is declared, the RCC Chief must make sure to:

- Notify the head of SAR service, The Director General of Civil Aviation
- Notify the operating agency
- Decide on a plan of action and inform as appropriate:
  - The aircraft in distress
  - ATS unit for traffic coordination purpose.
  - Any other RCC associated with the planned route of the aircraft as well as those whose SRRs lie within the radius of action of the aircraft as determined from its last known position
  - Decide on probability area and search area
  - Organize the RCC/RSC or ATS units
  - Inform and give orders to the crews of SAR units
  - Direct SAR services that may exists

- Immediately initiate action by search and rescue units in accordance with the appropriate plan of operation;
- Ascertain the position of the aircraft, estimate the degree of uncertainty of this position, and, on the basis of this information and the circumstances, determine the extent of the area to be searched;
- Through the appropriate ATS units inform all other aircraft, operating in the vicinity of the nature of emergency.
- Notify the operator, where possible, and keep the operator informed of developments;

- Evaluate and plot all incoming information and if necessary reconsider the plan of action.
- Notify other rescue coordination centers, the help of which seems likely to be required, or which may be concerned in the operation
- notify the associated air traffic services unit, when the information on the emergency has been received from another source;
- Request at an early stage such aircraft and other services not specifically included in the appropriate plan of operation and able to assist to:

  1) maintain a listening watch for transmissions from the aircraft in distress, survival radio equipment or an ELT;

  2) assist the aircraft in distress as far as practicable; and

  3) inform the rescue coordination centre of any developments;

- From the information available, draw up a detailed plan of action for the conduct of the search and/or rescue operation required and communicate such plan for the guidance of the authorities immediately directing the conduct of such an operation;
- Amend as necessary, in the light of evolving circumstances, the detailed plan of action;
- Notify the appropriate accident investigation authorities; and
- Notify the State of Registry of the aircraft.

The order in which these actions are described shall be followed unless circumstances dictate otherwise.

3.24. DETRESFA Check List:

The DETRESFA check list attached in **Appendix T.** require to complete by RCC/SMC personnel while declaring Distress phase.

3.25. Incident Closure

When the efforts to locate the aircraft have been successful and further efforts is no more required, the SMC will terminate the operation, close the incidents and immediately inform to operating agency and those concerned units which were activated before.

When, however a search has been prolonged and unsuccessful and it is determined that further search would be no avail, SMC may temporarily discontinue the active participation pending further developments but operations by other concerns may continue. In both cases, a suspended case file should be maintained and regularly screened so that if additional leads develop they may be reactivated without delay.

3.26. Phase transition

When the distressed craft has been located and the survivors rescued, the RCC will terminate the SAR operation, close the case and immediately advise the operating agency, the reporting source and any alerted authorities, centers and services. To ensure that search assets remain under some type of flight following system, the SMC should not terminate activities until all SAR assets have established alternative following plans, where they apply.

3.27. Communication Checks (Whose Position is Unknown)

3.27.1. General

Communication checks are conducted by the SMC when information, in addition to the initial report, is required. A most common situation is where the craft is overdue or unreported. It is the time when detective work is required of the SMC. Communication checks may be conducted prior to, during or after dispatching search units, depending upon the urgency of the incident.

Communication checks involve not only extensive use of various networks to provide additional information, but also may involve physical checks of areas where the craft may be located. Generally the purpose of communication checks is to continue efforts to contact the craft, to determine if the craft is overdue or unreported, to localize the search area, and to get more factual data for evaluation of subsequent SAR action.

Initial communication checks may consist of contacting and checking major facilities within the areas where the craft might be or might have been seen, and is normally conducted during the uncertainty phase. These checks should have a reasonably effective probability of locating the missing craft within a short period of time, if the craft is merely unreported rather than actually missing.

Where initial checks fail to locate the craft, communication checks are to be expanded to check a wider variety of possible sources of information on the missing craft, including physically checking at the possible locations airports

When an aircraft subject to a SAR watch fails to report by a prescribed time, or if an aircraft fails to report, the responsible ATS unit shall:

a. attempt to contact the aircraft direct by calling on normal and alternative frequencies;
b. attempt to contact the aircraft via another aircraft;
c. ascertain whether another unit has received the report; or
d. arrange for other ground units to call the aircraft on normal or alternative frequencies.

3.28. Actions by ARCC Colombo

ARCC Colombo will conduct checks by:

a. contacting aircraft operator, and destination and alternative airports to confirm that the aircraft has not arrived.
b. having physical checks of aircraft parking areas and hangars conducted at uncontrolled aerodromes and airfields;
c. thoroughly evaluating the flight plan, weather, terrain, possible communication delays, last known position, text of radio calls, pilot's qualifications, and the performance of the aircraft under favorable conditions;
d. compute the time of fuel exhaustion if not done earlier;
e. notify the operating agency of the aircraft;
f. assume responsibility for initiating suitable action in accordance with Para. under 3.7 and confer with neighboring RCC so as to designate one RCC;
g. unless otherwise decided by common agreement between RCC's concerned the RCC shall coordinate SAR actions and be responsible for:
   — the region in which the aircraft last reported its position; or

   — the region to which the aircraft was proceeding when its last reported position was on the line separating two search and rescue regions; or

   — the region to which the aircraft was destined when it was not equipped with suitable two-way radio communication or not under obligation to maintain radio communication; or

   — the region in which the distress site is located as identified by the Cospas-Sarsat system.

h. After declaration of the distress phase, the rescue coordination centre with overall coordination responsibility shall inform all rescue coordination centres that may become involved in the operation of all the circumstances of the emergency and subsequent developments. Likewise, all rescue coordination centres becoming aware of any information pertaining to the emergency shall inform the rescue coordination centre that has overall responsibility.

3.29. Designation of the RCC responsible for initiating SAR action

a. When the position of the distress aircraft known:

The responsibility for initiation of SAR operation will be that of the RCC in whose area the aircraft is located.

When the RCC recognizes that the aircraft is continuing its flight and may leave the SRR for which it is responsible, it should:

- alert the RCCs associated with the planned route of the aircraft and pass on all information;
- continue coordination of the SAR operation until it has been notified by an adjacent RCC that the aircraft has entered its SRR and that it is assuming responsibility; and
- remain ready to assist until informed that this is no longer required.

b.When the position of the aircraft in distress is unknown.

The ARCC shall assume responsibility for the SAR operation and consult adjacent RCCs along the route of the aircraft as to which center will assume primary responsibility unless otherwise decided by common agreements.

3.30. Passing of information to aircraft in respect of which an emergency phase has been declared

Whenever applicable, the rescue coordination centre responsible for search and rescue action shall forward to the air traffic services unit serving the flight information region in which the aircraft is operating, information of the search and rescue action initiated, in order that such information can be passed to the aircraft.

3.31. Procedures where responsibility for operations extends to two or more Contracting States

Where the conduct of operations over the entire search and rescue region is the responsibility of more than one Contracting State, each involved State shall take action in accordance with the relevant plan of operations when so requested by the rescue coordination centre of the region.

3.32. Procedures for authorities in the field

The authorities immediately directing the conduct of operations or any part thereof shall:

a) Give instructions to the units under their direction and inform the rescue coordination centre of such instructions; and
b) Keep the rescue coordination centre informed of developments.

3.33. Crashed Aircraft

When it is known that an aircraft will crash or has crashed and the crash position is incidentally reported or known with reasonable certainty, the RCC is required to confirm the crash site and ensure the provision of medical assistance and rescue of the survivors.
Pending assumption of the responsibility for the wreckage by investigating authority, the RCC shall endeavor to arrange a guard at the crash site to prevent interference with the wreckage or with marks made by the aircraft in landing. The Police customarily act as guards. Aircraft crashes that involve fatalities are to be treated as crime scenes from the outset and once survivors have been checked with minimal disruption to the scene, the RCC's responsibility ceases and the scene is then subject to investigation by police under the State law and/or AIU CAASL.

3.34. Health Hazards - Aircraft Accidents

Movement in the vicinity of crash sites can be extremely hazardous for ground parties. Therefore such movements are restricted. Any party willing to visit to the crash site required to take permission from the Investigating authority.

3.35. Procedures at the scene of an accident

When multiple facilities are engaged in search and rescue operations on-scene, the rescue coordination centre or rescue sub centre shall designate one or more units' on-scene to coordinate all actions to help ensure the safety and effectiveness of air and surface operations, taking into account facility capabilities and operational requirements.

When a pilot-in-command observes that either another aircraft or a surface craft is in distress, the pilot shall, if possible and unless considered unreasonable or unnecessary:

a) keep the craft in distress in sight until compelled to leave the scene or advised by the rescue coordination centre that it is no longer necessary;
b) determine the position of the craft in distress;
c) as appropriate, report to the rescue coordination centre or air traffic services unit as much of the following information as possible:

— type of craft in distress, its identification and condition;
— its position, expressed in geographical or grid coordinates or in distance and true bearing from a distinctive landmark or from a radio navigation aid;

— time of observation expressed in hours and minutes Coordinated Universal Time (UTC);
— number of persons observed;
— whether persons have been seen to abandon the craft in distress;
— on-scene weather conditions;
— apparent physical condition of survivors;
— apparent best ground access route to the distress site; and

d) act as instructed by the rescue coordination centre or the air traffic services unit.

If the first aircraft to reach the scene of an accident is not a search and rescue aircraft, it shall take charge of on-scene activities of all other aircraft subsequently arriving until the first search and rescue aircraft reaches the scene of the accident. If, in the meantime, such aircraft is unable to establish communication with the appropriate rescue coordination centre or air traffic services unit, it shall, by mutual agreement, hand over to an aircraft capable of establishing and maintaining such communications until the arrival of the first search and rescue aircraft.

When it is necessary for an aircraft to convey information to survivors or surface rescue units, and two-way communication is not available, it shall, if practicable, drop communication equipment that would enable direct contact to be established, or convey the information by dropping a hard copy message.

When a ground signal has been displayed, the aircraft shall indicate whether the signal has been understood or not by the means described in 3.8.9 or, if this is not practicable, by making the appropriate visual signal.

When it is necessary for an aircraft to direct a surface craft to the place where an aircraft or surface craft is in distress, the aircraft shall do so by transmitting precise instructions by any means at its disposal. If no radio communication can be established, the aircraft shall make the appropriate visual signal.

Note.— Air-to-ground and ground-to-air visual signals are published in Appendix D of this Manual.

3.36. Intelligence Gathering and Assessment

3.36.1. Overview

Information relating to a missing aircraft may be gathered from a variety of sources, in particular from the owner or operator.

A SAR officer shall be appointed as the RCC Intelligence Officer and given the task of seeking information and assessing and verifying information received. Careful and accurate assessment of intelligence information is a vital part of search action and may be instrumental in modifying probability areas, re-prioritizing search activities and adopting revised search strategies.

Symbols for use in plotting intelligence information are as depicted in **Appendix E.**

3.36.2. The phase declaration by RCC/SMC should be declared within the time specified in the following table:

		INCERFA	ALERFA	DETRESFA
For All Flights	Distress Signal Mayday – SOS – A7700			Within 5 min
	Urgency Signal – Pan Pan XXX – ELT		Within 5 min	Depending on the circumstances
	Unlawful Interference – A7500		Within 5 min	Depending on the circumstances
	Loss of both radio (where required by ATC) and radar contact		Within 5 min	Within 10

	Loss of radio contact in the approach phase and within the aerodrome traffic zone / aerodrome vicinity			Within 5 min	Within 10
	Loss of radio contact with aircraft leaving the aerodrome traffic zone / aerodrome vicinity		Within 10	Within 20	Within 30
Controlled flights	Loss of radio contact		Within 10	Within 20	Within 30
Uncontrolled flights	Flight plans submitted	Loss of radio contact (where required by ATC)	Within 30	Within 60	Within 90 min or when remaining fuel onboard is considered exhausted.
		Delay in arrival	Within 30	Within 60	Within 90 min or when remaining fuel onboard is considered exhausted.
	Flight plans not submitted		Depending on the circumstances		

Time Limit of Three Phases of Emergencies

S.No.	Nature	Airspace	Uncertainty	Alert	Distress	Responsibility
1.	No Radio Contact	Controlled	H+20	H+35	H+65	Unit Concerned
2.	,, ,, ,,	APP, CTR, TMA	-------	H+5	H+10	APP, TWR, ACC
3.	,, ,, ,,	Uncontrolled	H+30	H+60	H+90	FIC, ACC

Note:
H: means the time at which two ways radio communication should have taken place.

The sequence of events required to be done by ATS units, RCC and SAR units and SAR Committee from H hour are mentioned in **Appendix P.**

SEQUENCE OF EVENTS FROM "H" HOUR

Timings	FIC/ACC	RCC	SAR Unit	SAR Committee
H to H +30	Attempt to contact A/C informs all Alerting posts Notify RCC	Collect information and Liase	NIL	NIL
H+30	Inform RCC	Declare INCERFA Inform SAR unit and SAR Committee	Crew in-formed and on stand by	On stand by
H+60	Inform RCC	Declare ALERFA Inform SAR unit and SAR Committee. Brief SAR SMC	Crew assemble at ops room & plan A/C prepared	Meet and Inform CAASL HQ

H+90	Inform RCC	Declares DISTRESSFA Inform SAR Unit	Coordinate & guide SAR patrol (air)	Liase
During SAR Mission & If in maritime area	Provide information/ Communication	Direct and coordinate in consultation with the SAR Committee	Coordinate & guide SAR. Patrol (air) Patrol(SEA) SLN	Liase
Location & Condition Found	Provide information/ Communication	Coordinate with SAR Committee & activate rescue. Terminate the operation. Completion of mission and report.	Take part in rescue if Required. Guide SAR	Help Plan rescue & obtain assistance from CAASL
Location and condition Not found	Provide information/ Communication	Terminate the operation and report	Return to base	Report to CAASL

3.37. Sighting and Hearing Reports

When even an approximate position of a missing aircraft is not known, it is usual to arrange for a broadcast to be made over radio and, in some cases, television channels requesting information from members of the public who may have seen or heard the aircraft.

In composing a message for broadcasting, some significant feature of the aircraft should be transmitted with the description, thus enabling a better assessment to be made of the validity of reports received. Care should be taken in specifying the calling telephone number to avoid engaging vital RCC lines.

The aim of a broadcast is to promote the best reception of Sighting and Hearing reports from a defined area. The SMC, or delegate, will contact the police headquarters in the relevant State or District Administration and discuss an intention to request public assistance

The SMC will discuss the area to be covered by the broadcast, the frequency of the broadcast and its duration. Be very specific about the area you desire to be covered by the broadcast. Radio provides the quickest local coverage. Television may be very complicated and difficult to handle. All broadcasts are to be faxed to the police centre.

The SAR authority should be informed when a broadcast is issued. When PR is present in the RCC it may be more advantageous and expeditious to have them request a broadcast to a local station. If this occurs the police shall be advised.

If appropriate, a sighting/hearing cell will be established to receive, plot and assess the information.
A Sighting and Hearing Report should be completed for each call taken. Each report should be entered in the Sighting and Hearing Log and a plot of all reports kept on the applicable map.

RCC staff should be prepared to receive a large number of reports in the period immediately following a broadcast. Sighting or Hearing Report Forms should always be used to record reports of aircraft being seen or heard to ensure that vital information is not omitted.

3.38. Assessing Reports

To assist in the assessment of reports and to eliminate those that relate to other aircraft, every effort should be made to establish the movements of all aircraft that would have been operating in the same general area as the missing aircraft in the same time period. A general description of such other aircraft, including their colour schemes, is necessary to assist the process of evaluation.

In addition to seeking reports on the missing aircraft, it may be necessary to broadcast a request for information about, and descriptions of aircraft that were flying in the subject area at the appropriate time and for which flight details had not been lodged.

Reports that cannot be related to a known movement of aircraft other than the distressed aircraft shall be individually assessed and categorised as reliable, unreliable or doubtful.
A plot should be made of all reports. Those considered to relate to the missing aircraft shall be highlighted.

It may be good procedure to interview the originators of some reports a second time, either to confirm the original details, or to gain additional information.

3.39. Interviewing Witnesses

Care must be taken in the selection of a person to interview witnesses. Consideration should be given to the use of specially trained officers, eg: the police.

a) When interviewing witnesses, the following points should be kept in mind:

b) The interview should be conducted as soon as practicable after the event. Many people forget important facts quickly and are influenced by other opinions, press reports, etc.;

c) The interviewer should know the subject, be aware of the details reported previously, and have questions prepared in advance to clarify points on which further information is required;

d) After identifying himself, the interviewer should explain the purpose of the Interview clearly;
e) Persons being interviewed should be asked to give a personal account of events without coercion or suggestion. They may then be asked questions designed to solicit other facts;

f) When possible, statements should be tested by related occurrences, eg. The distance of the aircraft from the observer by weather phenomena such as visibility and cloud base; the time of observation by the extent of daylight, position of the sun or radio program; and

g) If witnesses are not clear about particular aspects, they may be left to consider the incident further and be given opportunity to contact the RCC should additional information subsequently come to mind.

h) Reports assessed as reliable may form a basis for modifying or extending the probability area. SMCs should, however, guard against neglecting the search of previously established search areas merely on the basis of such reports. Many compelling reports from the public have proven insubstantial.

3.40. Coordination with the Police

It is possible that the police will receive incidental reports from the public that may be of value to the search effort. It is essential that the police in the search area are made fully aware of the search activity and the need to pass all relevant reports and information to the RCC as soon as possible.

3.41. Examination of Recorded Communications

At an early stage in the search action, ATS communication records and/or tapes shall be examined for any data relating to the missing aircraft.
Radar tapes and tape recordings of frequencies used or possibly used by the missing aircraft shall be replayed

A discrete recording should be made of exchanges between the subject aircraft and other aircraft and ground stations during the time of flight. The recording should then be made available to the RCC.

When an aircraft disappears without a distress call having been received on the communication channels in primary use, requests should be made to other units to have tapes and written records examined to determine if transmissions were recorded from the missing aircraft on any other channels.
The assistance of specialist communication staff may be sought for transcription of dialogue from tape recordings.

3.42. Flight Path Analysis

In addition to information reported by the public, it is often possible to reconstruct a probable flight path from information contained in the flight plan and reports to ATS units of the subject flight's progress.
A detailed study of all available navigational data should be made. Particular attention should be directed to the pilot's application of variation and calculation of headings and speeds.
Mistakes have also commonly resulted from differences between forecast and actual weather.

3.43. Weather Analysis

An analysis of the weather existing at the time the aircraft encountered difficulty and the interaction of weather and terrain should be made. The opinion of meteorologists should be sought in this respect, as should the views of suitably experienced qualified pilots.

Effort should be made to obtain reports of in-flight conditions from pilots who were in the area at the time the aircraft encountered difficulty.
It is conceivable that a likely plan of action adopted by the distressed pilot can be deduced from these data of intelligence; decisions regarding priority of search effort may follow.

3.44. General Considerations for the SMC

SMC duties can be demanding. The gathering of information, evaluation of this information and initiation of action all require concentrated effort on many details.

The SMC will find the various forms, checklists, etc in the appendices to be very helpful. The following paragraphs provide some general guidance for the early stages of a SAR operation, including information gathering and preparation for the possible need to plan searches.
Several factors will influence the extent and manner of an initial SAR response. In general these are the:

a. extent and reliability of information about the location of the distressed craft and its occupants;
b. availability of aircraft and land parties for searching;
c. actual and forecast weather conditions;
d. times of daylight/darkness;
e. nature of terrain;
f. availability of survival supplies and supply dropping teams.
g. Time delay in notification.

3.45. Urgency of Response

Evaluating incidents to determine the urgency and the extent of required SAR response, or the termination of response is a function requiring information, judgment and experience. In emergency situations requiring immediate assistance, the action taken must be accomplished quickly and positively. Where uncertainty exists, evaluation is usually more difficult and time consuming because of the many factors involved.

Perhaps the most difficult task the SMC undertakes is the evaluation of these factors. They usually become apparent between the time the incident is reported and the execution of the search. This is a time when speed and reliability will be most important; however it is also a time when incident reports may be incomplete or confused.

The most serious limitation is time. When persons are injured or are subjected to adverse climatic or water conditions, the chances of survival decrease rapidly. Time limitation also may be dictated by the number of hours left for a daylight search, although the SMC should not arbitrarily rule out night search, especially in unpopulated areas and over flat terrain.

The facilities available to conduct a search may be limited by lack of available personnel and search assets. The SMC must be aware of availability of SAR facilities within their region.
Terrain, and weather conditions can affect all areas in SAR planning and operations. Search visibility, aircraft limitations, search effectiveness, safety of flight and time available to complete the search are some of the

factors that will affect search capability.

Whenever practicable, pertinent data should be plotted on a chart to aid in evaluating related factors.

Normally the SMC determines the urgency and extent of SAR services required for an incident. A rapid but systematic approach is essential since prompt response to emergency incidents is the essence of the SAR system.

3.46. General Time Factors

The probability of finding survivors and their chances of survival diminish with each minute after an incident occurs. Prompt positive action is required so that no life will be lost or jeopardized through wasted or misdirected effort. Individual incidents will vary with local conditions such as terrain, climatic conditions, ability and endurance of survivors, emergency equipment available and SAR units available to the SAR system.

In the case of seriously injured survivors or survivors in a hostile environment, the reaction time of the SAR system must be measured in minutes. Critically injured survivors of any accident usually die within the first 24 hours if not given emergency medical care.

3.47. Daylight Factor

For survivors not equipped with any type of detection aids daylight visual search is usually the only search method available to the SMC. If darkness were approaching this would be another limiting factor for the SMC to consider.

3.48. Night Factor

If it is known or suspected that the survivors have detection aids such as pyrotechnic flares or other night signalling devices or can display other lights, night searches should always be conducted. Night searches, visual and electronic are particularly effective at over sparsely populated areas, flat terrain.
Night aural and visual search should be considered. Modern electronic detection methods may be effective in locating targets. The capability of these devices should be discussed with the operators of the equipment

3.49. Survival Environment Factors

The environment in which the survivor is exposed is another factor that limits the time available to complete their rescue. In some cases, environment will be the most time critical of all. Climatic atlases are useful to evaluate probable climatic conditions in regions where few or no weather reporting facilities are available.

The relation of survival time to water temperature, air temperature, humidity and wind velocity is not a simple one. These and other factors often exist in combination to complicate the problem of estimating life expectancy of survivors. Individuals will vary in their reaction to cold and heat stresses.
Additional factors which will vary a survivor's life expectancy include the type of clothing worn, the clothing's wetness, the survivor's activity during their exposure, initial body temperature, physical conditions, thirst, exhaustion, hunger, and various psychological stresses such as isolation, loneliness and remoteness, and the all-important individual will to live.

The graphs at Figures 3.1 and 3.2 are provided to assist the SMC in determining the urgency required to remove survivors from the environment, and to assist in evaluating the practicality of terminating a search. These graphs are based upon case histories, field tests, laboratory experiments and analysis of all known data.

However, the SMC must understand that some individuals will exceed the life expectancy or tolerance times indicated in these figures, and therefore should consider these figures as helpful guidelines rather than absolute controlling factors.

3.50. Hypothermia

Hypothermia is the abnormal lowering of internal body temperature (heat loss) and results from exposure to the chilling effects of cold air, wind or water. Death from hypothermia may occur in both land survival and water survival situations including wind situation.

Internal body temperature is the critical factor in hypothermia. If the body temperature is depressed to only 35°C, most persons will survive. If the body temperature is depressed to approximately 33°C, most persons

will return to useful activity. At about 32°C, the level of consciousness becomes clouded and unconsciousness occurs at 30°C. Only 30 percent would be expected to survive these temperatures. At body temperature depressions of 26°C and below, the average individual will die and ventricular fibrillation (heart attack) will usually occur as the final event. However in some cases individuals have survived with body temperatures as low as 17°C. The warmest ocean water that can be expected at any time of the year is 29oC. About one third of the earth's ocean surface has water temperatures above 19oC.

The following Figure. displays predicted calm-water survival time, the time required to cool a lightly clothed, non-exercising human to 30oC in cold water. Figure below shows a line for the average expectancy and a broad zone that indicates the large amount of individual variability associated with different body size, build, fatness, physical fitness, and state of health. The zone would include approximately 95% of the variation expected for adult and teenage humans under the conditions specified. Factors that slow the loss of body heat are: high body weight, heavy clothing, survival clothing, or the use of a huddling or other protective behavior. Factors that make a person lose body heat faster are: low body weight, light clothing, or exercising (such as the situation where a survivor without lifejackets must swim to stay afloat). Specialized insulated protective clothing, such as immersion suits or wet suits, is capable of increasing survival time from 2 to 10 times the basic duration shown on the figure.

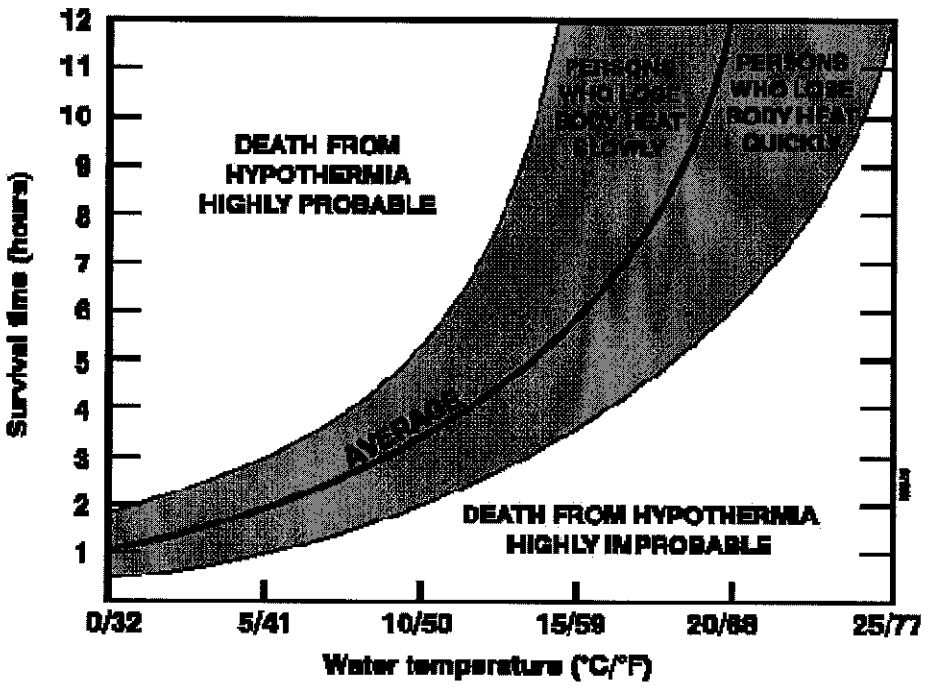
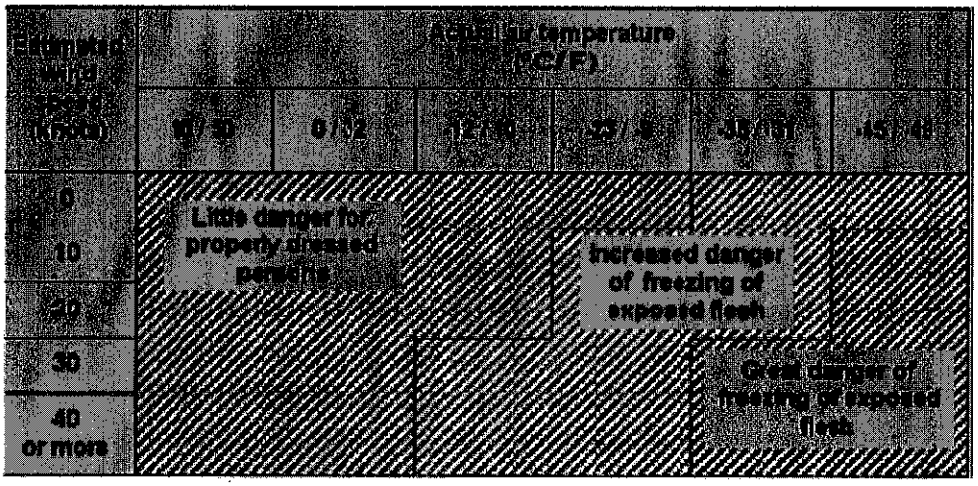


Fig..... Water Chill and Hypothermia

Figure below depicts the effects of various wind speed and air temperature combinations. The straight-line relationship between air temperature and the logarithm of D wind speed allows simple interpolation of the intermediate temperatures. The shaded areas represent wind speed and temperature combinations that would cause freezing of any exposed skin.



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3.51. Survivor Stress Factors

Two basic assumptions are to be made concerning survivors of a distress incident:

a. there are always survivors who require emergency medical care; and
b. they are under a condition of great stress and experiencing shock.

It may also be assumed that not even able-bodied, logical-thinking survivors will be able to help themselves.

Records include numerous accounts where supposedly able-bodied, logical-thinking survivors failed to accomplish extremely simple tasks in a logical order, and thus hindered, delayed or even prevented their own rescue.

This is due to shock that, following an accident, is often so great that even those of strong mind think and act illogically. All survivors will be in some degree of shock. Some may be calm and somewhat rational, some may be hysterical and in panic, while the remainder will be temporarily stunned and bewildered.

This last group will generally have passive attitude and can be easily led during the first 24 hours after the incident. As the shock wears off, most of them will develop active attitudes. Those that do not develop active attitudes will die unless rescued quickly.

Individuals who observe an emergency situation and reporting it to the SAR system should also be considered as being under stress. Many times it will be necessary for SAR personnel to specifically request essential information from an individual reporting an emergency. This situation should be expected and SAR personnel should be prepared to cope with it.

3.52. Terrain Factors

Terrain may be a major factor in evaluating an incident. Terrain may dictate the type of search pattern required, and may limit the selection of search aircraft that can be used. Aircraft that are highly maneuverable and will be effective at moderately high altitudes may be required in rugged mountain areas. High performance or large transport aircraft may be unusable in confined areas and helicopters may not be able to operate in the thin air and turbulence associated with mountains and contour searches.

Terrain may also limit the time available for search. For example low-level searches in mountain areas are normally limited to daylight only. The type of survival kit carried by the distressed craft and the equipment, such as the type of hoist device used by available helicopters will also be influencing factors. Dense foliage may hamper both visual and electronic searches and require increased numbers of aircraft and closer search track spacing.

Man-made additions to the terrain such as power-lines, towers and bridges must also be considered when

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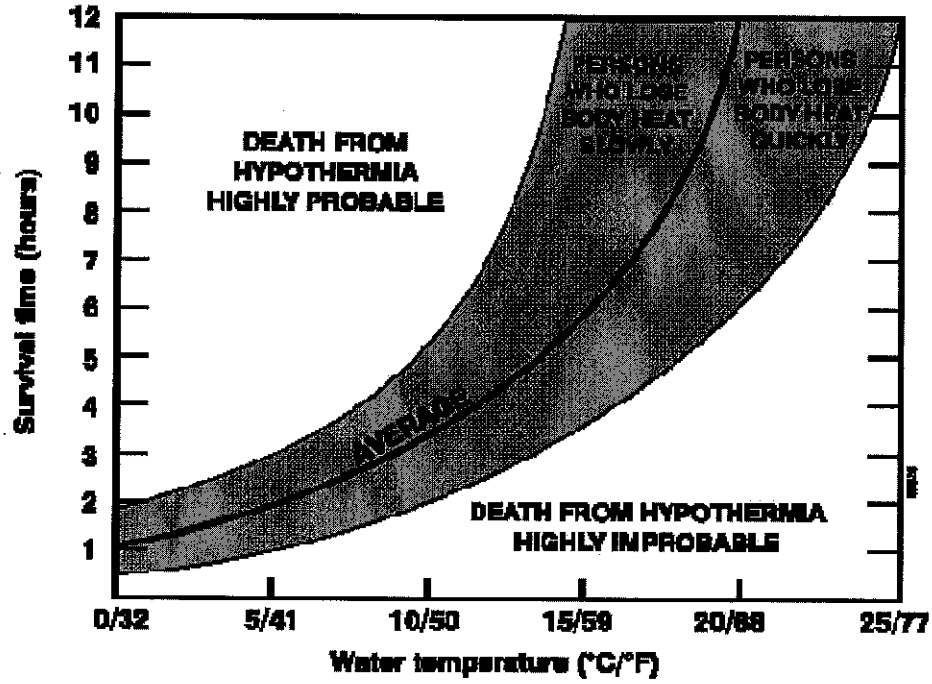

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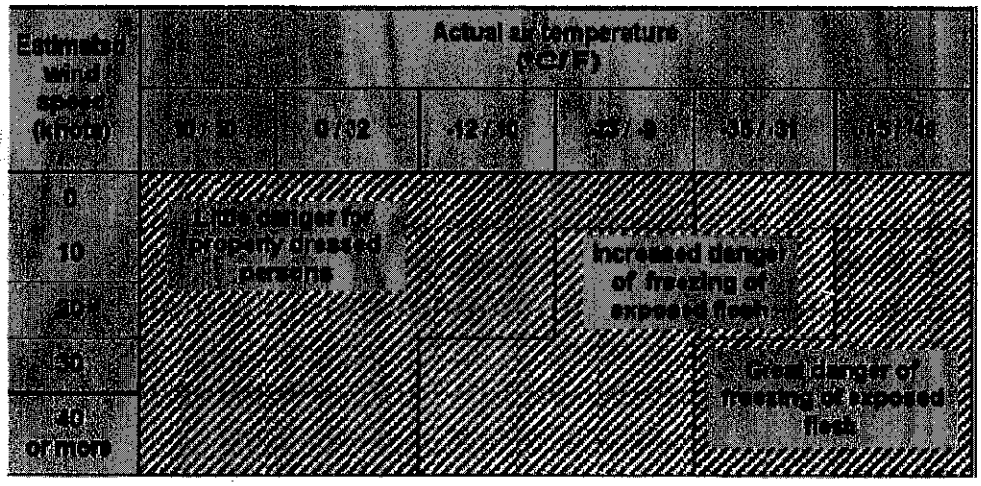

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Man-made additions to the terrain such as power-lines, towers and bridges must also be considered when

planning search areas and the altitudes of search aircraft.

The type of rescue team used after the distress site has been located is also dependent upon terrain. When there is doubt about survivors or the area is inaccessible, time is a factor. Should other help not be readily available, airdrops or parachutists may be required. Before deploying parachutists, the ability for them to land, to be resupplied and recovered must be considered

3.53. Available Search Asset Factors

During the prosecution of any SAR mission the SMC will have assets at their disposal whose primary mission is not SAR but who have SAR capabilities.

It is of primary importance that the SMC fully understands the limitations of all facilities available in their region if they are to be effectively used. The number, types, equipment and experience of available search units will limit the courses of action available to the SMC.

In addition there may be instances when all available crews are either committed to other operations, in the case of flight crews or have expended their maximum authorized crew duty time.

Some time is usually required for a suitable search unit to arrive on-scene, therefore search unit maximum speed for short distances or normal cruising speed for long distances is a factor. The search unit's range will determine both the maximum distance it can proceed from its operating base and its on-scene endurance. The search unit's communication capability for working with the SMC, other search units and the distressed craft must be considered.

The search units' navigation capability will influence the areas to which it can be assigned, since accurate navigation in search areas is essential for effective coverage.
The search unit may carry detection sensors and its ability to carry equipment that may be required on-scene should be considered. However, operating limitations of the search unit will override all other factors. These include such things as turbulence, icing and instrumentation for aircraft.

3.54. Survival Equipment Factors

The amount and type of survival and signaling equipment available to the survivor will influence not only the urgency of the SAR system's response, but also the methods and procedures employed in various SAR stages.

The SMC may concurrently conduct a high level electronic search and a visual search. The SMC must use their common sense, good judgment and background experience to evaluate the appropriate response for taking advantage of the survivor's capability to signal and survive.

3.55. Risks v Gain Factors

SAR facilities are responsible for taking whatever action they can to save life at any time and place where their facilities are available and can be effectively used. Nevertheless, there may be a point beyond which SAR services are not expected and cannot be justified. Known and inherent risk must be carefully weighed against the mission's chances for success and the gains to be realized.

SAR personnel and equipment shall not be placed at risk, nor the mission attempted, unless lives are known to be at stake and the chances for saving lives are within the capability of the personnel and equipment available.

All reasonable action shall be taken to locate distressed personnel, determine their status and bring about their rescue. Prolonged SAR operations after all probability of survival has been exhausted are uneconomical and not warranted. The decision to conduct such operations must be based on probability of detection.

Studies have shown that the period within 12 to 24 hours of a distress incident is the most critical for recovery of survivors. The best chance of successful recovery occurs during this time period. Within 48 hours, chances are still good, but after that time the chance of successful recovery decreases rapidly.

4. Search Planning and Evaluation

4.1. Overview

Search planning is necessary when the location of a distress is not known, or significant time has passed since the search object's position was known. The SMC is responsible for developing and updating an effective search plan. The plan may involve a single SRU or many SRUs searching for several days.

Search planning consists of determining datum (the most probable location of the search object) and search area, selecting search patterns, planning on scene coordination, transmitting search plan to OSC/SRU and reviewing the search plan.

For inland cases, search area is normally dependent on the environment. Natural boundaries, injuries and other hard-to-quantify factors affecting movement are important in search area decisions.

The wellbeing of survivors is critically dependent on early location and support. It is vital that as soon as possible after becoming aware of an incident, SAR authorities quickly implement procedures for a rapid search of the most likely area of distress. In general, the initial SAR response requires ready application of simple procedures to quickly cover the most likely area of distress. The search area described will be of rudimentary construction, e.g. a circle, square or rectangle depending on the nature of the distressed craft's operation. The area will be of sufficient proportions to cover all reasonable alternative tracks of the distressed craft and will incorporate areas highlighted by intelligence information. This strategy precedes the more complex calculations that will give rise to a more precise area which, failing the success of stage one search will form the basis for a formally planned and executed action at a later time. The stage one search may be undertaken in relatively short time and allow ready allocation and briefing of the few necessary resources.

All of the basic search theory concepts are described in this chapter. Practical examples are provided for each concept, showing how it may be applied to the search-planning problem. These examples require only basic arithmetic skills and an understanding of the basic probability concepts encountered in everyday life. Although search planning may be perceived to be complex, each step is relatively simple.

Note: It is essential when planning commences for search operations that rescue planning is commenced as outlined in the following Chapter. This is to occur as a concurrent action. Rescue planning forms an integral part of the Search Planning.

4.2. Search Planning Steps

Search planning involves the following steps:

a. evaluating the situation, including the results of any previous searching;
b. estimating the distress incident location and probable error of that location;
c. estimating the survivors' post-distress movements and probable error of that estimate;
d. using these results to estimate the most probable location (datum1) of survivors and the uncertainty (probable error of position) about that location;
e. determining the best way to use the available search assets so the chances of finding the survivors are maximized (optimal search effort allocation);
f. defining search sub-areas and search patterns for assignment to specific search assets; and
g. providing a search plan that includes a current description of the situation, search object description(s), specific search responsibilities to search facilities, on-scene coordination instructions and search asset reporting requirements.

These steps are repeated until either the survivors are located or evaluation of the situation shows that further searching would be futile.

4.2.1. Evaluating the Situation

Searching is the most expensive, risky and complex aspect of the SAR system. Often it is also the only way survivors may be located and assisted. All information received about the incident must be carefully analyzed and evaluated before a search is undertaken and at frequent intervals during its progress. In the early stages of a SAR incident, it is almost certain that the SMC will need to make some assumptions about the nature, time or place of the incident. It is very important that such assumptions be kept separate from the known facts. It is important to distinguish conclusions based on known facts from those based partially on

assumptions. It is also important to re-evaluate all assumptions regularly and as new information becomes available. Any assumption, which is allowed to go unquestioned for too long a period, begins to falsely assume the appearance of fact, and can compromise the search effort.

Some of the clues that may indicate the survivors' location or situation include:

a. intentions;
b. last known position;
c. hazards;
d. condition and capabilities;
e. crew behavior;
f. on scene environmental conditions; and
g. results of previous searching.

N..: The term datum is used extensively in this chapter to mean a geographic point, line or area used as a reference in search planning.

4.3. Estimating the Distress Incident Location

The first step in land search planning is to determine the limits of the area containing all possible survivor locations. This is usually done by determining the maximum distance the survivors could have travelled between the time of their last known position (LKP) and the known or assumed time the distress incident and drawing a circle of that radius around the LKP. Knowing the extreme limits of possible locations allows the search planner to determine where to seek further information related to the missing craft or persons and whether an incoming report might apply to the incident. However, systematic search of such a large area is normally not practical. Therefore, the next step is to develop one or more scenario/s or sets of known facts plus some carefully considered assumptions, describing what may have happened to the survivors since they were last known to be safe. Each scenario must be consistent with the known facts of the case, have a high likelihood of being true and allow the search planner to establish a corresponding geographic reference or datum for the survivors' most probable position (MPP).

Three possible situations may exist with respect to the location of a distress incident when it is reported.

4.4. Approximate Position Known.

The incident may have been witnessed: reported as a navigational fix by another craft or the craft in distress; or computed by the SMC as a dead reckoning position from a previously reported and reliable position of the craft in distress.

4.5. Approximate Track Known.

The craft in distress may have filed a trip or voyage plan prior to departure that included the intended track or route but the craft's actual position along the track is unknown. A single line of position, such as a flare sighting or DF, should be treated the same as a track known situation.

4.6. Approximate Area Known.

When neither the position nor the intended track are known, at least an area that the craft in distress was probably within can usually be determined. The SMC should try to reduce this area to an area of high probability that can be used as the initial search area or, if the area is small enough, use it.

4.7. Datum Definition

The most probable location of the search object, corrected for movement over time is known as datum. The datum is the geographic point, line or area used as a reference in search planning. A datum for the initial distress incident is first estimated from the known facts of the case and possibly some assumptions that have a high likelihood of being true. This datum for the distress incident is then adjusted to account for estimates of post-distress survivor motion, either through effects of drift or possible movement of survivor over land, at any particular moment during the incident. Finally, the level of uncertainty about the new datum is evaluated and limits are estimated for the smallest area containing all possible locations consistent with the scenario on which the new datum is based. This area is called the *possibility area* for that scenario.

4.7.1. Datum Point Definition

A datum point is the datum developed at a specific time when the initial position of the search object is known.

4.8. Datum Line Definition

A datum line is the line connecting two or more datum points computed for the same specified time, along which the search object is assumed to be located with equal probability. The most common instance when a datum line is developed is when the initial location reported of the search object falls within the track line-known category.

4.9. Datum Area Definition

A datum area is an area in which the search object is assumed to be located with equal probability throughout the area. A datum area is most often necessary in those incidents in which there is no initial position or track line known.

4.10. Drift Definitions

Drift is vectorial movement, (direction and distance), of the search object caused by momentum, drag, wind, water and other external forces.

Drifts caused by wind and water currents must be continually recomputed during an incident to correct the datum as the errors become greater with the passage of time.

4.11. Recomputed Datum

Datum is computed periodically during a search incident when drift forces continue to affect the position of the search target. These recomputed datums are usually labeled sequentially:

Datum1, Datum2, and Datum3, etc.

4.12. Datum Search Planning

The first step in search planning is to determine Datum. Datum calculations begin with the reported position of the SAR incident. The initially reported location may be a position, a line or an area.

4.13. Drift Corrections

External forces may move a distressed craft or distressed person away from the initial position of distress. These include such things as wind and water.

4.14. Search Stages

A search typically involves three stages:

Stage 1 Immediate response. An initial visual and/or electronic search along the missing craft's planned route.

Stage 2 Nominated areas either side of track. Normally a search conducted in an area 10 nautical miles either side of track but this can be varied depending on circumstances.

Stage 3 Mathematically derived area. An expanded search of a probability area calculated using the navigational tolerances of the missing and search craft, allowing for drift if applicable and the application of a safety factor.

Stage 1 and 2 searches can be run concurrently. By way of example, if a Distress incident occurs at the end of daylight or during the night, when the first visual search cannot be undertaken until the following day, then it may be appropriate to conduct both stages simultaneously.

Note that an essential part or any search stage will be the establishment of a rescue plan, coordination with the Police and consideration of the early dropping of SAR datum buoys.

Some emergency situations will suggest a still more spontaneous reaction. Where a craft reports encountering a distress situation, the location is reasonably well known and there are other craft in the near vicinity, it may be possible to divert an asset to the area or intercept the distressed craft's track with instructions to undertake a track crawl search along the known route.

If circumstances allow, the diverted asset may be instructed to proceed parallel to the distressed craft's track at an appropriate off-set distance and to return at the same off-set distance on a reciprocal heading. Such a procedure can provide coverage of the distressed craft's track and the most likely lateral area either side of it. Whether this is practicable will be dependent on such factors as endurance of the diverted craft, its suitability for the task, weather, daylight and terrain. The pertinent factors should be discussed with the crew of the diverted craft prior to tasking.

In other types of situations, a similarly rapid response may be made by tasking an airborne aircraft or one ready for departure at a nearby aerodrome to undertake a square or sector search around a known distress position. In any case, the imperatives of this response are:

a. Rapid assessment of the type of emergency circumstance;
b. Early assessment of the most likely position of distress;
c. A quick appraisal of readily available assets;
d. Rapid determination of achievable effort in the prevailing circumstances;
e. Consultation with crew well placed to assist;
f. Dispatch or diversion of SAR unit asset(s) without delay;
g. Deployment of rescue platform(s)

4.15. Factors Affecting Initial SAR Response

4.15.1. Overview

As discussed in the previous Chapter there is a wide spectrum of factors that may influence the extent and manner of an initial SAR response. To summarize some of the more important ones:

a. Extent and reliability of information about the location of the distressed craft and its occupants;
b. Availability of aircraft and land parties for searching;
c. Actual and forecast weather conditions;
d. Times of daylight/darkness;
e. Nature of terrain;
f. Availability of survival supplies and rescue assets

4.16. Location of a Distressed Craft

If the craft is in radio communication, or reports have been received from other sources, the problem of where to search is simplified and may only require the calculation of a DR position. However, should a craft disappear without a distress call being received, the following assumptions are made:

a. that the craft is probably between the last reported position and its destination; and
b. that the craft is most likely to be found on the section of the planned track between the last reported position and the position where the next report was due.

The possibility of a communications failure, and a subsequent diversion should not be overlooked. The operating agency should be questioned concerning policy as to diversion.

New intelligence information may cause the SMC to re-evaluate the assumptions made during the initial planning phase. The possibility of these evolutionary changes to search strategy should not, however, dissuade a SMC from basing initial search procedures on the above assumptions as long as there is, at that time, no indication of contrary tracking by the distressed craft.

When conducting an initial response, it is not necessary to draw up a probability area accurately based on the navigational history of the distressed craft's route, nor is it normally necessary to take water movement into account, unless the interval between the Last Known Position Time and the estimated time of arrival of search units at the scene is longer than four hours. This will vary in high drift areas and the SMC may make an arbitrary allowance in the first instance, which may be applied until an accurate probability area is calculated in readiness for a more intensive search.

The terms "Last Known Position" and "Last Known Position Time" are used when referring to last known

position and associated times. For simplicity, they are used to describe both land and water positions.

4.17. Initial Search Procedures

When the distress position is not known with certainty, the procedure most frequently used first is to search along the intended track of the missing craft. If not already completed, inspection of possible landing places should continue. It may be necessary to allocate one or more aircraft to the task of examining those possible landing areas that have not been inspected during the landing site and communications checks. The size of the area to be considered for this purpose will be at the discretion of the SMC, however, he should be guided in determining final limits to landing site checks by the size of the probability area, modified by any pertinent intelligence information.

Unless it is positively determined that the missing craft does not have an emergency beacon, information should be obtained from the MCC on the satellite pass schedule and an aircraft should be quickly allocated to an electronic search. It may be possible to arrange for an electronic search to be flown either before or after some other task but it should be noted that it is not practicable for an aircraft to be tasked for a combined electronic and visual search. All aircraft on visual searches however, as on other tasks, should be briefed to keep a listening watch on 121.5 MHz and 243.0 MHz if UHF equipped, but the maintenance of a listening watch will be supplementary to the primary task. Likewise, an aircraft assigned to an electronic search should be briefed to keep a general look out for visual signals if possible.

In addition to aircraft being tasked to conduct an electronic search, a general request should be promulgated through Air Traffic Services (ATS) for other nonsearch aircraft to monitor 121.5 MHz.

4.18. Aircraft Incident

Studies of SAR incident data confirm that in a majority of situations in which VFR aircraft have crashed without warning, the distress site has been located within a reasonable lateral distance of the intended track.

More precisely, an extensive foreign study has found that 77% of crashed VFR aircraft flying random tracks, e.g. through mountain valleys and over gaps, were located within 5 NM both side of track and 87% within 10 NM.

With respect to VFR aircraft flying straight line tracks, 79% of crashes were located within 10 NM either side of track and 83% within 15 NM.

These statistics may assist in an SMC's decision about the width of the area to be initially searched. In the first instance, the width of area may be dependent upon the number of search hours available from SAR units. If achievable, a common strategy is to initially search for missing VFR aircraft within 10 miles either side of planned track.

4.19. Basic Search Planning

4.19.1.Overview

The planning of a search presents two separate problems:

i. Estimation of the most probable position of the distressed aircraft;
ii. Determination of a search area.

A search plan is required for every mission. It may be a much abbreviated plan for a single search unit, or it may be a complex plan involving a large number of units. In any case, a search plan should always be developed by the SMC, as many lives may depend upon the care with which the search is planned and conducted. When a search mission is required, four factors are of immediate importance to the search unit for conducting their search:

a. An adequate description of the search target;
b. The search area, including weather conditions and any possible risks or dangers;
c. The best search pattern; and
d. The appropriate track spacing.

The SMC will most likely provide much more detailed information to the first search unit to be dispatched to the search area, but the above four items comprise a minimum. The SMC develops the original or optimum

search plan on the assumption that sufficient and suitable search units will be available for conducting the operation. Once the optimum plan is developed, the SMC must make every effort to obtain the services of the search units he needs

4.20. Controlling Factors

When developing a search plan, the SMC must carefully weigh the limitations of time, terrain, weather, navigational aids, search target detect ability, suitability of available search units, search area size, distance between search area and SAR unit staging bases, and the particular POD desired under the circumstances.

As the ability to survive after an emergency is limited, time is of paramount importance, and any delay or misdirected effort will greatly diminish the chances of locating survivors. While thorough mission planning and good conditions for search are desirable, positive and immediate action is also required. The SMC should exercise best judgment and initiate search with a minimum of information and few SAR units while additional data are obtained and more extensive search operations are planned.

Of all the factors involved in search planning, one or more may prove so important in a particular situation that the others can generally be regarded as secondary or even disregarded entirely. These important factors are referred to as the controlling factors, and are the ones given the most consideration when developing the attainable search plan. For example, when only a limited number of SAR units are available, the following relationships might exist between datum, search area, time available and probability of detection (POD):

a. Inaccurate datum requires a larger search area at the expense of time or POD.
b. Limited time available for the search requires a rapid search rate at the expense of the POD
c. High POD requires close track spacing at the expense of area searched or time.

4.21. Determination of Search Areas Planning

Should an initial response fail to locate either the distressed craft or its occupants, it will be necessary to plan and execute an intensive search. The planning of a search may be considered under six broad headings:

a. Determination of the most probable position of the distressed craft and/or its occupants;
b. Delineation of an area large enough to ensure that the survivors are within the area;
c. Selection of facilities and equipment to be employed;
d. Selection of the search procedures to be used;
e. Allocation of search resources;
f. Preparation for rescue.

Additionally, it must be decided what is desirable in terms of search coverage and what may be achievable using available resources.

The most probable position (MPP) of a distress incident may be determined from a position reported at the time of the incident, or by the calculation of a DR position.

The extent of a search area is based on the accuracy with which the position of the occurrence is known. The SMC should take into account such factors as the possible navigation error of the distressed craft and the search craft, meteorological conditions, and drift of the distressed craft or survivors if in the water.

When the location of a craft is not known, a reconstruction of the probable route and some estimation of the most likely position of the incident must be made by the RCC.

Two concepts of value in SAR Planning are the Possibility Area, and the Probability Area.

4.22. Possibility Area

The possibility area is the area in which a missing craft could be located. Usually the area is too big to be considered the search area but knowledge of its extent and boundaries may be of use when assessing intelligence information, in particular sighting or hearing reports.

The possibility area is displayed as a circle drawn around the last known position (LKP) of the craft. The radius of this circle should equal the endurance at the time of the LKP expressed in terms of distance and taking into account wind velocity for aircraft. It is assumed that the craft may have proceeded in any direction

until its fuel was exhausted.

The possibility area may be determined by:

a. for aircraft, drawing a wind vector downwind from the LKP to a scale representing a distance equal to the wind speed multiplied by the known or estimated remaining fuel endurance time, then
b. drawing a circle from the end of the wind vector or drift, of a radius (using the same scale) representing a distance equal to the aircraft TAS multiplied by the known or estimated remaining fuel endurance.

Figure. ..Shows the possibility area for an aircraft with a last known position (LKP) of **A**. Position **B** is the aircraft's datum once the wind vector has been applied. The circle is derived using a radius, centered on **B**, of the aircrafts remaining endurance, which in this example is 150 NM

Where: **A** = LKP, TAS = 100 KTS, Wind/Velocity =180/15 KTS, Fuel Endurance remaining at A = 90 minutes which is equal to 1.5 hrs

Therefore, Distance A-B = 15 KTS x 1.5 hrs = 22.5 NM = (Speed X Time), and
Radius B-C = (100 X 1.5) =150 NM

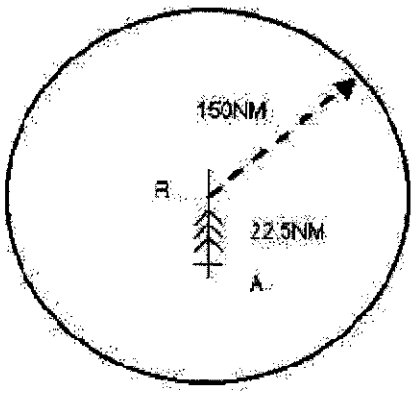


Figure Possibility Area

4.23. Probability Area

The probability area is the area in which a missing craft and/or survivors are most likely to be found, taking into account possible errors in the navigation of the missing craft and of the search craft, together with an allowance for any water movement (should the incident occur on or over water) and a safety factor.

When the position of an incident is reported by a witness, or reported as a navigational fix determined by radar or another craft or by the distressed craft itself, or calculated by the RCC in the form of DR position, the probability area is enclosed by a circle of probability centered on that position, taking into account the applicable above mentioned factors.

In the case of a downed aircraft (see Figure.), joining lines 10 NM either side of the aircraft's known, planned or suspected route will normally form the initial probability area for an aircraft search. The 10 NM may be adjusted to allow for the type of flight, eg a transiting helicopter may be 5 NM either side of track where as a turbo prop or jet aircraft may be 15 NM or more. This is referred to as a Stage 2 search.

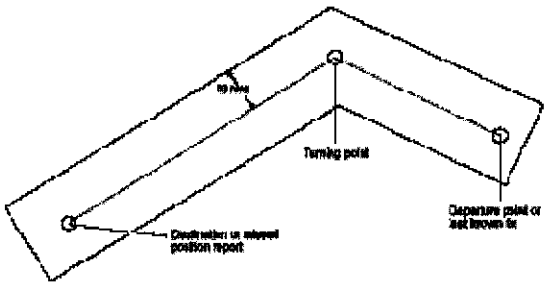
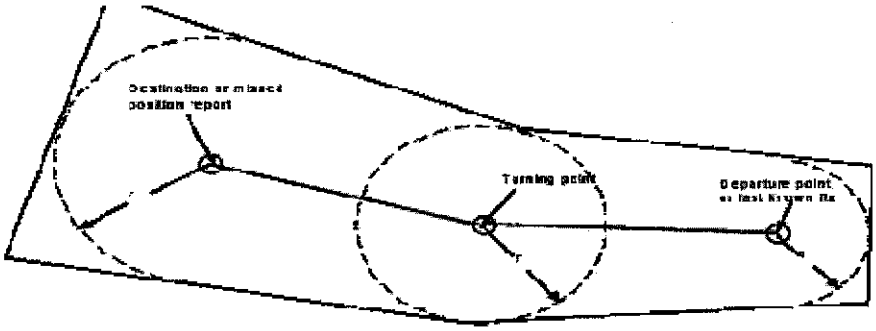


Fig 4.2 Stage 2 Search Area

When Stage 1 and Stage 2 search actions fail to locate the target, the probability area should be determined by drawing circles of probability around the last known position, the first missed report position, and any turning points along the planned track. Tangents to the circles then enclose the intervening area. This is referred to as a Stage 3 search and is shown in Figure. ...Planning for the Stage 3 search should commence when it is apparent the target cannot be located by the Stage 2 search.



Note: 'r' depends on the value o f x and y
Fig. Stage 3 Search Area (Mathematically derived)

4.24. Calculation of Circles of Probability

Total Probable Error (E) is a mathematical tool for determining search area based on the probable errors in estimation of drift (De), initial position of the incident (X) and navigational capability of the SRU (Y).
Initial Position Error (X) is the assumed error of the initial position based on navigational accuracy of the distressed craft. Similarly SRU Error (Y) is based on errors in SRU navigation accuracy which should be considered by SMC while calculating search area.

The Total Probable Error of Position (E) is found from the formula: E = {x2 + y2 + De2} where:
X is the probable navigation error of the distressed craft (initial position error);
Y is the probable navigation error of a search craft (search craft error); and
De is the probable error of the calculated drift of a target in water (total error)

In an environment where drift is not available, or does not exist eg land, the value for De should be zero.

4.25. Probable Errors of Position

Initial Position Error (X) of the distressed craft and Search Craft Position Error (Y) are the estimated errors of position based on navigational accuracy of the distressed craft and of the search assets. These errors of position for the calculation of e can be found in **Appendix ....**

4.26. Search Radius (R)

This is defined as the radius of a circle, centered at the most probable position of the target at any given time (the Datum), equal in length to the Total Probable Error of Position (E) in nautical miles, increased by a safety factor. For successive searches of the probability area the safety factor is increased progressively.

Search Radius is computed by multiplying E by the appropriate fs i.e. R=E x fs.

The safety factors applied to the Total Probable Error of Position to obtain a Search Radius (R) are shown in table below.

Search Effort	Safety Factor (fs)
1. Initial Probability Area	1.1c
2. First Expansion	1.6c
3. Second Expansion	2.0c
4. Third Expansion	2.3c
5. Final Expansion	2.5c

Table ... Search Radius Safety Factors.

When a search area is extended or additional areas must be searched, more search units will be required or the track spacing will have to be increased unless an increase of the duration of the search is permissible

Determination of the probability area is based on the navigational accuracy of the last known position of the aircraft. For positions reported as navigation fixes, the fix errors listed below can be assumed for SAR purposes;

a) radar: 1.8 km (1 NM);

b) INS : 0.9 km (0.5 NM) per flight hour without position update;

c) OMEGA: 7.5 km (4 NM);

d) LORAN C: 1.8 km (1 NM); and

e) VOR/DME : +/-5° ARC AND +/-0.9 km (0.5 NM) or 3 % of distance to the antenna, whichever greater.

[Values and Units to be checked / updated]

If the means of navigation of the distressed aircraft are unknown, the SMC should apply error factors as follows:

a) aircraft with more than two engines : 9 km (5 NM);

b) twin-engine aircraft: 18.5 km (10 NM); and

c) single-engine aircraft: 28 km (15 NM).

When the reported position is based on dead reckoning (DR), an additional error factor should be applied consistent with the distance travelled since the last fix:

a) aircraft with more than two engines: 5 % of the DR distance;

b) twin-engine aircraft : 10 % of the DR distance;

c) single-engine aircraft: 15 % of the DR distance.

4.27. Basic determination of the probability area

Approximate position at time of landing is known

When the approximate position of a distress scene is known, (e.g. witnessed or reported by radar, another aircraft or the distressed aircraft itself) or can be estimated with reasonable accuracy, the radius of the most probable area will be small. If there is more uncertainty about the position, the radius must be increased to ensure the inclusion of the search target in the area to be searched. Except when executing a sector search, the area should be squared off.

The search radius R is the radius of a circle centered on the datum. The initial value of R is determined by the SMC on the basis of the parameters of the SAR operation (search environment, accuracy of the approximate position). If the first search of the area is unsuccessful, the search area will have to be expanded in stages. The search radius is normally called R1 for the first search, R2 for the second; etc (see Illustration 1 – Probability area – radii expanded in stages). Rn is computed by multiplying Rn-1 by the appropriate safety factor fs as follows :

$$R_1 \times fs = R_2$$

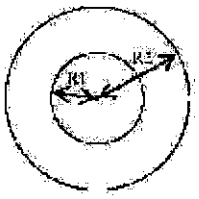


Illustration 1. Probability area – radii expanded in stages The safety factor is determined as follows:

Search Number	Safety factor
1	1.1
2	1.6
3	2.0
4	2.3
5	2.5
Subsequent searches	2.5

When a search area is extended or additional areas must be searched, more search units will be required or the track spacing will have to be increased unless an increase of the duration of the search is permissible.

Only reported time of crash, forced landing or ditching is known
If an accident occurs between two reporting points, the approximate position of the accident may be calculated from navigational data derived from the flight plan.

4.28. The probability area is determined as follows:

a) draw a circle with a radius R (e.g. 18.5 km (10 NM)[1]) around the last reported position;

b) draw a circle around the next reporting point with a radius of R plus 10 % of the distance between the two points; and

Note.: (18.5 km (10 NM) is used for illustrative purposes only)

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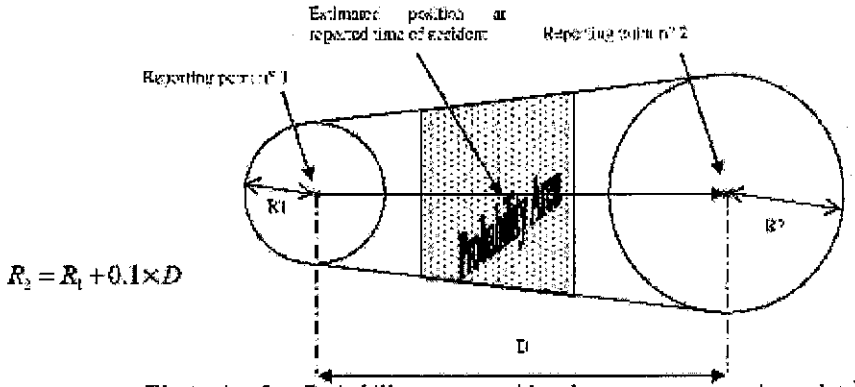
c) draw straight lines tangential to the circles.

The datum area will be centred on the probable location of the aircraft based on the reported time of crash. (cf. Illustration 2 - Probability area – accident between two reporting points)



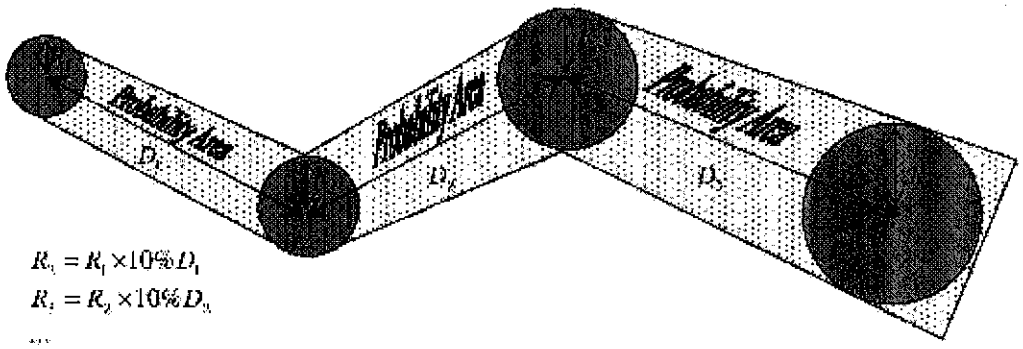
$R_2 = R_1 + 0.1 \times D$

Illustration 2. Probability area – accident between two reporting points[2]

4.1.3.1.3. Only the planned route is known

When an aircraft disappears en-route, the first theory is that the aircraft is located on or near the intended track, or that it has experienced a communication failure and is proceeding in accordance with the flight plan. In this case, the search will be confined to the immediate vicinity of the track.

Probability area No 1 – Draw a circle with a radius of 18.5 km (10 NM[3]) around the last reported position or the aerodrome of departure. Next, draw a circle around the next reporting point with a radius of 18.5 km (10 NM) plus 10 per cent of the distance between the two points. Continue in the same way along the route to the destination and square off both ends.



$R_1 = R_1 \times 10\% D_1$

$R_2 = R_2 \times 10\% D_2$

...

$R_n = R_{n-1} \times 10\% D_{n-1}$

Illustration 3. Search area – accident somewhere in between several expected reporting points

[1] The figure, used for illustrative purposes only, does not respect proportions between R1, R2 and D

[2] 18.5 km (10 NM) is used for illustrative purposes only

In the above example, the first area (radius R1) is drawn around the last reported position or the aerodrome of departure and the fourth area is drawn around the destination aerodrome. The probability area is the area enclosed by the tangents to circles whose radii are R1 to R4.

Probability area No 2 – If the area described in the previous paragraph is searched without locating the missing aircraft, an expanded area should be plotted in the same manner as before except that the radii of circles should be progressively increased and the area therefore expanded.

$R'_1 = R_1 \times f$ where f = 20 % for example, and $R''_n = R_{n-1} \times (100\% + D)_{n-1}$

Information, other than position, received since last position report

When the last communication received from an aircraft is not a position report but some other communication which did not indicate a distress, the probability area would be centred on the probable position of the aircraft based on the time of its last transmission. In such a situation, it will not be known whether the pilot has elected to continue, divert or turn back. Consequently, there could now be various subsequent areas of priority for search

4.29. Adjustment of the probability area

General

While the search is in progress, all information received must be given careful consideration. Some of the factors that must be taken into account are :

a) Serviceability of ground navigation aids and airborne equipment;

b) Meteorological conditions;

c) Nature of terrain;

d) Pilot training and/or habits; and

4.30. Meteorological conditions

In adverse weather conditions, aircraft in distress often require an intensive and prolonged search because of the uncertainties involved. Some meteorological factors may be of particular influence in determining the pilot's probable actions. Some of these factors that should be considered are:

a) Deviation in wind velocities from the forecast;
b) Areas of low cloud or reduced visibility;
c) Marked variation in barometric pressure;
d) Thunderstorm activity;
e) Severe turbulence;
f) Icing; and
g) Frontal conditions.
h) Weather conditions at the last known position and along the intended route to the destination (AIREPs, special AIREPS, regular weather observations, reports from reliable local sources);
i) Meteorological briefing given to the pilot; and
j) Any disparity between the forecast and actual weather en route.
k). Reduced visibility
l). Poor radio reception due to atmospheres

4.31. The nature of terrain

A map, giving sufficient details of the area where the aircraft has disappeared, should be studied carefully to determine the pilot's possible course of action. A very high mountain or mountain range close to its intended track should be given a high priority for search, particularly in adverse weather conditions. On the other hand, a pilot encountering adverse weather conditions may choose to avoid high terrains and attempt to follow valleys or proceed towards low terrain. When the terrain over which the aircraft is proceeding is too rough for an emergency landing, a pilot may head for an area where a landing would be less hazardous

4.32. The pilots known record and habits

The pilot's experience, local knowledge and stated opinions should be assessed in determining his/her possible actions in an emergency. The opinions of the pilot's colleagues may also prove useful

4.33. Company practices and procedures

The views of the owner / operator should be obtained, as company practices and procedures may provide indications as to the probable actions of the pilot

Illustration only

Note:
The formula uses the Total Probable Error (E), which includes the **Initial Position Error (X)** of the distressed craft and the **Navigation Error of the SRU (Y)**, but does not include Drift Error (De).
E2 = Square Root of (X2 + Y2)

For land SAR cases when an SRU arrives on scene and the search object is not seen, a 5 nm position error for the distressed craft and a 1 nm navigation error for the SRU may be assumed. Using the formula, when X = 5 and Y = 1 then:
E2= Square Root of (52 + 12)
E2 = Square Root of 26
E = 5.099 nm

Applying the safety factor for the first search (fs = 1.1), then:
Radius = (E) (fs)
Radius = (5.099) (1.1)
Radius = 5.6 nm
This is rounded up to 6 nm.

5. Search Techniques and Operations

5.1. Overview

Once the search area has been determined, a systematic search for the target should be planned. Before a search operation takes place, the search planner should provide a detailed search action plan to all involved, specifying when, where and how individual search assets are to conduct their search operations. Coordination instructions, communications frequency assignments, reporting requirements, and any other details required for the safe, efficient and effective conduct of the search must also be included in the search action plan.

As a minimum, developing a search action plan consists of the following steps:

a. selecting search assets and equipment to be used;
b. assessing search conditions;
c. selecting search patterns to cover the optimal search area as nearly as may be practical;
d. dividing the search area into appropriate sub-areas for assignment to individual search assets; and
e. planning on-scene coordination.

5.2. General Guidelines for Searches

As discussed earlier chapter, a search typically involves three stages including the immediate response, a search based on a nominated area either side of track, and a search based on a mathematically derived search area. This applies equally to aviation searches as well as maritime searches.

5.3. Search Area Coverage

Once the search area has been determined, a systematic search for the target should be planned. Factors such as the weather conditions, time available for search, aircraft speed, search altitude, sighting range, size of target, etc, should be taken into account. These factors are related but some may be more important than others. In planning a search operation, the SMC should endeavor to meet the requirements of the more important factors while satisfying the requirements of the others as far as practicable.

Search Area coverage is the systematic search of selected areas of land, or water, to ensure the optimum probability of detecting the object being sought. The factors affecting detection capability have been reduced to four inter-related expressions. The terms and their symbols are:
Sweep Width (W)
Probability of Detection (POD)
Track spacing (S)
Coverage Factor (C)

The type and number of available search aircraft will be a factor in determining search area coverage. More time will be required to search a large area thoroughly when there are limited numbers of search aircraft available unless the distance between successive sweeps of the area is increased. This is not desirable since it would reduce the probability of detecting the target. It may, therefore, be necessary to seek additional search aircraft from other sources. It is usually preferable to cover a search area from the beginning with an adequate number of search aircraft.

When the aircraft operate far from their home base, consideration should be given to them being redeployed at an advance base so that more time will be available for the search and less time will be spent on flights to and from the search area.
An adequate number of well-placed, trained observers as well as altitude and speed of the search aircraft are important factors determining the POD of a target. A slow aircraft will increase the chance of detection of the target.

5.3.1. Sweep Width (W)

Sweep width (W) is the distance on both sides of the SRU where the probability of detecting a target outside of the sweep width is equal to the probability of missing a target inside that distance. It is a measure of detection capability based on target characteristic, weather and other factors.

Sweep Width, "W", is a function of Search Visibility. It is the ideal width of the area that should be scanned after the appropriate correction factors have been applied.

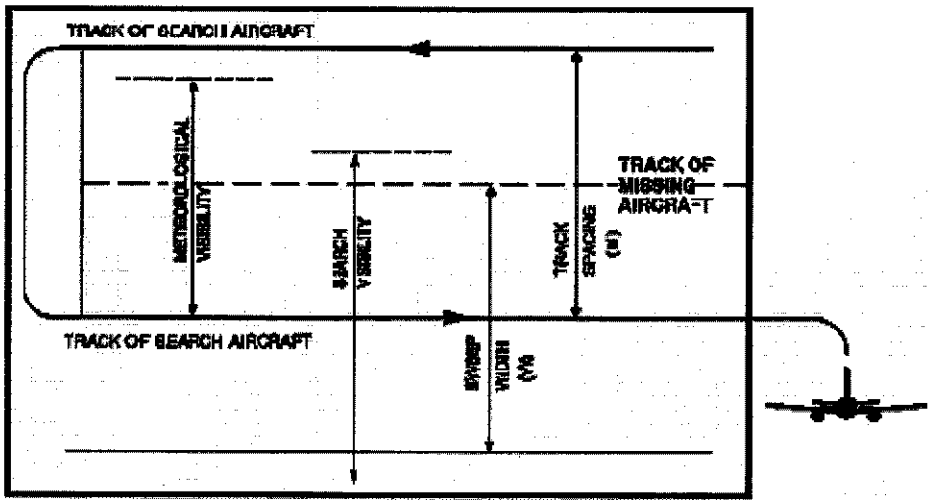


Figure Sweep width

Factors affecting Sweep Width
Search visibility and sweep width are equally split across the search track of a searching unit (refer Fig above). Search visibility is the range within which a particular search target has a reasonable probability of being detected. Search visibility as affected by the numerous factors discussed below will constitute sweep width

.

5.3.2. Type of target
The sweep width will depend on the type, size, colour and shape of the target, its colour contrast with the surrounding medium, amount of freeboard, and whether or not the target is moving. Targets may vary from wreckage of an aircraft on land to a person in the water. All targets should be sought from a direction in which they receive the best illumination, colour brightness or contrast. Over water, this is usually the direction in which **whitecaps** can be seen at the farthest distance.

5.3.3. Meteorological visibility
If visibility conditions are poor, the subsequent reduction in sweep width and POD may cause an interruption or necessitate a suspension of search effort, eg: a. Fog makes visual search ineffective if not impossible. Only an electronic search to determine the approximate position of the target, or, perhaps,

a. ground search, may normally be an appropriate option;
b. Smog and haze may reduce the effectiveness of daylight search and, to a lesser extent, night signals;
c. Low clouds may render search ineffective or impossible; and
d. Precipitation reduces visibility;
e. Terrain/

5.3.4. Type of terrain
The type of terrain to be searched obviously affects the ease with which the search target will be detected. The more level the terrain the more effective will be the search. Not only can the search aircraft maintain a constant search altitude, but also there is less likelihood that undulations or irregularities on the terrain surface will hide the distressed craft, wreckage or survivors. Thus calm water areas and flat deserts are easier to search than rough seas or rolling hills, while rugged mountain areas are the most difficult. The more trees, vegetation, rock outcroppings and other surface irregularities that exist on land, the more difficult will be the search. Likewise the more whitecaps, wind streaks, foam streaks, breaking seas, swell systems, salt spray and sun reflections, the more difficult will be a search over water.

5.3.5. Search aircraft speed

At low search altitudes the speed of the aircraft will affect the sweep width due to the angular velocity of targets moving through the scanner's field of view, blurring of targets at very close ranges, and decreasing the exposure time of targets to the scanner. Generally, higher speeds will increase the adverse influence of these factors at search altitudes below 500 feet.

5.3.6. Fatigue Factor

The effectiveness of observers depends on the number available, their experience, alertness, physical condition, incentive and the suitability of observing positions. The speed at which the search unit moves also has a direct relationship to the effectiveness of the observers' overall performance.

If feedback from the search unit indicates that search crews were excessively fatigued, use a correction figure for fatigue and reduce the sweep width by 10 percent (multiply the uncorrected sweep width by 0.9).

5.3.7. Search aircraft height

Several factors; the prime ones being the size and nature of the target being sought, and the surface conditions surrounding the probable location of the target dictate the selection of the search height. Recommended search heights for particular targets are listed in the following Table.

Over Water	**Recommended Height**
Survivor without raft or dye marker	Below 500FT
Survivor in raft without dye marker, or signaling equipment	800-1500FT
Survivors with dye marker	1000-2000FT
Survivors with signaling equipment and/or radar reflector	1000-3000FT
Over Land	
Level terrain with little or no foliage	1000FT
Level terrain with heavy foliage	500FT
Mountainous terrain (height selection governed by turbulence and foliage density)	500-1000FT

Table Recommended search heights

Meteorological conditions must be taken into account when selecting search heights. Turbulence, cloud base, and visibility, are the chief considerations.

For reasons mostly related to the apparent movement of the surface below a search aircraft, certain minimum heights are recommended according to an aircraft's speed; they are:

a. 2000 FT where the speed exceeds 200 KTS
b. 1000 FT where the speed is between150-200 KTS.

Advantage should be taken of the characteristics of helicopters to search at low level, possibly in conjunction with fixed wing aircraft operating at higher levels above.

Search heights will be quoted as height above ground level (AGL) or above mean sea level (AMSL).

5.3.8. Cloud cover

The greater the amount of cloud cover, the less will be the ambient light in the search area. This has a detrimental effect on the sweep widths of surface targets. In addition the variable surface shadows caused by scattered or broken clouds make it more difficult to visually detect targets due to the constant dulling effect of the shadows and the mottled appearance of the surface. Although a high, solid overcast will eliminate glare, shadows and reflection from the surface, this advantage is not as large as the detrimental effect of less ambient lighting.

5.3.9. Position of the sun

Objects are seen at a greater distance when looking down-sun as opposed to upsun particularly when the sun is in a position to reflect from water. With a clear sky and a bright sun, search conditions are at an optimum between mid-morning and mid-afternoon when the sun is high. Waterborne objects that have a high free board may sometimes be seen even in the sun's glare. Bright sunlight is especially detrimental when haze is present, due to the diffusion of light. Colour contrast is lost when looking up sun, with the result that small objects merge into a confused pattern of glaring light and shadow. Down-sun the sea appears much darker, glare is absent, haze is more transparent, and coloured objects show a marked contrast to their background. Observers forced to look into the sun suffer loss of visual acuity, and may fail to detect an object. When possible, search legs should be orientated to prevent observers having to look directly into the sun. If this is not possible observers should be equipped with sunglasses.

5.3.10. Day and night factors

In some conditions of wind and sea, daylight visual aids may be ineffective. The heliograph is an exception, but sunlight cannot always be expected. Sea conditions and wind have little effect on a night flare search, or on lights. When high winds and seas prevail, night search techniques usually offer the best POD. The quantity of pyrotechnics available to survivors is usually limited, and survivors are unlikely to fire pyrotechnic signals until sighting the lights of the search unit. For this reason sweep width for a night search should be based, not on the expected sighting range of the pyrotechnic aids, but on the range at which survivors may see the navigation lights of the search unit. On entering a search area, search units should turn on all possible lights, and from time to time display searchlights, or landing lights, to facilitate sighting of the search unit by survivors; however observer night vision needs must be taken into account. Ships in a search area should be asked to make smoke at intervals, during daylight hours.

5.3.11. First search light/last search light

Times of first and last light at the departure and destination points may limit the time available in a search area when all or part of a flight is governed by Visual Flight Rules.
Any limitations to visual searching indicated in a search forecast must be allowed for at the planning stage.
The 45-minute periods after sunrise and before sunset are considered unsuitable for daylight visual searching on account of the sun's low elevation and resulting lengthy shadows.
These periods are therefore commonly discounted for visual search at the planning stage. The periods may, however, be varied at the SMC's discretion to accommodate local conditions. There may be other factors arise that impact upon search planning with greater moment thus indicating the relative suitability of visual search during some or all of these periods.
Within proximity of the equator, where the apparent movement of the sun is at a greater angle to the earth's horizon and its rising and setting phases more rapid, these periods are less critical.
Examples of local factors that may need to be considered in the context of available search light are:

a. A search over tropical rain forest may best be started at dawn in consideration of a likely deterioration in local weather conditions later in the day.
b. A search of the western slopes of steep sided valleys may best be delayed until mid-morning.
c. A search of steep eastern slopes may best be abandoned earlier than 45 minutes before sunset.

Time available to aircraft outside the periods suitable for visual search may be utilized in other ways, for example, beacon search, radar search.
In general, Search Aircraft should arrive at the end of First Search Light & leave the area at Last Search Light

5.3.12. Miscellaneous Factors

Among the miscellaneous factors affecting sighting are shadows cast by clouds, rain showers, large patches of seaweed, and pure chance. Shadows cast by scattered and broken clouds are a distracting influence on the observers. Rain showers can result in areas not being searched effectively, as the object of search may be hidden by a squall. Despite all other factors, some sightings are made as a result of pure chance. An observer may just look at the right spot at the right time, conversely a momentary lapse on the part of the observer may allow the object of search to be passed unseen. The only safeguard against this possibility is to make repeated searches of an area if sufficient search units are available, and the use of the maximum number of observers.
Search begun early in the day, or extending late in the day has a reduced chance of success in wooded terrain due to the shadows cast by the trees and the oblique angle of the sun. These areas are preferably

searched when the sun is higher in the sky. Likewise because of the sun, mountainsides may be better searched in the early or late in the day depending on the direction the particular slope faces.
Different search heights will produce different sweep width values. It is good practice to calculate sweep widths for several search heights, enabling the search planner to select a sweep width to suit a search height dictated either by the target, or one best suited to the search aircraft to be used.

5.3.13. Sweep Width Calculations (W)
Tables of uncorrected sweep width values and correction factors are provided in Appendix... The sweep width used in planning and evaluating the search is computed as the product of the uncorrected sweep width and all the correction factors that apply. When using these table values of the **Appendix G** for weather correction factors use the worst case. Therefore if the wind is 10 knots but the sea is 5 ft, use the figures in the second row.

5.3.14. Track Spacing (S)
Track Spacing (S) is the distance in nautical miles between adjacent search legs. The desired track spacing is a function of detection capability. The more difficult the target to detect, the closer the search legs should be. Decreasing the track spacing increases the POD, but at the expense of reducing the area searched in a given time. There is a limit to which S may be reduced due to the limits of search unit navigation ability and accuracy. The optimum track spacing is one, which permits the maximum expectation of target detection in the available time, or is consistent with the economic employment of search units. Whenever possible Track Spacing (S) should be used that is equal to the Sweep Width (W).

Good Search Conditions. In conditions where the wind speed is less than 15 knots and/or visibility is greater than 3 NM, use a track spacing of up to 3 NM by day or night but reduce the separation depending on the size of the search target. After dark, the effect of the searchlight should be considered.

Poor Search Conditions. Where winds are greater than 15 knots and /or visibility is less than 3 nms but greater than 1 nm, a track spacing of 1 nm should be considered by day or night but reduced depending on the size of the search target. After dark, the effect of the searchlight should be considered.

Note: The track spacing suggested is given as a guide only. The track spacing used in any one search will be decided by the SMC in consultation with the OSC taking into consideration all the available information at the time.

5.3.15. Coverage Factor (C)
Coverage Factor is a measure of search effectiveness or quality. It is used as an entering argument when calculating POD. The quality of coverage for any sweep depends on the relationship between Sweep Width and Track Spacing. The relationship is termed Coverage Factor.

$$\text{Coverage Factor (C)} = \frac{\text{Sweep Width (W)}}{\text{Track Spacing (S)}}$$

The relationship between Sweep Width and Track Spacing determines the Probability of Detection (POD). Higher coverage factors indicate a more thorough coverage. Higher values of C offer a higher probability of target detection, however the higher POD is not proportional to the extra search effort required.

Whilst a coverage factor of 1.0 is most desirable there are occasions when terrain, time limitations, large search area, or shortage of search craft, prevent its attainment. For such occasions an alternative approach must be used that balances the factors of available search hours, size of area and C.

A coverage factor of less than 0.5 is unsatisfactory in itself.

5.3.16. Probability of Detection (POD)
Probability of detection (POD) is the statistical measure of search sensor detection performance. It is a function of sweep width and track spacing. It is a conditional probability meaning that search planners assume the search target is in the search area.

A definite POD exists for each scan made by a search observer or piece of detection equipment. The probability that a contact will be made in a single scan of a point on the surface is called the instantaneous

POD. The instantaneous POD, repeated by successive scans as the search unit moves along the track, develops the probability pattern of a given search. The POD is not uniform over the swept area. In general, it is highest near the search unit and decreases with distance from the search unit.
POD is a function of the coverage factor (c), which itself is derived from the relationship of sweep width to track spacing; and the total number of searches in an area. For repeated searches of the same area, the cumulative POD is obtained by making use of the average coverage factor. The application of this concept results in a progressive increase in the POD of a target in the most likely sector of the search area by repeatedly searching the original area within progressively larger areas, a part of each overlaying the original. Thus there results an aggregate POD after successive searches of part of a probability area. For each successive search, the safety factor is increased, and, as a result, the size of the probability area is enlarged. It is not to be thought that early search effort should be restricted in anticipation of the benefits of the expanded search technique; these will take time to accrue, and time, in the rescue of survivors, is of the essence. Neither should a particular search be prolonged unnecessarily in similar anticipation. Still, the concept of expanded search does allow flexibility in search planning in as much as the desired quality of search, if unattainable on account of limitations in the availability of search units, may be attained by repeated effort, while ensuring that
the most likely area is rapidly and repeatedly covered.

	Coverage Factor 1	**Coverage Factor 0.5**
Initial Search (R1)	78% POD	47% POD
First Expansion (R2)	95.6	71.9
Second Expansion (R3)	98.9	85.1
Third Expansion (R4)	99.7	92.1
Final Expansion (R5)	99.9	95.8

Table Coverage data example

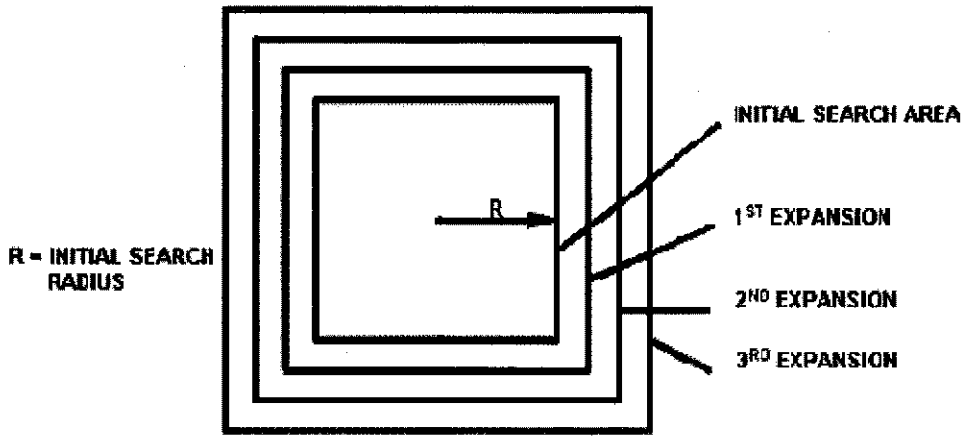


Figure Search area expansion (not to scale)

The data in the above Table confirms that by making five searches of the initial probability area, each to a coverage factor of 0.5, the cumulative POD (95.8%) is only slightly less than if the same five searches had each been made at a coverage factor of 1.0, (99.9%). The search effort in the former case would have been considerably less in terms of aircraft hours than in the latter. Further, a significantly larger area surrounding the initial probability area would have been searched, albeit at a progressively diminished level of intensity.

From the foregoing, it is apparent that for prolonged and repeated searches when aircraft numbers are limited, a coverage factor of 0.5 offers a reasonable coverage of an expanded area resulting, over time, in a good POD. Search of areas at a coverage factor less than 0.5 is not recommended.

Statistically, the target is more likely to be nearer the last known position, or datum, than in the outer reaches of the expanded search area. Application of the expanded search concept ensures that the greatest search effort is concentrated over the most probable position of the target where the POD is highest. Clearly, the expanding search procedure is best suited to situations where the approximate position or, at least, the planned track of the distressed craft is known.

When using POD Graph in Appendix .., the POD for any particular search is obtained by reference to the appropriate Search graph line depending on the search conditions apparent. For repeated searches of the same area, enter the graph with the average coverage factor and refer to the graph line relevant to the overall number of searches to obtain cumulative POD. The results are shown as:

1ST Search	Coverage Factor	0.5
2nd Search	Coverage Factor	0.7
3rd Search	Coverage Factor	0.3
4th Search	Coverage Factor	0.2
5th Search	Coverage Factor	0.3
		2.0

Over 5 searches, the average coverage factor = 0.4

In entering Graph 2 with an average coverage factor 0.4, the cumulative POD after five searches may be read off from fifth search graph line as 92%.

The projected value of the POD may be used by a SMC in deliberation of track spacing. Use of POD may also be conveniently made in describing the results of a search, or part of a search, to interested persons not familiar with search planning techniques.

Should the target not be located within the fully expanded probability area, the SMC must decide whether to continue searching it, recalculate the probability area using alternative data, or recommend the termination of search effort.

5.13.17. Accuracy of Navigation by Search Units

The navigational accuracy with which a search aircraft is able to reach a search area and fly a search pattern has an important bearing on the coverage of the area and the POD. Dead reckoning navigation alone generally produces poor results. Map reading can be effective but normally only over land areas in visual meteorological conditions. In areas where navigation aids are limited, search patterns should be selected so that greatest possible use is made of them. Aircraft with area navigation capabilities can be used for all search patterns in all areas. Alternatively, patterns providing a reference point or a visual navigation aid, e.g. a vessel or a smoke float should be considered. Coordinated air/surface or multi aircraft search with one aircraft doing the navigation may decrease the probability of duplication and overlapping, particularly in areas far from the base.

5.4. Search Patterns

General

The selection of a search pattern is very important and should only be made after all factors have been considered. The search pattern selected should meet the following criteria:

Suitability: It should permit the search to be completed within the time limits;

Feasibility: It should be within the operational capability of the available search units;

Acceptability: The expected result should be worth the estimated time and effort;

Air search pattern designators are listed in **Appendix...**

5.4.1 Safety of the search units

Close attention should be paid to air traffic in the area of the search. Normally more than one aircraft should not be assigned to a search area segment at the same time. Multiple aircraft operating in the same search area distracts aircrew attention from the search and decreases the flexibility to respond to electronic search from taking place at high altitude while a visual search is done at a lower level.

To assist with the pilot's responsibility of maintaining separation from other aircraft, the SMC may consider assigning aircraft in adjacent search area segments different search heights, the same creep direction and different start times.

Non-search aircraft can be informed about the search by the issue of a NOTAM.
Non-search aircraft can be excluded from the search area, or informed about the search activity by the issue of a NOTAM.

The choice of search pattern is the prerogative of the SMC, who may elect to use only one pattern or several patterns simultaneously but in different areas. A series of search patterns may be used in sequence for the same area, e.g. track crawls, sector search. The following factors will influence the SMC's selection of search pattern:

a. The accuracy of the distress position;
b. The size and shape of the search area;
c. The number and type of SRUs available;
d. The en route and on-scene weather;
e. The distance between search area and SRU base;
f. The availability of navigation aids in the search area;
g. The size and detestability of the search object;
h. The desired probability of detection;
i. The limitations of time; and
j. The terrain of the area where the search will be conducted.

Careful thought is essential when considering search pattern selection and the allocation of specific SAR units to execute these patterns. Once a large-scale search has been commenced, redeployment of search units or changing assigned patterns becomes complex and should be avoided unless new intelligence indicates such change is mandatory.

There are six main groups of search patterns:

a. Track line
b. Parallel track (search legs are aligned with the major axis of an individual search area)
c. Creeping line (search legs are aligned parallel with the minor axis of an individual search area)
d. Expanding square
e. Sector
f. Contour

When it is known, or likely, that an emergency radio beacon may be available in the target aircraft or to the survivors, an electronic search using an appropriate pattern, (e.g. track line search), should be carried out by at aircraft flying at a high level. This may occur at the same time as a visual search is carried out at a lower altitude or on the surface. In planning this search the coverage and possibility of detection by the Cospas–Sarsat system may be considered. It is also valuable to consider the location of the incident and the possibility of over flying aircraft detecting a signal.

5.4.2 Navigation of SAR Units

The navigational accuracy of available search units is a primary consideration for selecting the types of patterns to be used, particularly if the available search units are aircraft. While the accuracy of navigation of surface craft is generally not too great a problem, aircraft present a more difficult picture due to drift from prevailing winds.

The probability of detection curve is valid only when the search pattern tracks are accurately followed.
Significant errors will result from accumulated errors in turns and from wind forecast errors, especially for high-speed aircraft. Consideration must be given to selecting the type of pattern, which gives minimum turns and maximum search leg lengths in order to reduce turning errors and to make it easier for navigation, observations and corrective action. However, there may be a limit to the maximum search leg lengths when the search area covers water surfaces with strong currents or with high survivor drift rates. In these circumstances aircraft search legs are usually limited to 30 minutes or less of flying time if the legs are oriented across the drift direction. This is to avoid the possibility of the survivors drifting from one side of a track to beyond the next search track by the time the search aircraft returns to that same general area. A more satisfactory solution to this problem is to orientate the search legs with the drift direction.

Greater search accuracy is obtained when visual, radar or radio navigational aids are within reception range of search units or when aircraft are equipped with area type navigation equipment (RNAV) eg GPS or Inertial Navigational Systems (INS).

When dividing up the total search area into areas for assignment to individual SAR units it should be kept in mind that elongated search areas are covered better navigationally than small square areas. When two or more search aircraft are available, elongated search areas are preferred.

5.4.3 Parallel Track Search Patterns

Parallel track search patterns can be used for searches involving one or a group of search units and are the simplest patterns available. The legs are parallel to the long side of the search area.

5.4.4 Parallel Track Pattern Single Unit.

This pattern is conducted by a single unit. The SMC will detail the area to be searched by giving depth and distance, visual reference points or latitude, longitude if the Search Unit is so capable.

5.4.5 Creeping Line Patterns.

These are the same type of searches but the legs are parallel to the short side of the search area. These patterns would be used when there is a stronger probability of the craft in distress being closer to one end of the search area. The search unit begins the pattern at the end of the search area where the target is most likely to be. These patterns can also be used both in single and multi-unit searches.

The multi-unit creeping line pattern is used when there are five or more search units available in a search of a high probability area for small size targets, such a person in the water. This pattern concentrates the search units in the datum area and is structured to avoid gaps developing at the end of each sweep.

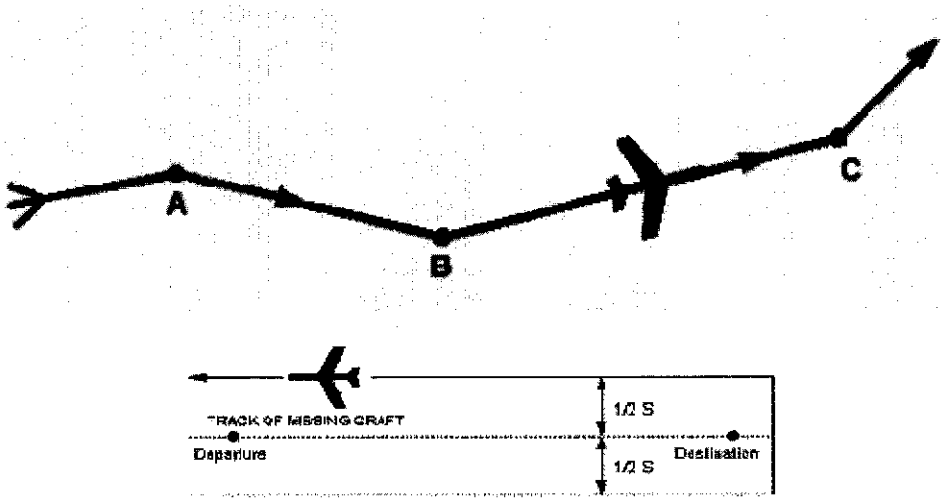
Search units pivot on the second search unit. By the time the first, second and third vessels take up their allotted positions, the fourth and fifth search units will have moved with the prevailing drift to position them at the top of the next sweep. This method will ensure total coverage of the search area, however, it must be borne in mind that this pattern is slower than other patterns and requires a greater degree of coordination by the OSC.

5.5. Visual Search

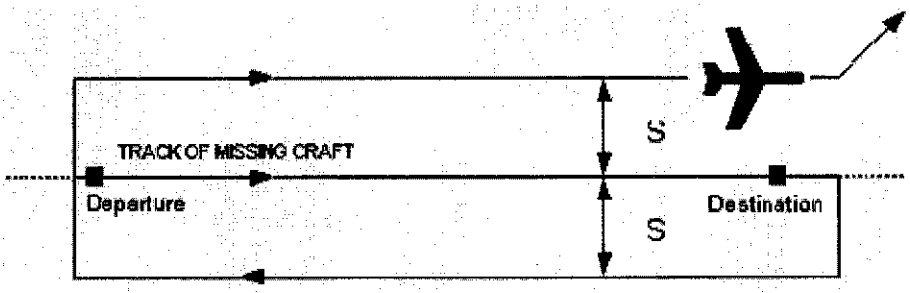
5.5.1 Track Line Search

This procedure is normally employed when an aircraft has disappeared without a trace. It is based on the assumption that the target has crashed, made a forced landing on or near the intended route and will be easily seen, or that there are survivors capable of signalling their position by a flashing lamp or other means. It consists of a rapid and reasonably thorough search on either side of the intended route of the target, normally at a height of 1000 to 2000 FT during day or at 2000 to 3000 FT at night. A track line pattern is often used as an initial reaction to a distress situation, the second, intensive phase being introduced on the failure of the track line search.

Aircraft following the same route as that of the missing aircraft should be asked if they are available to divert to assist in the search for the target. For aircraft, this type of search should be regarded as additional to searches by SAR units, as an enroute aircraft may not be entirely suitable as a search platform due to its performance, configuration, endurance, navigational capabilities or lack of observers.

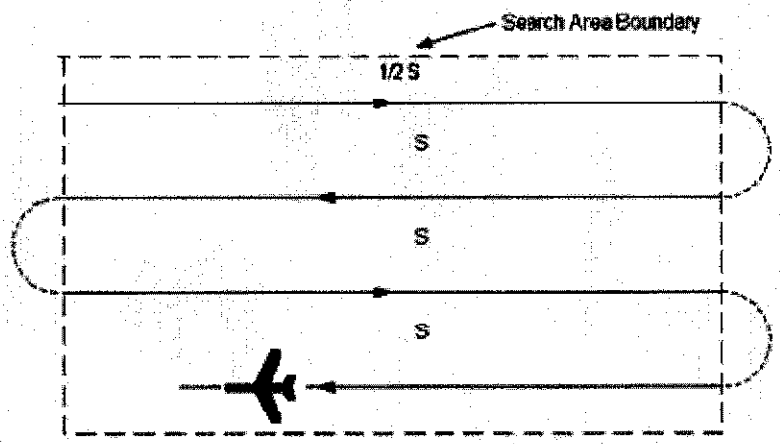


Where search aircraft returning back along track



Where search aircraft not returning back along track

Figure Track line search



NOTE: First leg may be displaced 1/2 S into Search Area.
Turns should be made outside Search Area Boundary

5.5.2 Expanding Square Search

This procedure is referred to as an expanding square search as it begins at the reported position or most probable location and expands outwards in concentric squares. It is a very precise pattern and requires accurate navigation. To minimize navigational errors, the first leg is usually oriented directly into the wind.

The square search pattern is used when the target is known to be in a relatively small area, no more than 15-20 NM from the start point.

The first two legs are held to a distance equal to the track spacing and every succeeding two legs are increased by track spacing. Turns may be to the left or right, depending upon the observer positions.

For successive searches, the direction of the search legs should be changed by 45 degrees. The final track should be the same as the initial search track from the start point. The number of search legs may be 5, or, increasing by increments of 4, 9, 13, 17 etc.

Scanning should start at a distance of "S" before reaching the most probable position to avoid leaving an area not scanned near the start point. Observers should be briefed to pay particular attention to the areas outwards of each turn to avoid leaving areas not scanned.

The search should be planned so that, whenever possible, the approach to the most probable position, and the first leg, is made into wind as shown in Fig. below.

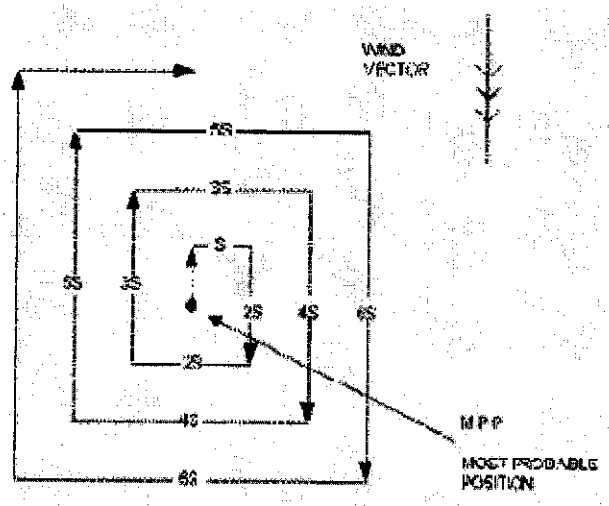


Figure **Expanding square search pattern**

Above Table may be used to determine the number of search legs (N) and total track distance (D), given a particular radius (R) and selected practical track spacing (S), e.g. if R = 10NM and practical S = 2NM, then N = 21 and D = 240NM. The total track distance can then be used to determine whether a suitable SAR aircraft has sufficient endurance to effectively complete the task.

NOTE: The total track miles that an asset has available on search can be calculated by multiplying the effective time available on search (from Worksheet 6: actual search hours (ASH) – 15%) by asset search speed.

RADIUS	S=0.5		S=1		S=2		S=3		S=4		S=5		S=10	
(NM)	N	D	N	D	N	D	N	D	N	D	N	D	N	D
1	9	12	5	8										

2	17 40	9 24					
3	25 84	13 48	5 16				
4	33 144	17 80	9 48	5 24			
5	41 220	21 120	9 48	9 72			
6	49 312	25 168	13 96	9 72	5 32		
7	57 420	29 224	13 96	9 72	9 36	5 40	
8	65 544	33 288	17 160	13 144	9 36	9 120	
9	73 684	37 360	17 160	13 144	9 36	9 120	
10	81 840	41 440	21 240	13 144	9 36	9 120	
11		45 528	21 240	17 240	13 192	9 120	
12		49 624	25 336	17 240	13 192	9 120	
13		53 728	25 336	17 240	13 192	13 240	
14		57 840	29 448	21 360	13 192	13 240	
15			29 448	21 360	17 320	13 240	5 80
16			33 576	21 360	17 320	13 240	9 240
17			33 576	25 504	17 320	13 240	9 240
8			37 720	25 504	17 320	17 400	9 240
19			37 720	25 504	21 480	17 400	9 240
20			41 880	29 672	21 480	17 400	9 240

Table Number of search legs in Expanding Square Search given Radius

Table Notes:
1. Do not interpolate.
2. Tabular values of D are based on the search aircraft completing the search at the boundary of the square area. To achieve this the final 3 search legs of a square search pattern are of equal length.

5.5.3 Sector Search

This pattern may be employed when the position of distress is known within close limits and the area to be searched is not extensive. It is simple to execute, is likely to provide greater navigational accuracy than a square search and, because the track spacing is very small near the centre, it ensures a high probability of detection in the area where the target is most likely to be located

A suitable marker is chosen as a datum and navigation aid on each search leg. For practical purposes, the datum may be moved a mile or two, either at the planning stage or on scene, to take advantage of a prominent landmark well suited as a navigation reference. When using the pattern over water, it is useful to drop either a visual or electronic beacon to mark the datum. Adjustment for total water current is automatic and only leeway need be separately considered.

Trained crews using an aircraft with capable electronic navigational equipment should only be used to fly this search.

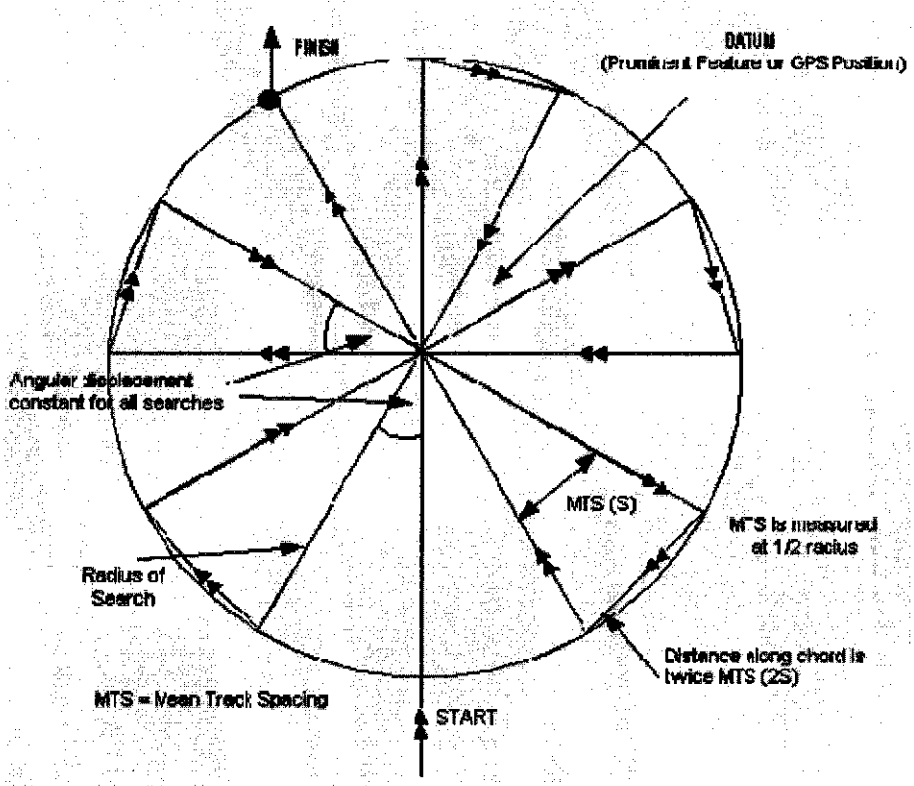


Fig 5.6 Sector search - aircraft

Each search leg is separated by an angle based on the maximum track spacing at the end of the legs and the search radius. For convenience, the angular displacement between each search leg and the distance required to fly the pattern for various track spacing and search radii may be extracted from the following Table

The table makes use of Mean Track Spacing (MTS) as a basis for deriving angular displacement and distance to be flown. MTS is the track spacing at a distance of half the radius of the search area from the datum. The table may also be used to determine the track spacing that can be used for a given track distance and search radius.

The search start point may be either on the perimeter of the pattern or over the datum depending on the approach track of the search aircraft and the orientation of the first leg. To keep track computation simple, the first leg may be oriented to the north but this is not essential. Successive tracks may be calculated by adding 90 degrees plus half the angular displacement to the previous track, and so on. The length of the cross leg is twice the mean track spacing.

The coverage factor, obtained using sweep width information and mean track spacing, may be used to determine the POD.
If a further sector search is necessary, it should be carried out on tracks plotted halfway between the tracks of the pattern followed during the first search:

SECTOR SEARCH CALCULATIONS (This table must not be interpolated)								
S	**1**		**2**		**3**		**4**	
R	**Deg.**	**D**	**Deg.**	**D**	**Deg.**	**D**	**Deg.**	**D**
5	24	90	48	45	72	30	100	30

10	12	330	24	180	36	120	48	90
15	8	720	16	375	24	270	32	210

Table Sector Search Calculations

Notes
1. Deg = number of degrees between successive legs
D = total track distance (NMs) to complete the search pattern
R= Sector Search Radius
S = mean track spacing (MTS)

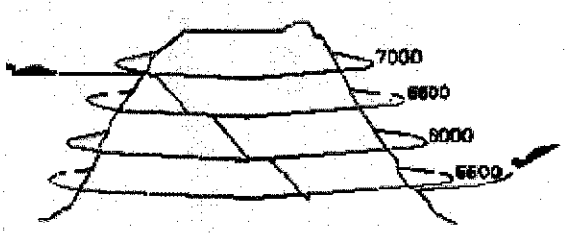
2. The total track miles that an asset has available on search can be calculated by multiplying the effective time available on search (from Worksheet 6: actual search hours (ASH) – 15%) by asset search speed.

Example
An area 10 miles radius is to be searched at a mean track spacing of 3NM. From the table, the angle between tracks is 36 degrees and the total time at 120 knots is 1 hour.

5.5.4 Contour search

Contour search is used to examine mountain slopes and valleys when sharp changes in elevation make other types of search impractical.

The procedure requires that the search aircraft be flown at a selected contour level adjacent to the side of steep terrain, starting at the highest selected level. The search is started above the highest peak with the search aircraft completely circling the mountain at that level. Then the search aircraft descends a planned vertical distance while making an orbit in the direction opposite to the search (forming a figure eight), then it makes another circuit of the mountain, and so on. When there is not enough space to make an orbit opposite to the direction of the search, the search aircraft may spiral downwards around the mountain. If the mountain cannot be circled, successive sweeps at the same intervals should be flown along its side Valleys are searched in circles, moving the centre of the circuit one track spacing after each completed circuit



Elevation view Plan view

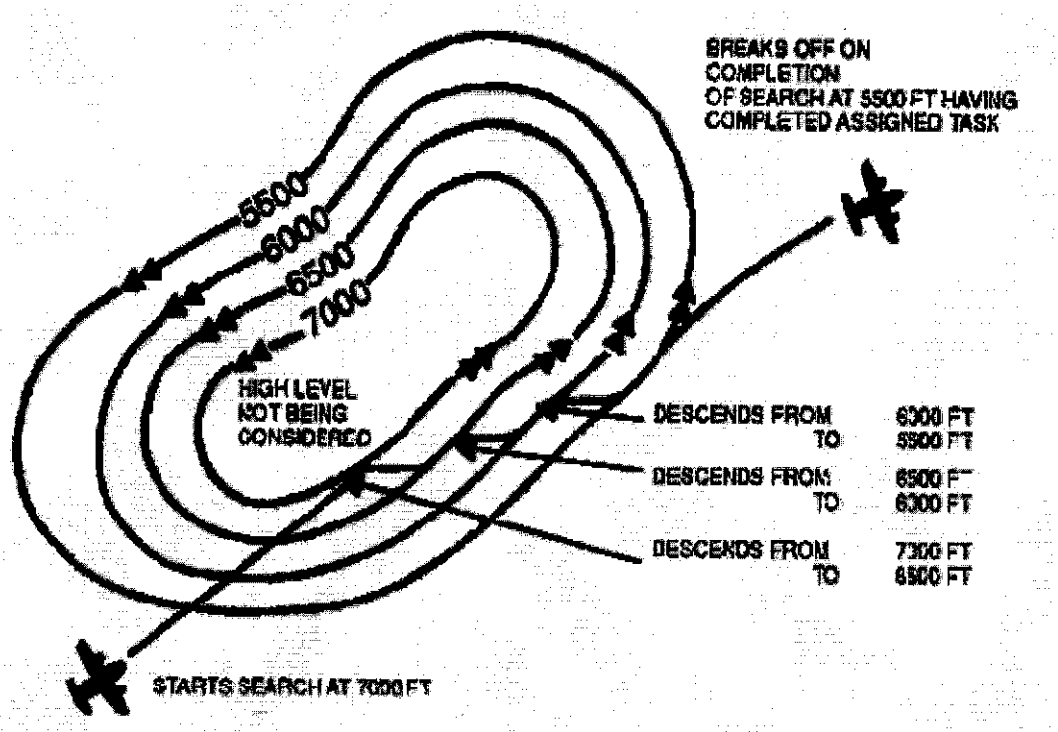


Figure Contour search pattern

It is common to plan for search aircraft to descend a particular vertical distance between successive sweeps. The vertical distance between contours may be selected on a case-by-case basis after consideration of factors similar to those governing the determination of track spacing, i.e. visibility, nature of terrain, type of target etc.

A contour search may be very dangerous. Extreme caution should therefore be exercised when searching mountains and valleys. The following safety matters should be considered:

a. The crew must be very experienced and well briefed and possess accurate large scale maps (1: 100,000 scale maps are recommended);
b. Mountainous search areas should be assigned to multi-engines aircraft whenever possible;
c. During search, all the pilot's attention will be devoted to flying the aircraft The pilot must evaluate forward terrain to avoid any hazard such as power lines, cables etc. When searching valleys, the pilot must plan ahead to ensure that the aircraft can either climb out of a difficulty or turn around, knowing at all times which way to turn in case of an emergency;
d. The weather conditions in the search area must be good, including both good visibility and lack of turbulence, and must be constantly checked. Flights in mountainous areas should be avoided when winds exceed 30 knots because downdraughts can exceed 2000 FT per minute;
e. Aircraft should not enter any valley that is too narrow to permit a 180 degree turn at the altitude flown. Searches should be flown close to one side of a canyon or valley so that the entire width may be used if a 180 degree turn becomes necessary. A similar method should be applied when making a contour search of a mountain; and
f. The aircraft should be highly maneuverable and have a high rate of climb and a small turning radius.

Orographic turbulence may be found as updraughts on the upwind side of slopes and ridges and on the downwind side as downdraughts. The extent of the effect depends on the wind speed and the steepness of the slope. Orographic turbulence will be more intense over a rough surface.

The safest crossing of mountain peaks and ridges at low altitude under windy or turbulent conditions is downwind, where any downdraughts will be encountered after the terrain is crossed. If this is not practical, altitude should be increased before crossing these areas. Best procedure in transiting a mountain pass is to fly close to that side of the pass where there is an upwind. This will provide additional lift in case of an emergency. Maximum turning space is available and a turn into wind will be towards lower terrain. Flying through the middle of a pass may be dangerous as this allows the least turning space and is often the area of greatest turbulence.

Should it not be practical to search the entire surface of a mountainous area, a SMC may initiate plans on the basis of certain assumptions, e.g., if limited to VMC, the pilot would neither willingly enter cloud nor descend below the lowest height at which a valley or a gap could be safely traversed. There may, on the other hand, be intelligence information to hand indicating that the pilot did enter cloud, in which case the aircraft may be found at an elevation within the extent of the then existing cloud layer. These possibilities should be examined carefully if it is known that a pilot was flying, or intended to fly, through a valley or gap in the proximity of cloud.

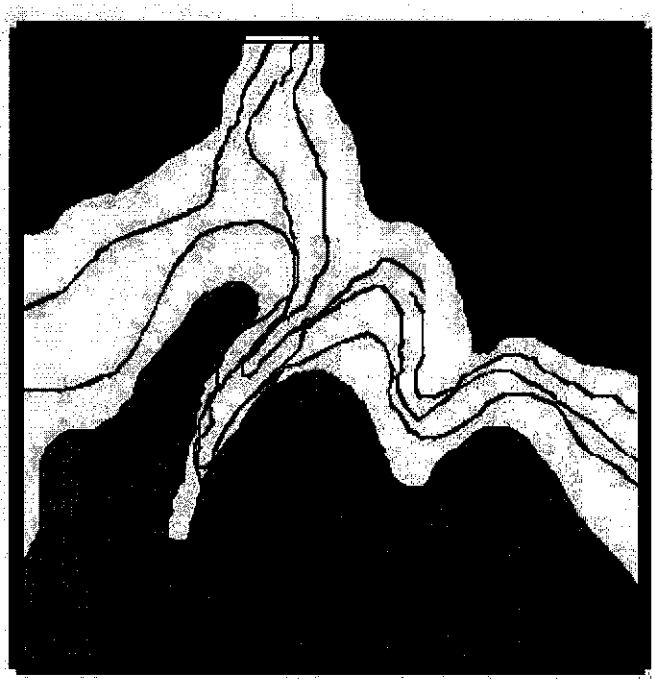


Figure Example of probability area for contour search

To determine a probability area in such circumstances, a SMC may proceed as follows:

a. Mark the contour line at a level 500 FT higher than the highest level it is considered that the aircraft would have been flown, and colour all areas above this height IN RED
b. Mark the contour line at a level 500 FT lower than the height at which the area could be safely traversed, and colour all areas below this height IN GREEN;
c. The uncoloured area will be the probability area, and, on an appropriate map, may be used as a three dimensional representation of ridges, gullies, etc.
d. Above Fig. demonstrates a resultant diagram after using this procedure.

Crews must be well briefed and possess accurate, large-scale maps showing the contour lines. (1:100,000 is the smallest practical scale). Crews shall be reminded to make all positioning turns away from the mountainside and to exercise extreme caution when searching valleys where climb-out or turn-around is difficult or impossible.

As with other forms of search, an accurate account of the areas actually searched is required by the RCC. The search crews should plot actual areas covered as the flight progresses. Areas that have been searched should be shaded in on a large scale topographical map, leaving the unsearched area outlined.

Only one aircraft shall be assigned to an area at any one time.

5.5.5 Searches in Mountainous or Rugged Terrain

Searches by fixed wing aircraft become ineffective over certain types of terrain. Helicopters should be tasked for these areas. Individual areas may be defined by using:

a. Squares or rectangles; or
b. Geographical areas, referenced to geographical, topographical or man-made features.

Points to note:

a. An area of approximately 20 – 30 square nautical miles is a good size, depending on the type of helicopters available and the transit distance;
b. A number of sorties will normally be required to complete each area;
c. The closer a refueling point can be established to the area the better; an oval or open area in town is suitable;
d. A Forward Command Post is very desirable; and
e. If using non-geographical areas, i.e. squares or rectangles, GPS is required.

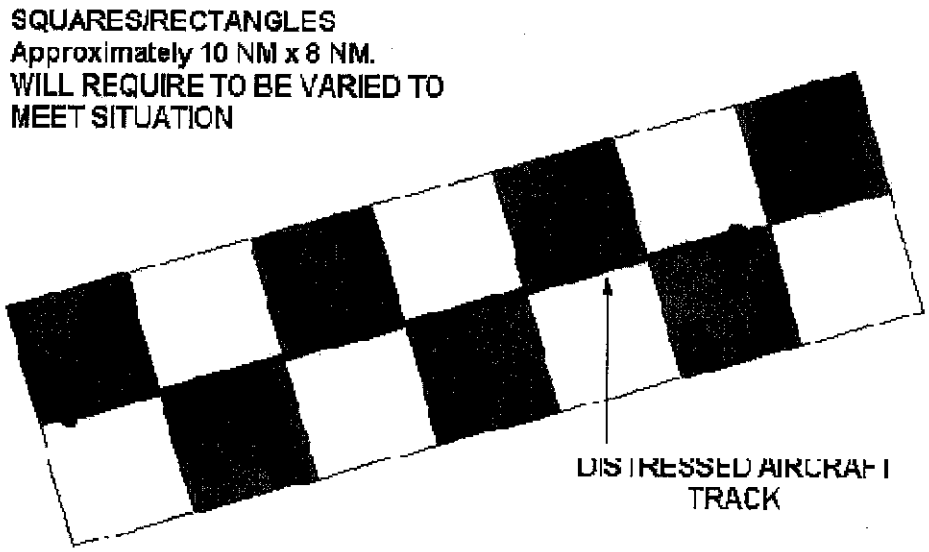


Fig 5.16 Helicopter search area

5.6. Electronic Searches

General

Distress beacons are carried by aircraft and land parties and operate on one or more of the international distress, safety and calling frequencies. When activated to indicate a distress situation, they emit a characteristic signal. The signal serves, in the first instance, to alert to a distress situation and, during an ensuing electronic search, as a homing beacon. The equipment can be activated either manually or automatically as a result of immersion in water or on impact.

The RCC shall use whatever resources are required to locate a distress beacon even if it is believed to be an inadvertent activation.

5.6.1 Beacon Types

ELT (Emergency Locator Transmitter) is the name given to an aviation distress beacon carried by aircraft; it operates on 121.5/243 MHz and/or 406 MHz.

PLB (Personal Locator Beacon) is a beacon for land use and operates on 121.5/243 MHz and/or 406 MHz.

Signals from beacons operating on 121.5/243 MHz are modulated with a characteristic swept-tone, which is normally continuous.

Beacons operating on 406 MHz have no audio signal but transmit in microburst Transmitted data, generally, cannot be monitored or interrogated by aircraft as the signal is generated by chip as a discrete data-package. Homing on 406 MHz beacons can only be achieved by using very specialized airborne equipment or by fitting the beacons with supplementary low-powered 121.5 MHz transmitters with conventional audio signal output.

5.6.2 Beacon Transmission Characteristics

The range at which a beacon may be detected varies considerably, being dependent on a number of factors:

a. Surrounding terrain - the range will be extended if the transmitter is located on the top of a mountain or hill and reduced if located in a valley, on a hill-side or mountain-side, amongst trees or bushes, or in a rain forest;
b. Power output of the transmitter;
c. Condition of the beacon - if a transmitter's aerial or aerial lead has been broken or disconnected, it will, if the unit is otherwise serviceable, still transmit but its range may be reduced to 1 km or less, and may only radiate on 243MHz;
d. Nature of surrounding surface - the range will be reduced if the transmitter is operated in dry, sandy country unless placed on a good earth mat, e.g. a space blanket, aircraft wing, or similar reflective surface; and
e. Presence of interference - interference sources can cause beacon-like transmissions, e.g. strobe and navigational lights.

A transmitter operating over water or relatively flat country will emit a radiation pattern approximately circular in horizontal cross section. However, if activated in rough country, between trees or amongst wreckage, its radiation pattern will be interrupted by obstructions and shaped as a series of irregular lobes. Flying a track that cuts these lobes, a pilot will hear the signal while within their coverage but receive only noise or hash between them.

Depending on the aircraft's distance from the transmitter and the particular pattern of the lobes, the period during which the signal is heard will vary from a few seconds to several minutes.

5.6.3 Beacon Search Procedures

Searches to identify and locate signals from emergency beacons will normally be initiated immediately following the confirmation of the receipt of a beacon signal. Electronic searches may be supplementary to visual searches. Rescue planning must be commenced with all beacon activations.

When it is known or believed that an aircraft or persons in distress are equipped with a beacon, an electronic search at a high level should be initiated immediately. In addition to beacons designed for operation by survivors, many aircraft carry ELTs that start operating automatically when G forces reach a certain level, such as in a crash.

The electronic search should not preclude the initiation of a visual search at lower levels since the success of an electronic search depends on a beacon actually radiating a signal.

When tasking aircraft to search for a beacon signal, it may be necessary to select a search pattern from one of those already described. The most commonly employed are the track line and parallel track patterns. Track spacing should take into account terrain and the height of the aircraft. See the following table:

ALTITUDE AGL/AMSL FT	MOUNTAINOUS DENSE TIMBER NM	PLAINS or DESERT NM
1000	2	10
5000	10	20
8000	15	25
10000	20	30
15000	30	60
20000	40	80
30000	50	100

Table Suggested maximum track spacing for aircraft conducting beacon searches

Note: Beacon search altitude should, initially, be as high as possible for the aircraft tasked, subject to air traffic and meteorological conditions.

Pilots should be briefed to disable the receiver squelch, if fitted, and to leave it disabled throughout the search for a beacon signal. On modern receivers not fitted with squelch control, it may be possible to use the test switch to achieve the same end.

When searching for beacon signals on 243.0 MHz over water, the track spacing quoted in the above Table should be reduced by 20%.

When searching over mountainous terrain, it is recommended that the track spacing approximates the lesser of that listed for "heavy timber, jungle or mountainous terrain" and the distance between ridges. The search pattern tracks should, as far as possible, be oriented parallel with the ridges.

5.6.4 Locating a Beacon Signal Source by Homing Devices

A number of civil and military aircraft are fitted with direction finding equipment that enables a pilot to home onto the source of a beacon signal and fix its position. RCC staff are not required to be familiar with the equipment or to brief pilots on its in-flight operation. Procedures have been developed to localize the position of a radiating beacon when homing devices are not available and the only information available are reports of beacon signals being heard.

A number of agencies and volunteer organisations also have hand held homing devices.

5.6.5 Aural Location of Beacons

Aural procedures are based on the assumption that an undistorted radiation pattern is very nearly circular.

5.6.6 Maximum Radio Signal Range Calculations

By using the following formula:

Maximum Range (in NM) = $1.2 \times \sqrt{h}$
Where: h = height/altitude of the receiving antenna in feet;
the theoretical maximum range of the transmitter may be calculated, or for search purposes, the theoretical maximum distance at which an ELT signal may be received given the receiving antenna's height above ground level.

Note: The transmitting antenna is assumed to be at ground level.

The area in which the transmitter is located may be determined by plotting a circle, with radius equal to the calculated range, from the position at which the beacon was heard. The intersection of circles plotted from two or more hearing positions will result in a fix of the probable position of the transmitter.

5.6.7 Night Vision Goggles

Note: While night vision goggles (NVGs) are in use by the DF, they are still under trial for use by civil operators.

Use of night vision goggles (NVGs) can be effective in search carried out by various types of search units.

The following factors may influence the effectiveness of NVGs for searching:

a. NVG quality
b. Crew training and experience
c. Environmental conditions, visibility, moonlight, cloud coverage, rain,
d. Level and glare effects of ambient light, natural and artificial.
e. SAR unit speed
f. Height of the observer above the surface
g. Surface conditions (like snow)
h. Size, illumination, and reflectivity of the search object. The presence of reflective tape greatly enhances delectability.
i. Types of survival equipment or light sources used by the survivors.

Glare should be minimized as much as possible within the facility where the NVG users are stationed. This may involve opening or removing windows where practicable. Also proper scanning techniques are important for reducing the adverse effects of moonlight or artificial light sources like, lighthouses, offshore rigs, ships, navigation and strobe lights.

Visible moonlight can significantly improve detection of unlighted search objects when using NVGs. Search object light sources, like strobe or similar lights, or even cigarettes, can greatly improve detection even in poor visibility conditions.

RCC staff should be aware that sweep width needs to be discussed with the crew conducting the mission.

5.7. SAR Unit Selection and Characteristics

5.7.1 Overview

The selection by SAR staff of available SAR units to be used in SAR operations should take into account the following considerations:

a. the need to reach the distress scene quickly; and
b. suitability for at least one of the following operations:
   i. provision of assistance to prevent or lessen the severity of accidents;
   ii. conduct of a search, primarily by air but with the assistance of land units as required;
   iii. carriage of supplies to the scene of an accident and, if necessary, delivery of supplies; or
   iv. execution of a rescue, (by land units or by helicopters; and as required fixed wing aircraft to provide guidance to units or to relay communications).

In coordinating a search, the SMC, as guided by local procedures, may charter, arrange or request the provision of suitable aircraft or resources.

The suitability and efficiency of an aircraft for search, support and rescue operations will depend on which and how many of the following desirable features it possesses:

a. Operational characteristics:

   i. safe low-speed and low-level flight capability,
   ii. short take-off and landing (STOL) capability,
   iii. sufficient range to cover the area, with due regard to the location of redeployment bases,
   iv. maneuverability, especially for searches in mountainous areas, and
   v. payload capacity;

b. Equipment:

   i. suitable navigation and instrument flying aids,

ii. radio equipment capable or receiving and homing on emergency radio signals, and
iii. adequate communications equipment;

c. availability of good observation posts;
d. suitability for the delivery of supplies, emergency equipment and personnel; and
e. facilities for the treatment and carriage of survivors.

The SMC shall select aircraft for use as SAR Units after consideration of the following factors:

a. type of search necessary;
b. type of terrain;
c. type of navigation involved;
d. need for dropping supplies;
e. disposition of aircraft with respect to search area;
f. crew experience and familiarity with the area;
g. weather conditions at and en route to search area; and
h. rescue considerations.

Aircraft not equipped with radios should not be used on SAR operations except as a last resort.

Fast, high flying aircraft equipped with homing and/or direction–finding equipment that have the operational flexibility to descend to low level for final search are recommended for beacon monitoring.
Helicopters are particularly useful SAR units as their slow speed and ability to hover make them suitable for search as well as rescue operations, particularly where small targets are sought or close scrutiny of terrain or sea is required. They also have the ability to land in a confined area and, in some instances, to operate from some specified base.

Aircraft classification for SAR purposes are contained in **Appendix V**.

5.7.2 Land Search Facilities

Search by land facilities alone is usually impractical for large search areas but it can be conducted in most weather conditions and can provide complete coverage of a confined area that cannot be thoroughly searched from the air. Land parties are also critical in operations where the search is carried out from the air and rescue by land facilities.

The need for coordination between land rescue units and search aircraft should be considered, and plans should cater for the need for two-way radio communication. There may also be a need in remote areas to keep land units supplied with fuel, water and food by means of airdrops.

When the survivors are located, the SMC should liaise with the police commander (assigned for this job) with a view to expediting the return of survivors to a place of safety. Consideration should be given to aircraft relay and the use of suitable motor transport: ambulances, four-wheel drive vehicles, buses, etc.

Specialist police and military land parties are equipped with material useful to the SAR role. It is desirable that land SAR units be equipped with basic navigation aids, two-way communication equipment, sufficient clothing, medical supplies and rations to reduce the need for air drops and specialist equipment appropriate to the unit's particular role.

The normal functions of land rescue units are to care for and evacuate survivors after they have been located. Search by land units alone is normally impracticable but may be used when aerial search is not possible or is ineffective, or when a closer examination of an area is desirable. It can be particularly effective in heavy forest or mountainous areas. Land search parties, may also be used to track down survivors who have left the site of a crashed aircraft.

5.8. Search Unit Allocation

5.8.1 Introduction

Before committing resources to an intensive search, an evaluation should be made of the total search effort required and the contribution that may reasonably be expected from each search unit

When assessing available search capacity, care must be taken not to over-estimate either the time that a particular aircraft and its crew can spend in a search area or the capability of the observers to remain

effective over long periods of flight time.

Failure to make a sound estimation of these factors may result in one or more of the search units being unable to complete its allocated task and the efficiency of the entire effort being seriously compromised.

5.8.2 Aircraft Capability

Search aircraft are expected to comply with the rules for navigation as stipulated in AIP documents, including limitations on crew times and navigation.

The tabulated search data is shown in **Appendix V.** The distance from the base is in the nautical air mile from the aerodrome the aircraft is operating form to the center of the search area allocated to that aircraft.

As a general principle, search aircraft of the smaller variety should be planned in such a way that a rest period on the ground is possible after about two hours of searching.

5.8.3 Calculation of Search Time Required

There is a simple but important formula that should be used to quickly calculate "search ability" and thus gives practical answers to these typical questions:

a. How long will it take to search the whole area?
b. I've got 6 hours, how much of the area can I search?
c. We've got 5 hours, what track spacing must I use?
d. We've got to cover the area by 1600 hrs, how many craft will I need?

The factors to be considered are:

a. the area to be searched in square nautical miles
b. time in hours
c. velocity, the speed(s) of the unit(s) (added together)
d. track spacing in nautical miles

Note: If any three are known then the fourth can be calculated using the formula:

A = TVS

Example 1: How long will it take to search an area 25 NM by 10 NM using a track spacing of 5 NM in a craft with a speed of 10 Knots.

$$T = \frac{A}{VS} \text{ and do the sum } \frac{25x10}{5x10} = 5 \text{ hrs.}$$

If diverting from the assigned pattern track to investigate a sighting, the search unit must fix its position with care. This is to ensure if the sighting is not the target, the search unit can return to and resume the assigned search from the position at which it diverted.

5.8.4 Calculation of Search Time Available

When evaluating the search time available from search assets, certain factors must be taken into account, where applicable:

a. total endurance;
b. transit time;
c. necessary fuel reserves at final destination;
d. first and last light at departure and destination aerodromes, unless flight
    i. is permissible and practical under Instrument Flight Rules (IFR);
    ii. or Night Visual Flight Rules (VFR) operation is possible;
e. weather conditions in the search area, and destination points, and any requirement for holding fuel or alternate aerodrome for aircraft.
f. any other operational limitations; and
g. investigation time while on search provides an allowance for investigating sightings and navigating turns at the end of search legs. It is normally 15% of the time available but may be increased where terrain or conditions dictates.

In most cases, time in transit to the search area may be calculated using speed and the distance between the

points of departure and destination and the mid-point of a search area.

For aircraft, when wind speeds are high, it may be advisable to compute a ground speed for use in transit-time calculations. This is especially appropriate for aircraft with low TAS. In a situation where an aircraft will depart from an aerodrome on one side of its allotted area, conduct its search, then recover to an aerodrome on the other side of the area, if the tracks are aligned with or against the wind direction, calculation of ground speeds is proper.

Fuel reserves shall comply with current regulations for the category of flight. The variable reserve allowance for IFR operations is not applied to the time spent in a search area (ie: it is only applied to the transit times).

Operational factors may limit the search time available from a specific aircraft, examples being the time at which an aircraft will become available, distance from mandatory servicing facilities, and other commitments of the operator that may require the return of an aircraft at a particular time.

5.8.5 Investigation Time

A search asset may sight objects that require investigation; therefore an allowance for the time taken to investigate must be made. The basic allowance is 15% of total time available in the search area, but the SMC may decide to increase this figure. The number of sightings investigated by previous search crews will influence any such decision. These, in turn, will be influenced by the nature of the terrain. Over heavily timbered, mountainous terrain the allowance may need to be as high as 50% of total search time.

5.8.6 Effective Search Time

Effective search time is the resultant of the actual search hours (ASH) available minus the investigation time.

After making allowance for "investigation time", it may be convenient to convert the effective search time to an equivalent time at 120 KTS before calculating the size of the area to be allocated to any given aircraft.

The conversion is made by using the formula:

$$T \text{ (hours at 120 Kts)} = \frac{\text{Search TAS x Effective search time}}{120}$$

Example: If an aircraft can be in the search area for a total time (ASH) of 6 hours at a TAS of 180 KTS and 15% is allowed for target investigations, then 5.1 (6 hrs – 15%) hours may be planned for actual searching. The equivalent time at 120 KTS would be:

$$\text{Hours at 120 KTS} = \frac{180 \times 5.1}{120} = 7.65 \text{ Hours}$$

When obtaining data about aircraft availability, special consideration should be given to the speed at which the aircraft will be flown whilst on search. In general, to provide for optimum scanning by observers, search aircraft should fly as slowly as possible. There are, however, other aspects to be considered, particularly the time available for search and the need to cover the area expeditiously. It may be beneficial to discuss these interacting considerations with operators. Some aircraft operate in excess of 120 KTS when on search; although this is less than optimum, logistic considerations may dictate the use of these speeds.

When the track spacing to be assigned to each aircraft has been decided, the area each aircraft can cover may then be calculated from the formula: A = TVS.

5.8.7 Comparison of Search Time Required and Time Available for Search Aircraft

Comparison of the search time required with that available, (both denominated at 120 KTS.), will reveal whether the aircraft resources available are enough, too much or too little.

At this point, a critical decision related to aircraft allocation may be made. The time required for search is directly related to track spacing; track spacing, in turn, is directly related to search height. It is feasible, therefore, that despite first indications that insufficient resources are to hand, timely coverage of the whole search area could be achieved by the available aircraft for the sake of a higher-than-optimum search height.

5.8.8 Sufficient Search Time for Search Aircraft

Having calculated the time available from each search aircraft and converted it to time at 120 KTS, it is possible to calculate the area that each aircraft can cover, and to allocate a specific sector of the area to each aircraft.

Various factors may influence the positioning of search aircraft in the area.

These include:

a. The type of aircraft;
b. Time of arrival in the search area;
c. Supply dropping capability;
d. Navigation capability;
e. Suitability to a particular type of search;
f. Search height, or speed limitations;
g. Location of recovery aerodrome.

5.9. SAR Crew Briefing

5.9.1 General

Comprehensive briefing and de-briefing of search crews is a vital component of search planning. They are time consuming processes, and in the case of briefing, preparation must commence at an early stage and, whenever possible, in good time before departure. It must be appreciated that many personnel engaged for search operations are neither trained for nor experienced in the search role. Field SAR personnel shall therefore be given every opportunity to familiarize with all relevant details of the distress. All instructions for the SAR operation shall be clearly and precisely presented.

The officer appointed to the briefing task, must be thoroughly familiar with the overall plan and individual search unit tasks.

5.9.2 Search Briefing

Comprehensive briefing of search units is vital to every search operation. The SMC should be satisfied that the briefings are well prepared, and that where group briefings are to be conducted, the venue is suitable for the purpose.

Similar arrangements shall be made for debriefing SAR units.

5.9.3 Search Area Description

There are many ways of describing search patterns and the boundaries of search areas. In selecting the method to be used, RCC staff must consider the SAR knowledge of the recipients and the method to be used for the transmission of the information.

5.9.4 Geographical Coordinates

This is the generally accepted method of designating an area, the corners of a search area being defined by latitude and longitude. To avoid confusion, the positions should be listed in a clockwise sequence, ending with a repeat of the initial coordinates. The disadvantages of this system are the possibilities of error in measurement and transmission.

5.9.5 Universal Grid Reference

A grid reference system is available on the JOG series chart. The Universal Grid is overprinted on all charts of the JOG series and is also shown on the majority of larger scale maps. The grid is indicated by the large numbered lines which are 10,000 yds apart and is oriented from east to west and north to south.

5.9.6 Track Line

A track line search may be designated by stating relevant points along the track together with the width of coverage, for example: "Fly a track 4 NM each side of a line between 16° 20' S 135° 15' E and 17° 50' S 137° 28' E."

5.9.7 Landmarks

Description of a search area by way of natural or man made boundaries is particularly suitable when describing mountainous areas. Care must be taken to be precise. Vague descriptions such as "7 NM SSW of..." shall not be used. Proper direction in this case would be by way of positive bearing and distance, i.e. "bearing 202° (T) from ...at 7 NM"

5.9.8 Search Pattern Abbreviations

RCC should ensure the pilot understands the type of search required. Refer **Appendix Q**.

5.9.9 Use of Air/Land Rescue Unit

Preliminary search efforts should generally be based on search aircraft, every endeavor being made to obtain sufficient aircraft to cover the probability area in the shortest possible time.

5.9.10 Observer Leaders

The number of observer leaders and observers required, if applicable, at the several bases which may be in use, should be established and called on in accordance with agreed procedures.

In prolonged search cases observer leaders and observers should be rostered to provide sufficient stand down periods to obviate fatigue.

5.10. SAR Crew Debriefing

5.10.1 Overview

Full and proper de-briefing of search units is as important as the briefing process Included in the briefing shall be instructions on the de-briefing procedure to be followed on completion of the search task. Where possible, blank debriefing forms will be given to the aircrew. A careful interrogation and evaluation of each search crew's effort is essential for intelligent forward planning.

Where a FCP (Forward Command Post) is established, pilots, observer leaders, surface search unit leaders and others shall be instructed to attend after their sortie for de-briefing.

Reports are required on anything that the search teams themselves consider pertinent, and may include:

a. Report on actual weather conditions;
b. Positions at which sighting investigations were made;
c. Descriptions of items which were investigated;
d. Accurate description of areas searched and not searched with an assessment of the effectiveness of the search;
e. Results of monitoring of radio frequencies;
f. Any operational difficulties encountered.
g. Observer debriefs forms when available and completed.

6. Rescue Planning and Operations

6.1. General

The primary purpose of any SAR action is the speedy return to a place of safety of the survivors of a distress situation.

It is essential that from the start of any SAR action, the RCC plans for the rescue of survivors and ensures that the appropriate resources are alerted, briefed and positioned so that the rescue may take place with the minimum of delay after the location of the survivors.

Without jeopardizing the ultimate safety of survivors, foremost consideration shall be given to the potential impact on any medical condition of survivors by the method of recovery or the actions of unqualified persons.

6.1.1 Assessing the rescue requirements

The SMC shall ensure that proper attention is given to the preparation and execution of the rescue effort. When the search object has been located, the SMC (or the OSC) or pilot-in-command of the SAR facility as the case may be) must decide on the method of rescue to be followed and the facilities to be used.

The method of rescue to be used shall be decided after consideration of all relevant factors including:

a. Action taken by sighting unit and the action that can be taken by other units at the distress scene;
b. Location of the survivors;
c. Condition of survivors and medical considerations;
d. Number of persons reported to be on board the craft and number who have been located;
e. environmental considerations;
f. Available SAR facilities and their state of readiness;
g. Effect of weather;
h. Time of day;
i. Any risks involved to SAR personnel at a crash site e.g. dangerous goods
j. Support methods available pending arrival of rescue assets, e.g. dropping of supplies.

To reduce delay, the SAR facilities that are likely to be used should be alerted and deployed to a suitable location while the search is still in progress.

6.1.2 Delivery of Rescue Personnel and Equipment

Air delivery of supplies, equipment, or personnel to the scene is the most expeditious method. Helicopters are particularly suitable for this purpose and are usually the primary means for delivering personnel.

Personnel delivery by fixed-wing aircraft is limited to para-rescue personnel.

SRUs should carry a variety of rescue equipment at all times, but SAR helicopters are limited due to their size. An SRU should be provided with rescue equipment suitable for individual operations. A supply of commonly required equipment should be maintained at the permanent bases of SRUs. This includes equipment designed for supply-dropping by aircraft.

Illumination of the scene of operation is required at night. All SRUs should be capable of providing this. Illumination could involve the use of parachute flares or high-intensity searchlights.

6.1.3 Supplies and Survival Equipment

Supplies and survival equipment are carried by air SAR facilities to aid survivors, and facilitate their rescue. The type and number to be carried depend on the circumstances on-scene. Helicopters generally can deliver this equipment directly to survivors.

Fixed-wing aircraft can deliver supplies to survivors if suitable landing areas exist nearby or if the supplies can be dropped at the scene. The packing of supplies and survival equipment should be adapted to the manner of delivery.

The lists of supplies and survival equipment which follow are not intended to be all inclusive but rather to

serve as a guide. The lists indicate which items should be included in a basic pack, i.e.;

a. medical
b. rations
c. signaling devices
d. covering material
e. fire and lighting material
f. sundry material.
h.drinking water

6.1.4 Rescue by Aircraft

In some cases aircraft may be used for rescue. Each aircraft has operational and technical limitations and should not be used on operations for which it is not suitable. When possible, a rescue operation by aircraft should be backed up by a surface facility, particularly for a large number of survivors.

Fixed-wing aircraft may drop equipment to survivors and direct rescue facilities. They can mark the position as long as they can remain on-scene, by serving as a radio, showing lights, dropping flares, and providing radio signals for direction finding and homing by other rescue facilities.

Helicopters can be used to rescue survivors if a suitable location exists. Due to their unique flying capabilities, they should be used whenever possible. They are particularly suitable for rescues at locations where surface facilities are unable to operate. However, there are special concerns of which the SMC must be aware:

(a) Operations by surface parties may be hampered by the noise and rotor wash produced by helicopters. To facilitate the co-ordination between helicopters and surface rescue facilities and to minimize the risk of collision associated with helicopters operating in a confined space, their operations should be coordinated by a facility in communication with them, and preferably by the OSC.

(b) The number of survivors that a helicopter may take aboard each trip is limited. Therefore, it may be necessary to reduce its weight by removal of non-essential equipment or fuel. Fuel loads at the scene may be reduced by use of advance bases with fuelling capabilities.

(c) The route followed by the helicopter as well as the location where the survivors are to disembark should be known to the SMC.

(d) Due to the generally limited fuel reserves of helicopters, and their susceptibility to icing in some locations, it may be advantageous to dispatch a fixed-wing aircraft in advance to confirm the suitability of en route weather, and ensure that the craft requiring assistance is properly briefed in advance on helicopter hoisting procedures.

(e) Recovery by landing of the helicopter creates additional concerns Factors like turbulence, level terrain, clearing, loose debris, altitude, and landing and take-off paths must be considered when selecting a landing site. Operations in a high-altitude environment will reduce helicopter performance and severely affect hovering capability. When conditions are marginal, landings should be carried out only as a last resort.

(f) A typical recovery is carried out by hovering over the survivors and taking them aboard using a winch with a sling, rescue basket, rescue net, rescue seat, or rescue stretcher. Selection of the site is the same as for recovery by landing. However, the cable and rescue device being lowered may have a large static electricity charge. No one should touch the cable or rescue device until it has made contact with the surroundings.

6.2. Preparation

It is the responsibility of the SMC to ensure that appropriate rescue resources are brought to a state of readiness and, as necessary, strategically positioned to be moved quickly into action immediately survivors are located.

6.3. Medical assistance

It must be assumed that the survivors of an emergency will be in need of medical attention, and arrangements should be made to include medically qualified persons in the rescue team. There should be an arrangement of trained medical personnel while rescuing survivors from the site until to the hospital.

6.4. Crashed Aircraft

6.4.1 Overview

When it is known that an aircraft will crash or has crashed and the crash position is incidentally reported or known with reasonable certainty, the RCC shall confirm the crash site and ensure the provision of medical assistance to the occupants and rescue of survivors. Police should be given early notification of a crash for a decision for their attendance at the crash site. Next of kin should be kept fully informed through the appropriate liaison channel; normally the police

Pending assumption of the responsibility by relevant Defense Force authority, the RCC shall endeavor to arrange security at the crash site to prevent interference with the wreckage or with marks made by the aircraft in landing. State police are responsible for securing the accident scene.

6.4.2 Health hazards - aircraft accidents

Movement in the vicinity of crash sites can be extremely hazardous for ground parties on account of toxic fumes, dangerous substances and explosives. Deaths have resulted from ground personnel breathing noxious air and contacting extremely poisonous substances in the proximity of wrecked aircraft.

To the extent that it can be governed, the RCC shall advise that permission should be secured from the appropriate DF authority before members of the public or other agencies approach a crash site of a service aircraft.

There have been aviation mishaps where search and rescue personnel became ill or died as a result of exposure to gases and hazardous materials that were present at aircraft accident sites.

Modern aircraft use composite materials for some of their structure, skin, and access panels. Significant health hazards exist at crash sites from the effects of crash damage and fire on composite materials. When burnt, released fibers and resins may be toxic through inhalation and/or skin and eye contact. Damaged composites may also produce needle-like edges that render handling hazardous. Carbon fibers are electrically conductive and may short-circuit nearby electrical equipment.

Certain exotic metals (radioactive substances) can also be found in military aircraft types, which are also poisonous in their own right. The inhalation, ingestion or absorption of radioactive substances is hazardous, as low-level radiation will continue to be emitted inside the body, possibly resulting in damage to surrounding tissues and organs. Police shall be given reasonable access to SAR facilities and staff during salvage operations.

6.5. Rescue by land facilities

6.5.1 General

Although the location of the distress scene may be known, it may be extremely difficult for a land party to reach it. Therefore the operation should be undertaken only after proper and complete planning.

The land party should be taken to a location as near as possible to the distress scene by some means of rapid transport. If access to the site is difficult, the team leader should, if possible, make an aerial survey of the site to determine the best route. The equipment carried should be carefully selected and arrangements made for supplies to be dropped, should further supplies and equipment be required. A land party should therefore be equipped with a portable two-way radio.

The police will determine equipment necessary for land rescue parties. A portable radio capable of communicating with other SAR Units should always be included in a rescue party's equipment.

In cases where all occupants of a crashed aircraft are not immediately accounted for, the search for missing

persons must be continued. In the meantime, activities for the rescue of the others should be started.

6.5.2 On Scene Procedures

The duties of land party at a distress scene include:

a. giving first aid;
b. collecting and preserving medical and technical data for investigatory purposes;
c. making a preliminary examination of the wreckage;
d. reporting to the SMC; and
e. Evacuating survivors by whatever means are available.

Advice to police officers, other emergency services personnel and the public of the necessary actions to be taken in the event of a civilian aircraft crash in their area is obtained from the civil administration.

The ground rescue party should make a report to the SMC as soon as possible. The SMC will relay advice of the condition of persons on board and disposition of wreckage to other authorities as appropriate.

The aircraft wreckage should not be disturbed except to assist in the recovery of survivors. Not only may the wreckage pose dangers by way of toxic materials and fumes, but also the position of flight controls, the location of debris and other factors are important to the accident investigation.

It is important for the team leader to ensure that the aircraft is not accidentally set on fire.

Note: If it is necessary to cut into the aircraft to remove survivors, non-sparking tools should be used and fire extinguishers should be kept ready.

To help the investigators, photograph and videos should be taken of the crash site and of the wreckage. A description should be passed on to the SMC as soon as possible.

The team leader should take measures to preserve as much medical evidence as possible. These measures should include:

a. photograph of bodies before moving them;
b. preservation of bodies from the elements by the best means available; and
c. notation of position of mobilized survivors and maintenance of medical logs for each survivor.

Note: Except for compelling reasons, human remains should not be moved or removed without authorization from the SMC who should, in turn, obtain authorization from an appropriate authority.

6.5.3 Evacuation of survivors

Survivors should be removed from the distress scene and transported to receiving medical facilities by the most expeditious means. When selecting the method of transport, the SMC should consider:

a. the condition of survivors;
b. the capability of the rescue unit(s) to reach the survivors in the shortest possible time;
c. the medical training, qualifications and operational abilities of the rescue personnel;
d. the rescue units' capability to transport survivors without aggravating injuries or producing new complications;
e. the difficulties that may be encountered by land parties, e.g. provision of shelter;
f. the need for food and water;
g. the weather conditions; and
h. methods of maintaining communication with the rescue party, either directly or through their organization's operational office.

If an early evacuation is considered undesirable, camp should be established in a favorable site. The site should preferably be close to landing zones or supply-dropping zones and/or the planned evacuation route.

Evacuation of survivors will be relatively simple if they are located in an area where medical and rescue facilities are available locally and from where aerial, road or water transport is possible. However, if the distress site is in a difficult or inaccessible area, the evacuation will have to be made on foot to a place from where transport can be provided. This may require sufficient foliage to be cleared by the land party to allow helicopter operation into the site.

The overland route to be followed should be made known to the RCC. This will simplify the provision of aerial

coverage, if this is considered necessary.

If it is decided to evacuate the survivors by air, the rescue party may provide advice of a suitable landing area for fixed wing aircraft or a landing or hovering site for a helicopter. If verbal communication is not possible, the land party should prepare the appropriate ground/air visual signals.

6.5.4 International SAR Signals

The following visual signals are internationally recognized. They are authorized for use in the Colombo SRR.

Number	Message	Code Symbol
1	Require Assistance	V
2	Require Medical Assistance	X
3	Proceeding in this Direction	▬
4	Yes or Affirmative	Y
5	No or Negative	N

Figure - Ground - Air Visual Signal Code for use by Survivors

6.5.5 Use of aircraft for rescue

When considering the use of aircraft to bring about the recovery of survivors, care must be taken to ensure that the rescue aircraft and crew are not exposed to inordinate danger

Fixed wing aircraft should only be used to retrieve survivors when there is significant advantage over the use of surface transport and when there is a suitable aerodrome or landing area near the scene. Pilots shall be discouraged from attempting to land at other than prepared landing areas to pick up survivors. However, should this prove to be the best or only viable option, all available specialist advice concerning the operation shall be obtained. It may be possible to have a qualified person lowered or parachuted in to survey the area. Helicopters may be employed to shuttle survivors from a distress site to a suitable fixed-wing landing area.

6.5.6 Use of helicopters for rescue

When available, helicopters should be considered for rescue work. While eminently suited to the task in many respects, helicopters do have specific limitations that may be summarized as:

a. the adverse effects of turbulence;
b. the need for a level, or near level, landing area;
c. a requirement for a cleared landing area of specific dimensions to avoid rotor blade damage;
d. a requirement for safe approach and take-off paths;
e. potential for adverse effects on certain serious injuries;
f. limited endurance;
g. inability to hover with loads at high altitudes;
h. limited accommodation.

Helicopters can be used to rescue survivors by winching or by landing at a suitable location. Owing to their unique flying characteristics, helicopters should be considered for use as a rescue unit as a matter of course.

They are particularly suitable for rescues at locations where surface units are unable to operate. At the same time, some helicopter evacuations may be hazardous, particularly in mountainous areas at high altitudes. Such evacuations should therefore only be carried out by specially qualified and experienced crews and then only in the event of serious injury or illness or when lack of other means of rescue might result in loss of life. It is important that any information on the condition of survivors is considered by specialists before committing to helicopter use. Operations by surface parties may be hampered by the noise and rotor wash produced by helicopters. To avoid damage to rotor blades, the landing site should be cleared to a diameter specified by the pilot-in-command for each proposed operation. To facilitate the coordination between helicopters and surface rescue units and to minimize the hazard of collision associated with helicopters operating in a confined space during rescue operations, their operations should be carefully planned by the RCC and coordinated by the ATS unit in communication with them.

The helicopter's mass may be a factor limiting the number of survivors that may be taken aboard each trip. It may, therefore, be necessary to reduce weight by all possible means, e.g. removal of non-essential equipment, minimum fuel, use of advance bases with fuelling capabilities, etc.

It must be ensured that the route followed by the helicopter as well as the location where the survivors are to disembark are known to the SMC.

A medically qualified person, medical equipment and respiratory equipment, when available, should be carried on a helicopter recovery mission, at least on the first flight to the distress scene.

Survivors may not know how to operate a strop. A two-person winch is preferred to a single winch. A double strop allows one rescuer to supervise while being winched down and up again with each survivor.
Note: A helicopter should not be approached unless directed and/or escorted by a member of the helicopter's crew. Helicopters may require approach from different aspects dependant on type.

6.5.7 Use of top cover aircraft with rescue and MEDEVAC helicopters

The provision of a top cover aircraft should be considered during operations that may expose the helicopter to undue risk. The SMC is to discuss the requirement for a top cover aircraft with pilot in command of the helicopter. The decision to task a top cover aircraft can be made by the SMC alone or on request by the pilot in command. Circumstances that may require the provision of a top cover aircraft may include:

a. helicopters operating over water. This will vary with the type of helicopter involved. If in doubt, consult with the crew.
b. helicopters operating at or near the limit of their endurance
c. helicopters operating in poor or marginal weather conditions
d. helicopters operating at a rescue scene presenting special dangers, e.g. night.

Aircraft tasked for top cover should be a SRU aircraft carrying suitable supply drop equipment. The primary tasks of the top cover aircraft will be to:

a. provide navigation assistance to the helicopter to locate the target;
b. provide communications assistance to the helicopter; and
c. provide immediate assistance by way of supply drop should the helicopter ditch.

6.6. Supply dropping and delivery of survival equipment

6.6.1 General

Situations will arise where the immediate recovery of survivors is not possible and arrangements will have to be made to deliver sustenance, medical and survival equipment. Such situations shall be anticipated and planned for by the SMC during the conduct of a search.

Where possible delivery will be by way of surface vehicle or craft or by helicopter or aircraft landing nearby. An example of this would be a situation with seriously injured survivors who may need stabilizing prior to being moved or where specialized evacuation vehicles / craft needed are not immediately available.

Supply of survival equipment by air should be considered where there is an expected delay in the recovery of survivors from remote locations on land.

6.6.2 Civil SAR equipment

The inventory of Civil SAR Equipment required includes:

a. Heliboxes for the supply of sustenance, medical and survival equipment
b. EPIRBs.
c. Search and Rescue Communicators (SARCOM) emergency AM radios operating on the aviation band of 123.1MHz that are suitable for dropping in Heliboxes.

Only suitably qualified, trained and equipped crews shall be tasked for supply dropping.

Aircraft tasked for supply dropping will be suitable for the purpose.

Specifically, dropping of articles from aircraft at night requires the approval of SAR Committee.

6.6.3 Supply drop from aircraft over land

Where it may take too long to get to survivors by land, stores and equipment can be dropped from civil or DF aircraft. The main method of delivering supplies to survivors on land from aircraft is by Helibox that can contain food, water, blankets, radios and medical equipment. In situations where it is important to provide survivors with shelter, it may be appropriate to drop one or more liferafts. Where there is no suitable landing place close to the survivors, vital survival equipment, food and stores could be winched or dropped from a helicopter with great accuracy.

7. Delegation of Authority

7.1. Overview

The SAR authority, having its jurisdiction, depending upon situations may delegate its authority as following:

7.2. Rescue Sub center

In some situations, the RCC may delegate some or all of its responsibilities to an RSC, where these have been established, including communications, search planning and arrangements for SAR facilities including medical evacuation.

7.3. On Scene Coordination

In some situations, the RCC may delegate some of its responsibility to an on-scene coordinator (OSC). The function of the OSC is to provide co-ordination at the scene and to carry out the RCC plan to locate and rescue survivors.

Tasks that may be assigned include:

- Co-ordinate operations of all SAR facilities on-scene and ensure that operations are conducted safely;
- Brief and debrief search crews;
- Make periodic situation reports (SITREPs) to the SMC. The standard SITREP format should include but not be limited to
  - weather conditions
  - the results of search to date
  - any actions taken, any future plans or recommendations.
  - status of local resources such as aircraft, fuel, crew and observers.
- Modify the search action or rescue action plan as the situation on-scene dictates, keeping the SMC advised (do in consultation with the SMC when practicable).
- Where possible, ensure fresh observers are allocated to aircraft conducting more than one sortie.
- Co-ordinate on-scene communications.
- Report the number and names of survivors to the SMC.
- Liaise with local authorities

The following tasks that may NOT be assigned include:

- Tasking aircraft.
- Providing information to the media.
- Communicating with aircraft on ATC operational frequencies.

8. Conclusion of SAR Operations

8.1. General

SAR Operations enter the conclusion stage when:

a. the target is located and the survivors are rescued;
b. the emergency beacon has been located and the survivors rescued, or if there was no distress, the beacon has been turned off;
c. information is received that the target is no longer in distress;
d. all known persons on board are accounted for, or it has been determined that there is no longer a chance of survival; or
e. the SAR Authority determines that further searching has no significant chance of succeeding and either suspend or terminate the search.

The authority to end a search rests with different levels within the SAR organisation, depending on the circumstances. In particular, the SAR Authority is responsible for deciding when to suspend or terminate an unsuccessful search where lives were known to be at risk.

The SAR Authority may delegate to the SMC the authority to conclude the operation in all other circumstances (i.e. when the SMC determines that the target is no longer in distress and in situations where an identified beacon has ceased transmitting).

8.2. Conclusion of a successful SAR action

When the target of a search action has been located and the survivors removed to a place of safety, the RCC shall ensure:

a. all people and organizations involved in the SAR action are stood down;
b. all appropriate agencies are notified;
c. next of kin are fully informed;
d. arrangements are made for the recovery of dropped survival equipment;
e. the collection all maps, worksheets, notes, messages in chronological order and file on a SAR incident file; and
f. that administrative and financial procedures are completed.

8.3. Suspension of a search when the target is not found

When it is determined that further search would be of no avail, the SMC shall consider recommending the suspension or termination of the SAR operation. However, search action shall not be suspended or terminated nor the distress phase cancelled without the specific concurrence of the SAR Authority.

The decision to suspend a search shall not be made until a thorough review of the search is conducted. The review will focus on the probability of there being survivors from the initial incident, the probability of survival after the incident, the probability that the survivors were in the search area, and the effectiveness of the search.

The review should:

a. examine search decisions to ensure that proper assumptions were made and that planning scenarios were reasonable;
b. reconfirm the certainty of initial position and any drift factors used in determining the search area;
c. re-evaluate any significant clues and leads;
d. examine datum computations and data calculations;
e. confirm that all reasonable means of obtaining information about the target have been exhausted;
f. review all intelligence material to ensure no information had been overlooked;
g. examine the search plan to ensure that:

    i. assigned areas were searched;
    ii. the probability of detection was as high as desired; and
    iii. compensation was made for search degradation caused by weather, navigational, mechanical or other difficulties; and

h. consider the survivability of the survivor/s taking into account:

i. time elapsed since the incident;
ii. environmental conditions;
iii. age, experience and physical condition of (potential) survivors;
iv. survival equipment available;
v. studies or information relating to survival in similar circumstances; and
i. consider the rescue plan to ensure that:
i. best use was made of available resources;
ii. contingency plans were sufficient to cater with unexpected developments; and
iv. coordination with other agencies was effective in ensuring best treatment of survivors.

Before an unsuccessful search is suspended or terminated, the SAR Authority shall make arrangements to ensure that the next of kin and SAR Committee are fully briefed on the complete search effort, including conditions in the search area, other salient operational factors and the reasons for proposing the suspension or termination of the search.

Consideration may be given to notifying the decision to suspend or terminate search effort at least one day prior to suspension of operations allowing next of kin at least one more day of hope while giving them time to accept that the search cannot continue indefinitely. Accordingly, the SMC should maintain regular contact with the relatives during the conduct of the search, providing access to the RCC if practical and appropriate.

In a case where foreign nationals are involved, liaison shall occur with the Department of Foreign Affairs.

The reasons for suspending a search shall be clearly recorded.

When a SAR action is discontinued or a search is suspended, the RCC shall inform all authorities, units and facilities that have been activated and/or alerted.

On occasions, after the suspension of a search, it may be necessary for the Police or Defence to continue to search for bodies and/or aircraft wreckage. In such cases the SAR Authority that had responsibility for the coordination of the search and rescue operation may, where possible:

a. provide briefings on the path of the aircraft prior to disappearance, last known position, area searched and related intelligence;
b. review intelligence to assist search;
c. source aircraft for transport or search purposes; and/or
d. provide drift information.

Should any other organization such as the operating company, wish to continue with or initiate an independent search, the SAR Authority that had responsibility for the coordination of the search and rescue operation should ascertain whether there is any new intelligence that provides grounds to resume or continue the search. Under the circumstances where there is new intelligence, it should be evaluated and if considered valid the search should be continued or resumed. Where there is no new intelligence, then the SAR Authority may assist the requesting organisation by:

a. briefing the aircraft path prior to disappearance, splash/crash point, area searched and related intelligence;
b. advising the possible location of suitable search aircraft; and/or
c. providing drift information.

8.4. Reopening a suspended search

If significant new information or clues are developed, reopening of a suspended case should be considered. Reopening without good reason may lead to unwarranted use of resources, risk of injury to searchers, possible inability to respond to other emergencies, and false hopes among relatives.

8.5. Records and reports

Records relating to search and rescue operations, including air searches on behalf of other organizations, shall be retained for periods as required under the relevant legislation and regulation.

When a search has been terminated without locating a missing aircraft or its occupants, all records, charts etc. shall be retained and be accessible to SAR staff to allow easy resumption of search activity should further intelligence be received.

Reports on SAR actions shall be generated as required for inquiries, management purposes and for training requirements.

8.6. Incident debriefs

Following an incident the conduct of debriefs of agencies and groups involved should be considered. The purpose of incident debriefs is to establish opportunities for improvement in the operation of the national SAR system.

Incidents worthy of debrief may include those where:

a. lives have been lost unexpectedly;
b. large and complex searches have been conducted;
c. multi agency involvement occurred; or
d. where coordination, communication or response challenges were experienced during the incident.

This list is not exhaustive and the conduct of a post incident, multi-agency debrief is at the discretion of the SAR Authority in overall coordination of the incident with mutual agreement of other SAR Authorities and agencies involved.

Post incident debriefs should be used to;

a. establish opportunities for improvement in the operation of the SAR System; and
b. ensure current policies and procedures are appropriate.

The SAR Authority with overall coordination is to:

a. decide the need for a debrief in consultation with other SAR participants;
b. organize and host the debrief unless otherwise agreed by the participants;
c. establish a venue that maximizes opportunity for participation in, and learning from, the debrief;
d. capture and share the opportunities for improvement arising;
e. initiate changes to the National SAR Manual as appropriate arising from the debrief; and
f. include lessons learned from debriefs in their jurisdiction reports to the annual SAR Committee meeting.

Participation at debriefs may be restricted to particular SAR Authorities and agencies depending on the issues that are likely to arise and would be a decision for the SAR Authority with overall coordination for the incident.

SAR Authorities that participate in debrief will meet their own attendance costs, unless otherwise agreed by the participants.

The debriefing attached at **Appendix-O** should include the opportunity for all significant parties involved in the incident to contribute and learn from it.

8.7. Case studies

Case studies may be conducted at the direction of the SAR Authority. IAMSAR provides guidance on case studies as follows.

Sometimes a SAR case has a surprise ending, as when the survivors are found by someone not involved in the search effort in a location outside the search area, or they are found, alive and well, in the search area after the search effort has been suspended. There are also occasions when there seems to have been an unusual number of problems in spite of the best efforts of the SAR personnel. Finally, there may be important and valuable lessons to learn from a SAR incident and the subsequent response of the SAR system that would be revealed only by a careful after-the-fact review.

a. A SAR case study is an appropriate method for addressing those aspects of an incident that are of particular interest. Individual aspects of interest could include problems with communications, assumptions made, scenario development, search planning, or international co-ordination. SAR case studies or incident reviews also provide opportunities to analyze survivor experiences and lifesaving equipment performance. Survival in hostile environments is affected by many variables, including the physical condition of the survivors, survivor actions, reinforcement given by rescue forces prior to rescue, and the effectiveness of safety or survival equipment. Knowing more about these factors can help the SAR system become more effective.
b. When used to review and evaluate all aspects of a response to an incident, SAR case studies are one of the most valuable and effective tools for improving SAR system performance. Therefore, SAR case studies or reviews should be performed periodically even when no problems are apparent. There is almost always room for improvement, especially in large, complex cases. The most important outcome, however, is that early detection and correction of apparently small problems or potential problems will prevent them from growing into serious deficiencies later.

To get a balanced view, more than one person should conduct SAR case studies; the case study team should include recognized experts in those aspects of the case being reviewed. To achieve maximum effectiveness, case studies should not assign blame, but rather, should make constructive suggestions for change where analysis shows that such change will improve future performance.

8.8. Performance improvement

Constant improvement in the performance of the SAR system should be a clearly stated goal of SAR managers. One method to encourage performance improvement is to set up goals whose degree of attainment can be measured by key performance data. This data should be collected, analyzed, and published on a routine basis so that individuals can see how the system as a whole is doing, and how their performance is contributing to the achievement of the established goals. Routine reports from the SMCs to the SAR managers can be used for monitoring system performance and highlighting areas where improvement is possible through changes in policies, procedures, or resource allocation.

8.9. Inclusion of the Report

A record of SAR operations is required to improve methods, evaluate mistakes, if any, and provide statistics for the appropriate authority to justify SAR system support and for any subsequent investigation. This record should include all information gathered during the operation. If the SAR service maintains computer files of SAR cases, appropriate information from this case file should be extracted and entered into the database for future analysis.

All information pertaining to a specific SAR incident should be placed in an easily identified and labeled file folder and then placed in storage. This folder will comprise a final report whose format should be as follows:

An example of suggested sections for the report:

- Final report with number
- Date and time
- RCC logs, forms and folders
- Aircraft registration, type and call sign
- Aircraft operator
- POB
- Narrative [description of incident] with charts
- RCC actions (operations conducted by RCC etc.)
- SAR units - identity, time alerted, time on task, time released, time returned
- Other organizations
- Result of operation
- Number of persons – rescued, deceased, missing
- Any other information.

9. Search and Rescue Training and Exercises

9.1. General

The head of a SAR service will be responsible for ensuring that SAR personnel reach and maintain a high level of competence by establishing adequate training programmes. The head of each facility will be responsible for the training of personnel in the specialized techniques and procedures assigned to them, while each individual must assume responsibility to perform competently any assigned role.

The importance of thorough training for all personnel employed on SAR missions cannot be over-emphasized. Failure of a single link in the often complex chain of action required in SAR missions can compromise the success of the operation, resulting in loss of lives that might otherwise have been saved. The purpose of training is to meet SAR system objectives by developing SAR specialists. Since considerable experience and judgment are needed to handle SAR situations, necessary skills require significant time to master. Training can be expensive but contributes to operational effectiveness. Quality of performance will match the quality of training.

The training programmes should comprise:

a. Formal Training
b. Practical Training (OJT Exposure)
c. Synthetic Training (Table Top EX)

9.1.1 Professionalism

Consistency in training and sharing of information relating to search and rescue is promoted through the SAR Committee. Standardization to the prosecution of SAR Operations is encouraged through these floras. Efforts to ensure professionalism extend to career development for individuals who are assigned to undertake SAR duties. The aim is to ensure SAR officers are competent. In additions, agencies should consider making assignments of sufficient length to develop expertise and take advantage of SAR experience in subsequent assignments of officers.

9.1.2 Who to train

All personnel involved in SAR Operation need to undertake SAR-specific training. One of the advantages in associating in RCC with an FIC (or ACC) is that it may be possible to use ATS staff for SAR functions. Their ATS training is a great asset but, even so, they will require further training in SAR techniques.
The formal training of RCC personnel should include:

a. organization
b. procedure
c. administration
d. information

9.1.3 Requirement for Training

Training is critical to performance and safety. The SAR system should save those in distress when it can, and also use training to reduce risks to its own valuable personnel and facilities. Training personnel in making sound risk assessment will help to ensure that these trained professionals and valuable facilities remain available for future operations.

Search and rescue organizations are responsible for the establishment of training programs for SAR personnel to reach and maintain competence appropriate to their role.

Training of SAR personnel should focus on both the practical and theoretical application of SAR and can include the following:

a. Study of SAR procedures, techniques and equipment through lectures, demonstrations, films, SAR manuals and journals;
b. Assisting in or observing actual operations; and
c. Exercises in which personnel are trained to coordinate individual procedures and techniques, or operate specialized equipment, in an actual or simulated environment.

9.2. Search and Rescue Exercises

To reach a high degree of proficiency, all SAR facilities must periodically take part in coordinated SAR operations. This SAR Exercise (SAREXs) should be designed to exercise the SAR system, in whole or part, and test such things as operational plans, communication procedures and facilities, individual staff performance, SAR unit performance and inter-organization and/or international operations.

It is equally important that personnel have a good knowledge of the duties and procedures of other units and person who may be involved in a SAR operation, particularly those with whom they will have direct contact. It is especially important that SMCs be aware of the time, effort, and risk involved when requests are made to other units or organizations.

Liaison visits between personnel likely to become involved together in SAR operations are encouraged. SMCs and SAR personnel should visit other SAR units or RCC's to become familiar with their facilities and capabilities and when possible take part in training exercises.

The regular conduct of joint SAREXs between SAR Authorities should form a part of any training program.

9.3. Training of search and rescue units Land SAR Training

As the responsibility for land search, as defined in the SAR Plan, is that of the State Police organizations, with assistance from members of the Emergency Services, land SAR training is generally conducted by those organizations.

Other SAR authorities that may become involved in a land SAR incident should ensure that their members are familiar with police arrangements for alerting and dispatching of rescue units.

9.3.1 Aircrew Training

SAR Authorities should coordinate SAR exercises in conjunction with aircrews to ensure practice is maintained in pilot techniques employed in SAR operations.

9.3.2 Drop master and Dispatchers

The dispatch of survival stores and equipment from an aircraft to survivors on land or over water is an exacting task, which, if not performed well, can nullify or seriously delay the rescue effort and may endanger the aircraft.

Joint exercises involving all authorities who organize or participate in land rescue should be arranged on a periodic basis.

9.3.3 Air Observer Training

Major SAR operations require a considerable number of observers who may be drawn from various organizations. They require special training in Air Observation.

9.3.4 AIRBORN SRU'S SLAF

The Sri Lanka Air force will be providing. The main thrust in Airborne SRU'S
The Spread of These SRU, are as follows:

SEARCH AND RESCUE UNITS NAME	LOCATION	FACILITIES	REMARKS
a	b	c	d
ANURADHAPURA	081800N 0802843E	i). Helicopter (01 Unit)	A/c Type : MI17 Endurance : 0230 Hrs. Range : 120 NM

9.3.5 SEA BORNE MARATIME RESCUE UNITS SLN

SEARCH AND RESCUE UNITS NAME	LOCATION	FACILITIES	REMARKS
a	b	c	d
COLOMBO	065621.49N 0795055.33E	i) Off Shore Patrol Vessels (OPV) (1 unit)	- Could carry Four Hundred Fifty (450) casualties. Speed : 21 KTS Range : 5800NM at 15KTS
		ii). Fast Missile Vessel (PMV) (01 unit)	- Could carry Seventy (70) casualties. Speed : 32 KTS Range : 1650NM at 30 KTS 4000 NM at 17.5 KTS
		iii). Fast Gun Boat (FGB) (01 unit)	- Could carry Twenty (20) casualties. Speed : 28 KTS Range : 750 NM at 16 KTS
GALLE	060202.24N 0801354.36E	i). Support/ Training Ship (AA/AX) (01 unit)	- Could carry Three hundred (300) casualties. Speed : 10 KTS Range : 5500 NM at 09 KTS
		ii). Fast Gun Boat (FGB) (01 unit)	- Could carry Twenty (20) casualties. Speed : 28 KTS Range : 750 NM at 16 KTS

KATUNAYAKE	071048.68N 0795307.08E	a) Aircraft (01 unit of each type)	A/c Type : AN 32 Endurance: 0420 Hrs. Range : 400 NM A/c Type : C130 Endurance: 0800 Hrs. Range : 850 NM
MINNERIYA	080301N 0805823E	i). Helicopter (01 Unit)	A/c Type : B212 Endurance: 0230 Hrs. Range : 110 NM A/c Type : MI17 Endurance: 0230 Hrs. Range : 120 NM
RATMALANA	064923N 0795396E	i)Aircraft (01) unit of each type ii) Helicopter (01 Unit)	A/c type : B200 Endurance : 0600 Hrs Range : 400NM A/c Type : Y12 Endurance : 0430 Hrs Range : 200NM A/c Type : B212 Endurance: 0230 Hrs. Range : 110 NM A/c Type : MI17 Endurance: 0230 Hrs. Range : 120 NM
KANKASANTHURAI	094731N 0800347E	i)Helicopter (01 Unit)	A/c Type : B212 Endurance: 0230 Hrs. Range : 110 NM

TRINCOMALEE	083242.37N 0811319.64E	i). Off shore Patrol Vessel (OPV) (01 Unit) ii). Fast Missile Vessel (FMV) (01 unit) iii). Fast Gun Boat (FGB) (01 unit)	- Could carry Four hundred and fifty (450) casualties. Speed : 18 KTS Range : 6100NM at 14 KTS 2700 NM at 18 KTS - Could carry Seventy (70) casualties. Speed : 32 KTS Range : 4000 NM at 17.5 KTS - Could carry Twenty (20) casualties. Speed : 28 KTS Range : 750 NM at 16 KTS
KANKASAN-THURAI	094731N 0800347E	i). Landing Ship tanker (LST). (01 unit) ii) Fast Gun Boat (FGB) (01 unit)	- Could carry Three Hundred (300) casualties. Speed : 14 KTS Range : 1000 NM at 12 KTS - Could carry Twenty (20) casualties. Speed : 28 KTS Range : 750 NM at 16 KTS

These operators once formally trained and equipped are provided with appropriate continuation training and are known operationally as Search and Rescue Units (SRUs). The scope of training provided is specific to the resource capability of individual operators, in terms of human resources and aircraft availability.

Accordingly, operators are given training in one or more of the following aspects of SAR operations:

a. visual search procedures/techniques;
b. airborne location of distress beacons using aural homing techniques;
c. airborne location of distress beacons using DF equipment;
d. on ground location of localized distress beacons;
e. aerial delivery of supplies/equipment overland and; and
f. helicopter rescue techniques.

9.4. Photographic Records

Where possible, a photographic or video recording should be taken on exercises and actual SAR missions for use as future training aids. Participating authority's film crews may be helpful in providing this facility.

9.5. Liaison Visits

It is important that personnel have a good knowledge of the duties and procedures of other units and persons who may be involved in SAR operations, particularly those with whom they will have direct contact. It is especially important that SMCs be aware of the time, effort and risk involved when requests are made to other units or persons.

Liaison visits between personnel likely to become involved together in SAR operations are encouraged. SMCs should inspect other units' facilities and where possible take part in appropriate activities, eg. packing and loading equipment, helicopter rescue exercises, etc. The personnel of other organizations or units should be encouraged to visit RCCs and other SAR related units. Potential SAR team members, either units or individuals, should be invited to participate in, or attend exercises.

10. Emergency Assistance and Services other than Search and Rescue

10.1 General

SAR services may be required to perform operations other than search and rescue, e.g. intercept and escort service and unlawful interference assistance.

10.2 Intercept and Escort Services

The purpose of this service is to minimize delay in reaching the scene of distress and to eliminate a lengthy or abortive search for survivors.

10.3 Unlawful Acts

RCC Colombo may become aware of an aircraft known or believed to be subject to unlawful interference. It will advise ATS Unit as soon as possible. Appropriate procedures will be implemented in accordance with the procedure prescribed in Aerodrome Emergency Plan of before the situation develop to a point that SAR action is or will be necessary.

10.4 Delivery of rescue and salvage equipment

10.4.1 Air Delivery

Air delivery of supplies, equipment or personnel to the scene is the most expeditious method. Helicopters are particularly suitable for this purpose and are usually the primary means for delivering personnel to the scene. Personnel delivery by fixed wing aircraft is limited to par rescue personnel only.

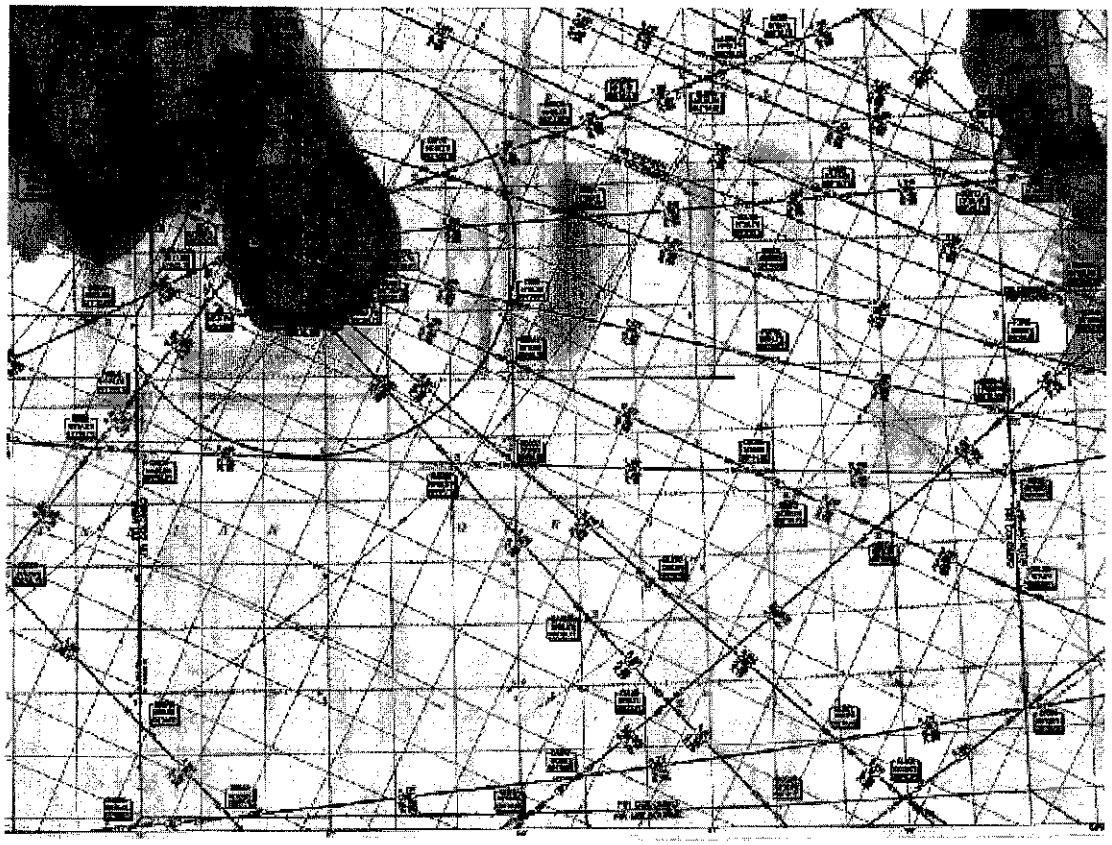
10.4.2 Rescue Equipment

SAR units should carry a variety of rescue equipment at all times; however, helicopters are limited to their size. A unit should be provided with rescue equipment suitable for the requirements of individual operations. A supply of commonly required equipment should be maintained at the permanent bases of SAR units. This includes equipment designed for supply dropping by aircraft.

10.4.3 Illumination

Illumination of the scene of operation is required at night. All SAR units should be capable of providing this. Illumination might involve the use of parachute flares or high-intensity search lights.

Appendix A –COLOMBO Search and Rescue Region



Appendix B: Search and Rescue Functions and Responsibilities

Overall Coordinator		**Function to be performed by or on behalf of the overall coordinator authority**				
For Land and Air Search and Rescue	Responsible Authority	Provision and coordination of air SAR units	Provision and coordination of land SAR units	Communication (other than air/surface)	Air/Ground communication for land SAR	Aircraft Communications where direct communications not available
In respect of aircraft emergencies International/Domestic	CAASL	AASL	SLAF COMMANDOS, Police, & Other Armed Services	AASL	AASL	AASL
In respect of military aircraft	SLAF	SLAF	SLAF	DEFENSE	AASL	SLAF
In respect of Unidentified Distress Beacon Alerts	CAASL	AASL	Army, Police, & Armed Police Force	AASL	AASL	AASL

Note:

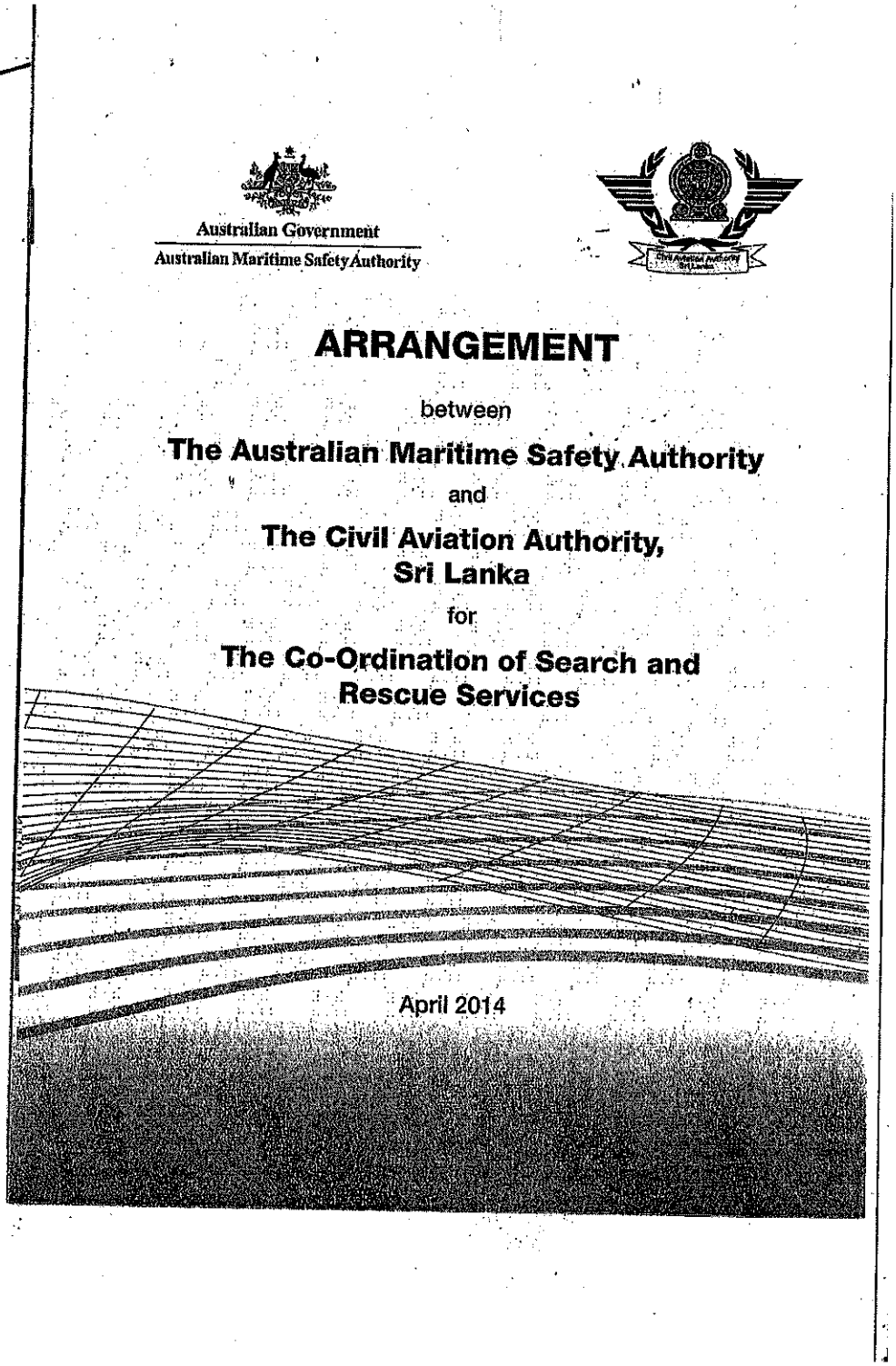
1. Overall coordination responsibility may, if necessary, be transferred to or from State Authorities, by agreement, during the conduct of a Search and Rescue Operation.

2. An Authority which hires or requisitions privately owned facilities shall, unless otherwise agreed between the Authorities, bear any costs of hiring or payment of compensation for requisitioning.

3. Defense Forces called upon to provide air and land SAR units in accordance with established procedures.

Appendix C – SAR PLAN / INTER-GOVERNMENTAL AGREEMENT ON SEARCH AND RESCUE RESPONSE ARR ANGEMENTS.

1. SAR AGREEMENT Sri Lanka and Australia



The Australian Maritime Safety Authority of Australia and Civil Aviation Authority, Sri Lanka (the Parties)

Recognising the importance of co-operation in aeronautical and maritime search and rescue and the need to ensure expeditious and effective search and rescue services, and

Noting the relevant provisions of the standards and recommended practices contained in Annex 12 to the Convention on International Civil Aviation 1944, the Annex to the International Convention on Maritime Search and Rescue 1979, the International Convention on Safety of Life at Sea 1974, and Article 98 of the United Nations Convention on the Law of the Sea 1982,

Desiring to coordinate search and rescue services, mutually arrange the following:

1. IMPLEMENTING AGENCIES

The Australian Maritime Safety Authority of Australia and the Civil Aviation Authority, Sri Lanka, are the national Search and Rescue (SAR) agencies that will implement this Arrangement. Each of these agencies has responsibility for the operation of a Rescue Coordination Centre.

The term 'Rescue Co-ordination Centre' (RCC), includes the terms 'Maritime Rescue Co-ordination Centre' (MRCC) or 'Aeronautical Rescue Co-ordination Centre' (ARCC), as appropriate. The RCCs of the Parties covered by this Arrangement will be:

For Australia: RCC Australia

For Sri Lanka: ARCC Colombo

2. SCOPE OF THE ARRANGEMENTS

Subject to the legislation of each State, the RCC of each Party will:

2.1 Promptly and regularly exchange SAR information concerning an actual distress or a potential distress situation with the other;

2.2 Assist the other, to the extent possible, in the conduct of SAR missions in their respective Search and Rescue Regions (SRRs) and across their common SRR boundaries;

2.3 Take appropriate measures to arrange access to and use of facilities in each other's SRRs while engaged on a SAR mission;

2.4 Exchange information on SAR resources available to it to ensure mutual knowledge of each other's SAR capabilities;

2.5 Conduct regular communications checks with the other to ensure the efficiency and effectiveness of SAR communications links;

2.6 Conduct periodic SAR exercises with the other to test its ability to conduct a SAR response across the common SRR boundary; and

Without prejudicing the ownership of intellectual property and copyright, exchange SAR operational and procedural manuals (and ongoing amendments), and form documents, to allow for the development of procedures and practices that will interface smoothly in practice.

3. SEARCH AND RESCUE REGIONS (SRRs)

The common SRR boundaries between the Australian aeronautical SRR and the aeronautical SRR of Sri Lanka are delineated by the following points:

SRR Boundary

02° 00' South 78° 00' East to 02° 00' South 92° 00' East

4. STANDARD OPERATING PROCEDURES FOR THE RESCUE COORDINATION CENTRES (RCCs)

The following procedures will be followed:

4.1 Determination of Responsible RCC

While the responsibility for declaring an aeronautical emergency phase and initiating local action rests with the relevant aeronautical authority, and, in the case of a marine emergency, with the relevant maritime authority, the responsibility for initiating all subsequent SAR action rests with the RCC. The RCC responsible for overall coordination of SAR action will be determined as follows:

4.1.1 When the position of the aircraft needing assistance or in distress is known, action will be coordinated by the RCC in whose SRR the aircraft is located and this RCC will remain the responsible RCC.

4.1.2 When the position of the aircraft is unknown, SAR action will be initiated by the RCC which first becomes aware that the aircraft may need assistance. The RCC initiating a SAR mission will remain in overall coordination of the mission until the responsible RCC is determined and handover takes place. The responsible RCC will be:

4.1.2.1 The RCC in whose SRR the aircraft was operating when the last contact was made; or

4.1.2.2 The RCC into whose SRR the aircraft was proceeding if the last contact was made on the common SRR boundary.

4.2 Transferring Responsibility for Overall Coordination or part of a SAR Mission

4.2.1 When a transfer of overall SAR co-ordination is proposed as a result of either the establishment of the aircraft's position or movement, or because an RCC other than the one initiating the action is more favourably placed to assume overall coordination of the mission by reason of better communications, proximity to the search area, more readily available SAR units or facilities, or for any other reason, the following procedures will be adopted:

4.2.1.1 Direct discussions or communications will be conducted between the Search and Rescue Mission Co-ordinators (SMCs) concerned, to determine the best course of action;

4.2.1.2 Full details of the previous action taken will be exchanged between the SMCs; and

4.2.1.3 The RCC with initial overall coordination will retain overall coordination until the accepting RCC formally advises that it has assumed overall coordination of the SAR.

4.2.2 The same procedure will be followed where the RCC with overall coordination wishes to transfer coordination of part of the SAR mission to the other RCC.

4.3 SAR Missions in Adjacent SRRs

4.3.1 Each Party will recognise the established interest of the other Party whose aircraft is the subject of, or participating in, a SAR mission. Each Party will be notified without delay about any SAR mission by SAR units of the other Party into its SRR to render assistance.

4.3.2 If it becomes necessary for the coordinating RCC to deploy SAR units into the SRR of the other Party, the SMC will deploy such units for the mission without delay. Simultaneously the adjacent RCC will be advised by written message, providing the following information:

(a) SAR mission identification;

(b) SAR units' identification and type;

(c) Call signs and names;

(d) Point of departure, route and destination;

(e) Assigned search tasks;

(f) Number of persons on board;

(g) Communications frequencies in use;

(h) Relevant equipment carried;

(i) Range and endurance; and

(j) Recovery plan.

4.3.3 The SMC at the adjacent RCC will, on receipt, send an acknowledgment to the initiating RCC and indicate the conditions, if any, under which the intended mission is to be undertaken. All practicable assistance will be rendered to enable the SAR mission to be carried out successfully.

4.3.4 Search units will not enter an Air Defence Identification Zone (ADIZ) until approval is notified by the appropriate RCC.

4.4 Promulgation of Search Areas

The RCC with overall coordination will determine the area of probability and establish the search area(s). The RCC with overall coordination and the RCC in support will, if appropriate and requested, arrange for the promulgation of a Notice to Airmen (NOTAM) defining the search area(s) and any associated Restricted or Danger area(s) within their respective SRR, and will arrange for the issue of any necessary safety message(s) to shipping.

4.5 Liaison during a SAR Mission

4.5.1 During the course of a SAR mission, the RCCs concerned will maintain close liaison in order to ensure the smooth and successful execution of the SAR mission. The RCC with overall SAR coordination will keep the other RCC informed at regular intervals of the number of SAR units involved in the mission, areas to be searched, actions taken to date, and the decision to suspend or terminate the SAR mission.

4.5.2 This notification will take the form of regular situation reports (SITREPs); this means at least daily or at any time of significant change to the situation. Direct discussion between the SMCs of both RCCs should be undertaken whenever necessary.

5. USE OF OTHER PARTY'S SAR UNITS OR FACILITIES

5.1 The RCC of the Party requesting assistance in the form of SAR units or facilities from the other Party will provide all pertinent details of the type and scope of the assistance or facilities required at the time of the request.

5.2 Where the RCC in overall coordination requests the assistance of SAR units from the other Party those SAR units will be placed under the direction of the SMC of the RCC in overall coordination for the period of their assignment, with the exception of military aircraft, ships or personnel, which will remain under the command of the military headquarters of their State. As far as direct communications are possible, the RCC with overall coordination will send directly to the SAR unit all instructions and information relative to the operation and the mission requested. The SAR unit will report directly to the RCC with overall coordination.

5.3 A SAR unit of a Party participating in a SAR operation coordinated by the RCC of the other Party will, without special request, be authorised to enter into or over the territorial sea of this last Party. Except when the RCC with overall coordination already has accurate information about the position of this unit, the SAR unit will notify the RCC with overall coordination of its time and position of entry into the territorial sea.

5.4 A SAR unit of a Party participating in a SAR operation co-ordinated by the RCC of the other Party will be authorised to call into appropriate ports or aerodromes of this last Party. The RCC of this Party will make necessary arrangements, including assistance with logistical support, with public services and other bodies to facilitate this call and will transmit any useful information to the unit involved.

6. SAR OPERATIONAL EXPENSES

Each Party will be responsible for expenses incurred by their own SAR units deployed during any SAR mission.

7. RECOVERY OF SUPPLIES AND EQUIPMENT

Recovery of re-useable supplies and survival equipment will be arranged between respective RCCs. When practicable, recovered items will be returned to their owners unless other arrangements for their relocation are mutually determined in specific instances.

8. AMENDMENTS

This Arrangement may be amended by mutual decision of the Parties by exchange of letters.

9. SETTLEMENT OF DISPUTES

Any disputes between the Parties arising out of the interpretation or implementation of this Arrangement will be settled amicably by consultation between the Parties and without reference to a third party or tribunal.

10. COMMENCEMENT AND DURATION

This Arrangement will come into effect on signature of both Parties.

This Arrangement may be terminated at any time by mutual consent or by either Party upon giving ninety (90) days notice in writing.

In accordance with the provisions of the International Convention on Maritime Search and Rescue, 1979, the Secretary-General of the International Civil Aviation Organization will be notified of this Arrangement.

In witness whereof the undersigned, being duly authorised by their respective Agencies, conclude this Arrangement.

SIGNED in duplicate

.....

Chief Executive Officer
Australian Maritime Safety Authority
This day of 8 April 2014

SIGNED in duplicate

.....

Director General of Civil Aviation &
Chief Executive Officer
This day of 29 April 2014

1.2 *SAR Agreement Sri Lanka and Republic of Indonesia*

MEMORANDUM OF UNDERSTANDING

BETWEEN

THE CIVIL AVIATION AUTHORITY OF

THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

AND

THE NATIONAL SEARCH AND RESCUE AGENCY OF

THE REPUBLIC OF INDONESIA

ON SEARCH AND RESCUE COOPERATION

The Civil Aviation Authority of the Democratic Socialist Republic of Sri Lanka and The National Search and Rescue Agency of the Republic of Indonesia (hereinafter referred to as the Parties):

RECOGNIZING the importance of cooperation in aeronautical and maritime search and rescue and the need to ensure expeditious and effective search and rescue services;

NOTING the relevant provisions of the standards and recommended practices contained in Annex 12 to the Convention on International Civil Aviation 1944, the International Convention for the Safety of Life at Sea 1974 as applicable, the International Convention on Maritime Search and Rescue 1979 and the United Nations Convention on the Law of the Sea 1982:

PURSUANT to the prevailing laws and regulations of the respective countries;

HAVE AGREED AS FOLLOWS;

Senior Air Traffic Controller
(Safety & SAR)
Airport & Aviation Services (SL) Ltd.

ARTICLE 1

OBJECTIVE

The Objective of this Memorandum of Understanding is to set up a framework for the enhancement of cooperation in the field of aeronautical and maritime search and rescue.

ARTICLE II

FORM OF COOPERATION

The Parties will promote the following form of cooperation:

1.1 Promptly and regularly exchange SAR information concerning an actual distress or a potential distress situation with the other Party.

1.2 Assist the other Party in the conduct of SAR missions in their respective Search and Rescue Regions (SRRs) and across their common SRR boundaries;

1.3 Take appropriate measures to arrange access to and use of SAR facilities in each other's SRRs while engaged on joint SAR mission, in line with the national regulation and procedures of each Party.

1.4 Exchange information on SAR resources available to it ensure mutual knowledge of each other's SAR capabilities;

1.5 Conduct regular communications checks with the other Party to ensure the efficiency and effectiveness of SAR communications links;

1.6 Conduct periodic SAR exercise with the other Party to test its ability to conduct a SAR response across the common SRR boundary;

1.7 Conduct Joint trainings to enhance capacity building;

1.8 Conduct of mutual visits of search and rescue personnel and assets to develop common understanding on search and rescue practices; and

1.9 Sharing of technical expertise in the field of Search and Rescue through seminars, workshops, conferences, etc.

ARTICLE III

SEARCH AND RESCUE REGIONS (SRRs)

The common SRR boundaries between the Indonesia aeronautical SRR and the aeronautical SRR of Sri Lanka are delineated by the following points.

SRR Boundary

06°00'N 092°00'E,

02°00S 092°00E

ARTICLE IV

IMPLEMENTING ARRANGEMENT

The implementation of the cooperation set forth in Article II of this Memorandum of Understanding will be carried out through implementing arrangements to be agreed upon by the Parties.

ARTICLE V

FINANCIAL ARRANGEMENT

The Parties shall realize that the cooperation set forth in Article II is specified within their own liabilities and financial capabilities. The Parties shall mutually agree upon any financial arrangement arising therein on a case-by-case basis subject to the availability of funds.

ARTICLE VI

INTELLECTUAL PROPERTY RIGHTS

1. Any intellectual property rights brought by one of the Parties for the implementation of activities under this Memorandum of Understanding shall remain the property of the Party.

2. The use of the name, logo and/or official emblem of any of the Parties on any publication, document and/or paper is prohibited without the prior written approval by either Party.

ARTICLE VII

STANDARD OPERATION PROCEDURES FOR JOINT SAR MISSION

The Parties shall establish the Standard Operation Procedures for joint search and rescue mission according to the related international law, regulation and guideline (manual) in the field of search and rescue.

ARTICLE VIII

FACILITATION TO ENTRY

1. The Party requesting permission to enter the territory of the other Party for SAR mission purposes, including for refueling, shall send its request through the other Party to the competent authority of the other Party.

2. The Party receiving such a request shall confirm such receipt with minimum delay. The receiving Party shall advise as soon as possible as to whether entry into its territory has been permitted and the conditions, if any, under which the mission may be undertaken.

3. The Party receiving such a request, shall apply, in accordance with the laws, regulations, procedures and national policies from time to time in force, governing the subject matter in their respective countries, the most expeditious border crossing procedure possible.

ARTICLE IX

AMENDMENT

This Memorandum of Understanding may be amended at anytime by mutual written consent of the Parties through diplomatic channel. Such amendment shall form an integral part of this Memorandum of Understanding and shall enter into force on such date as may be determined by the Parties.

ARTICLE X

SETTLEMENT OF DISPUTES

Any differences or disputes that may arise between the Parties relating to any matters under this Memorandum of Understanding will be settled amicably through consultations and negotiations between the Parties.

ARTICLE XI

ENTRY INTO FORCE, DURATION AND TERMINATION

1. This Memorandum of Understanding shall take effect on the date of signature and remain in force for 5 (five) years. It may be renewed by mutual consent in writing through diplomatic channel, 6 (six) months prior to the expiration date.

2. This Memorandum of Understanding may be terminated at any time by either Party by giving prior 6 (six) months written notification through diplomatic channel to the other Party.

3. The termination of this Memorandum of Understanding shall not affect the validity and duration of any activities made under this Memorandum of Understanding until the completion of such activities.

IN WITNESS WHEREOF, the undersigned being duly authorized thereto by their respective Governments, have signed this Memorandum of Understanding.

DONE at Colombo on this 24th day of January in the year of 2018 in duplicate, in Sinhala, Bahasa Indonesia and English languages, all texts being equally authentic. In case of any divergences in interpretation, the English text shall prevail.

FOR THE CIVIL AVIATION AUTHORITY OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

HON. NIMAL SIRIPALA DE SILVA
MINISTER OF TRANSPORT AND CIVIL AVIATION

FOR THE NATIONAL SEARCH AND RESCUE AGENCY OF THE REPUBLIC OF INDONESIA

M.SYAUGI.S.Sos,M.M
HEAD OF THE NATIONAL SEARCH AND RESCUE AGENCY OF THE REPUBLIC OF INDONESIA

1.3 *SAR Agreement Sri Lanka and Maldives*

ARRANGEMENT
BETWEEN
THE REPUBLIC OF MALDIVES
AND
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
FOR THE
COORDINATION OF SEARCH AND RESCUE SERVICES

The Government of the Democratic Socialist Republic of Sri Lanka represented by the Civil Aviation Authority and the Government of the Republic of Maldives represented by the Ministry of Defense and National Security and the Maldives Civil Aviation Authority (the Parties)

RECOGNISING the importance of co-operation in aeronautical and maritime search and rescue and the need to ensure expeditious and effective search and rescue services, and

NOTING the relevant provisions of the standards and recommended practices contained in Annex 12 to the Convention on International Civil Aviation 1944, the International Convention on Safety of Life at Sea 1974, and Article 98 of the United Nations Convention on the Law of the Sea 1982,

Desiring to coordinate Search & rescue services, mutually arrange the following;

1. IMPLEMENTING AGENCIES

The Ministry of Defense and National Security and the Maldives Civil Aviation Authority of the Government of the Republic of Maldives and the Civil Aviation Authority of the Government of the Democratic Socialist Republic of Sri Lanka are the National Search and Rescue Agencies that will implement this Arrangement.

Hereafter the term Rescue Coordination Centre, (RCC) covers the terms Maritime Rescue Co-ordination Centre (MRCC) or Aeronautical Rescue Co-ordination Centre (ARCC), where appropriate. The RCCs of the Parties involved in this Arrangement will be:

For Sri Lanka:	ARCC Colombo
For the Republic of Maldives:	ARCC Male'
	MRCC Male'

2. SCOPE OF THE ARRANGEMENTS

The RCCs of both Parties will:

2.1 Promptly and regularly exchange Search and Rescue (SAR) information concerning an actual distress or a potential distress situation;

2.2 Assist each other, to the extent possible, in the conduct of SAR missions in their respective Search and Rescue Regions (SRRs) and across their common SRR boundaries;

2.3 Take appropriate measures for the use of facilities in each other's SRRs while engaged on a SAR mission;

2.4 Exchange information on current SAR resources available to ensure mutual knowledge of each other's SAR capabilities;

2.5 Conduct communications checks with each other to ensure the efficiency and effectiveness of SAR communications links;

2.6 Conduct periodic SAR exercises to test their ability to conduct a SAR response across their common SRR region boundary;

2.7 Without prejudicing the ownership of intellectual property and copyright, exchange SAR operational and procedural manuals with ongoing amendments, and form documents, to develop procedures and practices as nearly common as possible.

3. SEARCH AND RESCUE REGIONS

The contact area between the Sri Lankan aeronautical and maritime SRRs and the aeronautical and maritime SRRs of the Republic of Maldives is delineated by the following points:

A: 06° 00′ North 78° 00′ East
B: 02° 00′ South 78° 00′ East

4. STANDARD OPERATING PROCEDURES FOR THE RESCUE COORDINATION CENTRES

The following procedures will be followed:

4.1 Determination of Responsible RCC

While the responsibility for declaring an aeronautical emergency phase and initiating local action rests with the relevant aeronautical authority, or, in the case of a marine emergency, with the relevant maritime authority, the responsibility for initiating all subsequent SAR action rests with the RCC. The RCC responsible for SAR action will be determined as follows:

4.1.1 When the position of the ship or aircraft needing assistance in distress is known, action will be initiated by the RCC in whose SRR the aircraft or ship is located and this RCC will remain the responsible RCC.

4.1.2 When the position of the ship or aircraft is unknown, SAR action will be initiated by the RCC which first becomes aware that the ship or aircraft may need assistance. The RCC initiating a SAR operation will remain in charge of the mission until the responsible RCC takes over. The responsible RCC will be either

4.1.2.1 The RCC in whose SRR the aircraft or ship was operating when the last contact was made; or

4.1.2.2 The RCC into whose SRR the aircraft or ship was proceeding if the last contact was made on the common SRR boundary.

4.2 Transferring Overall Coordination Responsibility or responsibility for part of a SAR mission

4.2.1 When a transfer of responsibility for overall SAR coordination is proposed, either from the subsequent establishment of the aircraft's or ship's position or movement, or because an RCC other than the one initiating the action is more favorably placed to assume control of the mission by reason of better communications, proximity to the search area, more readily available SAR units or facilities, or any other reasons, the following procedures will be adopted:

4.2.1.1 Direct discussions or communications will be

conducted between the Search and Rescue Mission Coordinators (SMCs) concerned, to agree on the best course of action.

4.2.1.2 If it is decided that a transfer of responsibility is appropriate for the whole mission, full details of the previous action taken will be exchanged.

4.2.1.3 The initiating RCC will retain responsibility until the accepting RCC formally advises the initiating RCC that it has assumed responsibility for overall SAR coordination.

4.2.2 The same procedure will be followed where the responsible RCC wishes to transfer responsibility for part of the SAR mission to the other RCC.

4.3 SAR Missions in Adjacent SRRs

4.3.1 Each Party will recognize the established interest of the other Party whose aircraft or ship is *the subject of,* or participating in a SAR mission. Either Party will be notified without delay about any SAR mission by SAR units of the other Party into its SRR to render assistance.

4.3.2 If it becomes necessary for an RCC to deploy SAR units into the SRR of the other Party, the SMC will deploy such units for the mission without delay. Simultaneously the adjacent RCC will be advised by written message providing the following information.

1. SAR mission identification
2. SAR units identification and type
3. Call signs and names
4. Point of departure, route and destination
5. Assigned search tasks
6. Number of persons on board
7. Communications frequencies in use
8. Relevant equipment carried
9. Range and endurance
10. Recovery plan

4.3.3 The SMC at the counterpart RCC will, on receipt, send an

acknowledgment to the initiating RCC and indicate the conditions, if any, under which the intended mission is to be undertaken. All practicable assistance will be rendered to enable the SAR mission to be carried out successfully.

4.3.4 Search units will not enter an Air Defense Identification Zone (ADIZ) until approval is notified by the appropriate RCC.

4.4 Promulgation of Search Areas

When the responsible RCC has been determined in accordance with Paragraphs 4.1 and 4.2, that RCC will determine the area of probability and establish the search area(s). The responsible RCC and the counterpart RCC will, if appropriate, arrange for the promulgation of a Notice to Airmen (NOTAM) defining the search area(s) and any associated Restricted or Danger area(s) within their respective SRR, and will issue any necessary safety message(s) to shipping.

4.5 Liaison during a SAR Mission

During the course of a SAR mission, the RCCs concerned will maintain close liaison in order to ensure the smooth and successful execution of the SAR mission. The RCC responsible for overall SAR coordination will keep the other RCC informed at regular intervals of the number of SAR units involved in the mission, areas to be searched, actions taken to date, and the decision to suspend or terminate the SAR mission. This notification will take the form of situation reports (SITREPs) at least daily or at any time of significant change to the situation. Direct discussion between the SMCs of both RCCs should be undertaken whenever necessary.

5. USE OF OTHER PARTY'S FACILITIES BY SAR UNITS

5.1 SAR units assigned by one Party to the RCC of the other Party which is responsible for overall coordination of the SAR mission will be placed under the direction of the relevant SMC for the period of their assignment, except that military aircraft, ships or personnel will remain under the command of the military headquarters of their State. As far as direct communications are possible, the responsible RCC will send directly to the SAR unit all instructions and information relative to the operation and the mission requested. The SAR unit will report directly to the responsible RCC.

5.2 The RCC of the Party requesting assistance in the form of SAR units or facilities of the other Party will provide all pertinent details of the type and scope of the assistance or facilities required.

5.3 A SAR unit of a Party participating in a SAR operation co-ordinated by the RCC of the other Party will without special request be authorized to enter into or over the territorial sea of this last Party. Except if the RCC in overall co-ordination already has accurate information about the position of this unit, the SAR unit will notify this RCC with the time and position of its entry into the territorial sea.

5.4 A SAR unit of a Party participating in a SAR operation co-ordinated by the RCC of the other Party will be authorized to call into appropriate ports or aerodromes of this last Party. The RCC of this Party will make necessary arrangements, inc luding assistance with logistical support, with public services and other bodies to facilitate this call and will transmit any useful information to the unit involved.

6. SAR OPERATIONAL EXPENSES

The respective Parties will be responsible for expenses incurred by their own units deployed during a SAR mission.

7. RECOVERY OF SUPPLIES AND EQUIPMENT

Recovery of re-useable supplies and survival equipment will be arranged between respective RCCs. When practicable, recovered items will be returned to their owners unless other arrangements for their disposal are mutually determined in specific instances.

8. AMENDMENTS

This Arrangement may be amended by mutual decision of the Parties by exchange of letters.

9. SETTLEMENT OF DISPUTES

Any disputes between the Parties arising out of the interpretation or implementation of this Arrangement will be settled amicably by

consultation between the Parties.

10. COMMENCEMENT AND DURATION

This Arrangement will come into effect on signature of both Parties.

This Arrangement may be terminated at any time by mutual consent or by either Party upon giving ninety (90) days notice in writing.

In accordance with the provisions of the International Convention on Maritime Search and Rescue, 1979, the Secretary-General of the International Maritime Organization will be notified of this Arrangement. Similarly, the Secretary-General of the International Civil Aviation Organization will be notified of this Arrangement.

In witness whereof the undersigned, being duly authorized by their respective Governments, conclude this Arrangement in duplicate, on 25th day of June 2014.

ON BEHALF OF THE GOVERNMENT OF THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

ON BEHALF OF THE GOVERNMENT OF THE REPUBLIC OF MALDIVES

Appendix D - Distress and Emergency Signals

Overview

Many signals have been devised over the years to signal a condition of distress or other emergency status. Those listed in this Appendix are those which are most common, have been accepted by international agreement or which may be significant for occasional use by SAR units. Because of the large number of possible signals of various types that may be used to indicate an emergency condition or may be used for emergency communication, this list is not all-inclusive.

Search and Rescue Signals –COLOMBO SRR

Procedures for a pilot-in-command intercepting a distress transmission

Whenever a distress transmission is intercepted by a pilot-in command of an aircraft, the pilot shall, if feasible:

a) Acknowledge the distress transmission;

b) Record the position of the craft in distress if given;

c) Take a bearing on the transmission;

d) Inform the appropriate rescue coordination centre or air traffic services unit of the distress transmission, giving all available information; and

e) At the pilot's discretion, while awaiting instructions, proceed to the position given in the transmission.

Communications

Transmission and reception of distress messages within the Colombo SRR are handled in accordance with ICAO Annex 10, Volume II Chapter 5.

For communications during SAR operations, the codes and abbreviations published in ICAO Abbreviations and Codes (Doc 8400) are used.

The frequency 121.5 MHz is guarded continuously by the Control Tower, Approach Control and Area Control Centre.

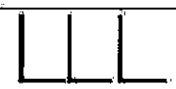
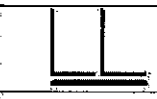
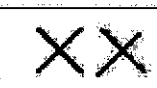
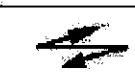
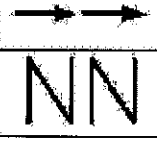
When it is necessary for an aircraft to direct a surface craft to the place where an aircraft or surface craft is in distress, the aircraft shall do so by transmitting precise instructions by any means at its disposal. If such precise instructions cannot be transmitted or when necessary for any other reason, the instructions shall be given by using the procedure prescribed herein.

International Code of SAR Signals

The following visual signals are internationally recognized. They are authorized for use in the Colombo SRR.

Number	Message	Code Symbol
1	Require Assistance	V
2	Require Medical Assistance	X
3	Proceeding in this Direction	
4	Yes or Affirmative	Y
5	No or Negative	N

Figure . - Ground - Air Visual Signal Code for use by Survivors

No.	Message	Code symbol
1	Operation completed	
2	We have found all personnel	
3	We have found only some personnel	
4	We are not able to continue. Returning to base	
5	Have divided into two groups. Each proceeding in direction indicated	
6	Information received that aircraft is in this direction	
7	Nothing found. Will continue to search	

Appendix E - Plotting Symbols

	Heading and TAS
	Track and ground speed
	Wind velocity
(TIME)	Position line
	Transferred position line
(TIME)	Average position line
TIME	Air position
TIME	Dead reckoning position
TIME	Most probable position (MPP)
TIME	Fix (position line)
TIME	Fix (Other than position line – Radar, GPS etc.)
TIME	Visual fix (pinpoint)
B/H TIME	Sighting and Hearing Reports red - probable black – all other sighting and hearing reports
TRACK CALLSIGN POSITION TIME LEVEL ENDURANCE	Aircraft position

Appendix F - Sighting & Hearing (SHR) Techniques

Listening techniques
It is important when questioning an individual either in person or over the phone to actively listen to the information being provided. Practice the following listening techniques when questioning an individual during a SAR incident.

Put the individual at ease.
Remove distractions: don't doodle, tap or shuffle paper.
Empathize with the individual: attempt to see the other person's point of view.
Be patient: allow plenty of time and don't interrupt.
Ask questions: this encourages the individual and shows that you're listening.
Stop talking: you can't listen if you're talking.

Open questions
Open questions are a good way to question an individual. Open questions avoid influencing or guiding the individual in their answer. This ensures the integrity of the answers given. For example: What was the color of the aircraft you saw?
Open questions usually begin with:
How
Where
When
What
Who
Why.

Closed questions
Closed questions follow on from an open question, helping to refine the information already given. They usually require a yes or no answer and are good for gaining information quickly. For example: Are you saying the colour of the aircraft was white?
The closed question usually begins with:
Do
Is
Are
Can
Have.

Leading questions
The problem with leading questions is that they can elicit unreliable information. The individual being questioned may tell you what they think you want to hear.
For example, do not ask: 'You say you saw an aircraft. Was it white with a red tail?'
Ask: 'You say you saw an aircraft. What colour was it?'

Instructions for Completing Sighting and Hearing Reports

The objective of the Sighting or Hearing Report is to obtain the maximum information available from an observer at the initial contact.

The following points assist persons untrained in SAR to correctly complete the Sighting and Hearing Report.

When taking a call, introduce yourself with your organization such as 'Australian Search and Rescue'.
Establish follow-up by first obtaining a call back number and the person's availability.

Print CLEARLY on the Sighting or Hearing Report.

Number each report by referral to the Sighting and Hearing Log.
If you find that a component of the report is important, put the caller on hold and obtain the attention of the Intelligence Officer. Use your initiative.

Time. Be cautious: use local time only. This is very critical: try to narrow down an exact time.
Record how the time was assessed. If the operation is in an area near a State or Territory border, be mindful

of time changes. Also be aware of Daylight Saving Time.

Aircraft location. Attempt to obtain as much detail as possible. If necessary, ask pointed questions. Height may be 'low', 'well above the hills', 'just above the trees'.

Remarks. Be on the lookout for key words. Words like 'slow' can help to assess a report.

Aircraft description. The broadcast is normally a little vague and you must be likewise. Do not ask if the aircraft was a high-wing aircraft, as the caller may tend to agree with you.

Weather. Obtain accurate reports of cloud, rain, and fog. Most people will report wind speed as 'light' or 'strong'. Direction may be only known as 'north'.

Other witnesses. Obtain full details and interview these separately. This may help to verify parts of another report.

Reliability. Annotate only if this is obvious, for example, whether the person reporting was a police officer or an intoxicated person.
Final check. Check the entire form before hanging up. Ensure the form is SIGNED, DATED and your NAME IS PRINTED.

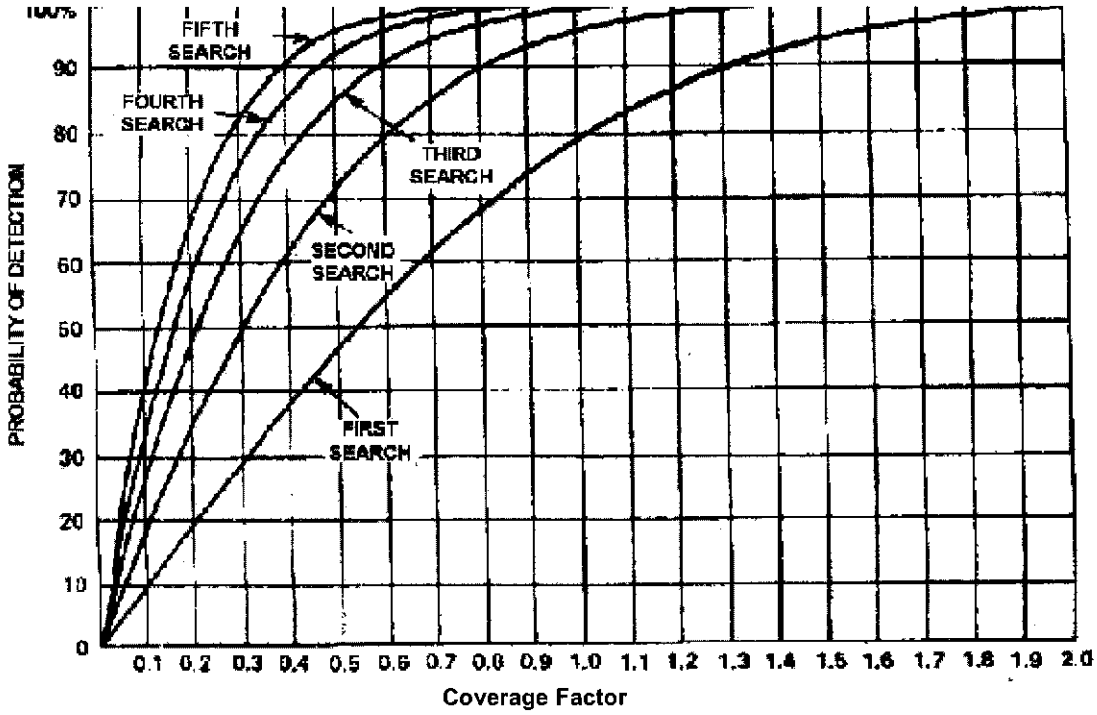
Sighting and/or Hearing Report for missing aircraft

Sighting and Hearing Log

Ser	SRU	Location	Name	Info Received	Remarks

Appendix G – TABLES AND GRAPHS

Probability of Detection



Sweep Width Tables for Visual Search Over Land

Table I-9. Sweep Widths for visual land search [nm]

	0.4	0.4	0.5	0.5	0.5
	0.4	0.4	0.5	0.5	0.5
	-	-	-	-	-
	-	-	-	-	-
	0.9	1.3	1.3	1.3	1.3
	1.0	1.4	1.4	1.5	1.5
	1.0	1.4	1.7	1.7	1.7
	1.0	1.5	2.0	2.0	2.0
	1.0	1.4	1.4	1.4	1.4
	1.0	1.5	1.5	1.6	1.6
	1.0	1.5	1.8	1.8	1.8
	1.0	1.6	2.0	2.0	2.0
	1.2	2.0	2.2	2.2	2.2
	1.6	2.7	3.0	3.0	3.0
	2.0	2.8	3.2	3.2	3.2
	2.2	2.9	3.5	3.5	3.5

Table I-10. Correction factors – vegetation and high terrain

	0.8	0.5	0.3	0.1
	1.0	0.7	0.4	0.1
	1.0	0.7	0.4	0.1
	1.0	0.8	0.4	0.1

Appendix H - Probable Errors of Position

Probable Navigation Error of the Distressed Craft (x)
Initial Position Error (X) of the distressed craft and Search Craft Position Error (Y) are the estimated errors of position based on navigational accuracy of the distressed craft and of the search assets.

If the information on the means of navigation to be used by the distressed craft or by a search facility is available, the navigational fix errors listed in Table below may be used for positions reported as navigational fixes.

Means of Navigation	Fix error (NM)
GPS	0.1 NM
Radar	1 NM
Visual fix (3 lines) *	1 NM
Celestial (3 lines) * fix	2 NM
Marine Radio Beacon	4 NM (3 beacon fix)
LORAN C	1 NM
INS	0.5 NM per flight hour without update
VOR	+ or - 3 DEG arc and 3% of distance or 0.5 NM radius, whichever is greater
TACAN	+ or - 3 DEG arc and 3% of distance or 0.5 NM radius, whichever is greater

Navigational Fix Error.

* Should be evaluated upward according to circumstances.

The above values for Fix errors are appropriate for the actual position of a distressed craft and/or search assets. An SMC should be aware that if the values in the above Table, particularly that for GPS, are used to calculate a Total Probable Error of Position (E) for a Stage 3 search, particularly for a search over land or any search for an aircraft, the search area produced, because of its dimensions, may not be practical to use.
When designing a search area an SMC can always use his discretion, however to obtain a practical search area it is recommended that the fix errors be utilised.
When the means of navigation used by the distressed craft or by a search asset is unknown or the SMC wishes to produce a practical search area for a Stage 3 search, the following Fix errors may be applied:

Type of Craft	Fix error
Ships, military submarines.,	5 NM radius
Aircraft navigated by a self contained navigation system	5 NM radius
Aircraft (other)	10 NM radius
Small craft, Submersibles	15 NM radius

Type of Craft

When the initially reported position of the distressed craft is based on dead reckoning (DR) or the search asset must use DR navigation, an additional error is assumed for the distance travelled since the last fix. The position error is the sum of the fix error plus the DR error (DRe) as shown in the Table below.

Type of craft	DR error (DRe)
Ship, Submarine (Military)	The error of the last positive fix plus 5% of the distance from that fix
Aircraft	The error of the last positive fix plus 10% of the distance from that fix
Small craft, Submersibles	The error of the last positive fix plus 15% of the distance from that fix

Dead reckoning (DR) errors

The figures and factors shown in the above Tables are minimum values and may be increased at the SMC's discretion should information be received indicating that the navigational accuracy of either the distressed or the search craft differs significantly from the accepted standard.

As an example, the 'x' factor for a missing two or more engine aircraft not using a self contained navigation system which reported at position 'A', but failed to report at position 'B' 200NM distant, would be, for 'A' 10NM, and for 'B', 10 + 20 = 30NM.

Should a pressurized aircraft suffer a major loss of cabin pressure when flying above the oxygen height the pilot will put the aircraft into a steep diving turn to bring the aircraft down to 10,000FT as quickly as possible. The possibility of this maneuvers being made and the consequent diversion from track should be considered when constructing a probability area.

Probable Navigation Error of the Search Craft (y)
All search craft are expected to obtain frequent, and near continuous navigational fixes while conducting their search; therefore, only fix error is considered for search craft. Should it be necessary to navigate a search craft by DR in a search area, the RCC should be notified so that both fix and DR error can be taken into account in determining the 'y' factor. The figures selected in respect of a search craft will depend on the method of navigation to be used by the search craft. The figures in Tables shall be taken as minimum values and may be increased at the discretion of the SMC

Appendix I - Worksheets

Incident Reference	**Search and Rescue**	Compiled By .....
	Worksheet No. 3 (Land)	Date ..... / ..... / .....

Search Object — Fatigue Factor Yes or No

MET Visibility ..... KM — Vegetation: 15-60 60-85 +85

	500 ft	1000 ft	1500 ft	2000 ft
Search Height (AGL)				
Uncorrected Sweep Width (Wu) - Table I-9	NM	NM	NM	NM
Searches over land: use Terrain/Vegetation Correction Factor (Fv) - Table I-10				
Fatigue Correction Factor (Ff) If crew will be suffering significant fatigue enter 0.9, Otherwise enter 1.0				
Sweep Width Factor W = Wu Fv Ff				
Practical Track Spacing S (NM)				
Coverage Factor C - W/S				
Probability of Detection (POD)				
Search Area A (SQ NM)				
Search Hours (T) Required at 120 KTS (V) T = A/V/S				

Total Search Hours Available at 120 KTS (.....) (from Worksheet No. 6)

A. Whole Area Calculated at a Search Height of ..... FT (A = TVS C = W/S S = W/C)

A		SQ. NM	S	NM	C	P	%	FOR	SEARCH

B. Modified Area at Calculated Track Spacing in Available Hours

A		SQ. NM	S	NM	C	P	%	FOR	SEARCH

C. Whole Area at Modified Track Spacing in Available Hours

A		SQ. NM	S	NM	C	P	%	FOR	SEARCH

D. Compromise Area and Modified Practical Track Spacing in Available Hours

(i) A		SQ. NM	S	NM	C	P	%	FOR	SEARCH
(ii) A		SQ. NM	S	NM	C	P	%	FOR	SEARCH
(iii) A		SQ. NM	S	NM	C	P	%	FOR	SEARCH
(iv) A		SQ. NM	S	NM	C	P	%	FOR	SEARCH

Mark selected variables with *

Incident Reference **Search and Rescue**

Compiled By

Worksheet No. 4 (Search Radius) Date ..../..../....

Reported Distress Position

..... S

..... E

Time UTC

or

1. Last Positive Fix .....
2. Last Reported Posn .....
3. Missed position .....
4. Next Posn or Dest

Search No

Radius Computed .....

For Search Commencing ..... UTC

Previous Search No. .....

Radius Computed

For Search Commenced ..... UTC

Distress Craft Callsign/Identity

	Position	A	B	C	D
Time Elapsed since last Positive Fix	(T)	.....	.....	.....	.....
Distance Craft Position Error (Fix / 10%T)	(x)				
Search Craft Navigation Error	(y)	.....	.....	.....	.....
Probable Error of Position	(e)	√	√	√	√
$e = \sqrt{x^2 + y^2}$		.....	.....	.....	.....
		.....	.....	.....	.....
Sweep Factor for Search (1.1; 1.5; 2.0; 2.5; 3.0)	(Sa)				
Search Radius (R) = (e) x (Sa)	(R)	.....	.....	.....	.....
Rounded up Radius		.....	.....	.....	.....

Appendix J – Aircraft Accident Site Precautions

Safety precautions and procedures at aircraft accidents

The following precautions should be observed at all aircraft accident sites:

a. Attendance at crash sites should be limited to essential personnel.
b. Personnel should wear Personnel Protective Equipment (PPE).
c. All work at the crash site should be conducted upwind of the wreckage wherever possible.
d. The location of helicopter landing zones in close proximity to crash sites should be avoided to prevent the possible spread of contamination.
e. Eating, drinking, and smoking in or around the crash site should be prohibited.
f. Aircraft technical personnel familiar with the aircraft type should be utilized in the location, identification, and salvage of hazardous materials and remnants.
g. Environmental health personnel should also be notified when suspected dangerous substances are present at the accident site.
h. SAR personnel who were working at the accident site should shower as soon as possible after leaving the area.
i. If time permits, advice to civilians in fallout areas that are not otherwise threatened should be as follows:

i. Remain indoors,
ii. Shut external doors and windows,
iii. Turn off forced air intakes, and
iv. Await further notification.

Appendix K – Search and Rescue Units (SRUs)

Air Units

Operator	Type	Base	Range	Cruise Speed	Specialized Equipment	Response Time	Flight Conditions	Others

Appendix. L

INITIAL REPORT FORM

Date:..... Time:

1. Reason for emergency.....

2. Incident reported by: .....
   Address: .....
   Other witnesses (Name and address):.....

3.Observation made at Date.....Time.....
   at Location .....

4. Flight Plan information:
   Departure from:.....Time (ATD).....
   Expected route:.....
   Cruising speed:.....Destination....
   Arrival time(ETA):.....Alternates.....
   Fuel Endurance Total:.....known position.....
   Number of persons on board:.....
   Name of Pilot- in- Command:.....

5. Comm, Call sign:..... Last Call time.....
   Received by:..... on freq:.....

6. Last position rep. at point:.....time:.....

7.Aircraft type:.....Registration.....
   Color and distinctive markings:.....
   Owner/ Operator:.....
   Emergency equipment: .....

SAR-unit briefing form

Briefing of search personnel should, if possible, be held in sufficient time before departure. Search and relief personnel should be given all relevant details of the distress incident as well as all necessary instructions for the execution of the search and rescue operation. This is best done by issuing a "SAR" unit briefing form to each officer in charge of SAR-unit. If that is not possible the briefing form should be filled in at the RCC and used as checklist when briefing on telephone or radio.

Appendix. M

BRIEFING REPORT FORM

1. Nature of distress or emergency.....
2. Date and time of Incident.....
3. Position or area.....
4. Description of search object:
   a. Aircraft: Type..... Registration.....
   b. Color and distinctive markings and characteristics.....
   c. Owner or operating agency.....
   d. Number of persons on board.....
   e. Emergency equipment carried.....

5. Description of Search area:
   a. Delineation.....
   b. Position of start of search.....
   c. Area to be covered.....
   d. Nature of Terrain.....
6. a) Pattern to be used.....at.....(ht/alt)....
   b) Track spacing.....sweep width.....
   c) Recording of area-as searched.....

7. Other search and rescue facilities to be engaged and areas assigned,
   a. Aircraft
   b. Land Parties

8. Frequencies and call signs to be used for communication with:
   a. R.C.C. or search aircraft in-charge.....
   b. Land Parties.....
   c. .....
   d. Aircraft in distress/ survivors.....

9. Frequencies to be guarded for transmission from survivors
10. Type and quality of droppable survival stores to be carried.....
11. Action on sighting the search object
    a. Report to .....
    b. Drop communication equipment, survival stores and /or Para rescuers necessary
    c. If unable to rescue, direct land facilities and other aircraft to the scene.
    d. Take photographs of wreckage and survivors
    e. Remain at the scene until relieved or forced to return or rescue has been conducted
    f. Weather at the assigned search area.....

12. All above points were passed to :-
    Name.....
    At.....(place) on .....(date) at.....
    (time).....via telephone/W/TR/T briefing

Signature.....
Briefing Officer.

Appendix. N

Search Operation Debriefing Form

1. Search aircraft.....Type.....Registration.....

2. Pilot in command .....

3. Time and date of departure.....

4. Search area assigned.....

5. Search carried at.....

   a) Visual.....Electronic.....
   b) Pattern used.....at.....(ht/alt).....
   c) Track spacing.....Sweep width.....
   d) Search began at..... Ended at.....
   e) Number of observers..... Were they rotated

6. Results of search:
   a) Area actually searched.....
   b) Object of search found/not found.....
   c) If found, location and condition.....
   d) Number and condition of survivors.....

7. Frequencies and call signs used for communication with:
   a) R.C.C. or research aircraft in-charge.....
   b) Other search aircraft.....
   c) Land parties.....
   d) Aircraft in distress/survivors.....

1. Signals received from survivors.....
2. Para rescuers carried.....
3. Survival stores carried.....
4. Weather condition in the search area.....

12.Remarks.....

Signature.....
Pilot in Command

APPENDIX. O

SEQUENCE OF EVENTS FROM "H" HOUR
(i)

Timings	APP/TWR/ACC/ FIC	R.C.C	SAR Unit	SAR Committee
H to H+30	Attempts to contact A/C inform all alerting post and Notify to RCC.	Collect information and liaise	Nil	Nil
H+ 30	Inform RCC	Declare INCERFA inform SAR unit and SAR Board	SAR crew informed and on stand by.	On stand-by
H+60	Inform RCC	Declare ALERFA	SAR crew Assembles at OPS and plan. A/C s prepared	Meet and Inform other Departments.

Timings	APP/TWR/ACC/ FIC	R.C.C	SAR Unit	SAR Committee
H+90	Inform RCC	Declare DETRESFA. Informs SAR Committee and activates SAR unit	Send SAR mission	Liaise
During SAR	Provide information and communication	Direst and co-ordinate SAR mission in consultation with SAR Committee	Co-ordinate and guide SAR patrol (air)	Liaise
Location and condition found	"	Co-ordinate with SAR Committee and activate RESCUE. Terminate the operation. Report completion of mission.	Take part in RESCUE if required	Help plan RESCUE and obtain assistance from Depts.
Location and condition not found	"	Terminate the operation report	Return to base	Report to depts.

(ii)

Appendix P

ABBREVIATIONS FOR PATTERN DESIGNATION

Pattern Designation	Type	Units Required	Remarks
PS	Parallel track	1 Aircraft	Search of an area when the position of the distress is unknown
PM	Parallel Track	2 or more aircraft	Same as plan PS except that two or more unit search in a beam formation at distance S apart for faster and greater area of cover
CS	Creeping Lins Single unit	1 Aircraft	For use when survivors or distress are reported to be between two point and position is not known. Covers wider area than track crawl plans.
TSR	Track Crawl Return Single unit	1 Aircraft	For search of a track line, or like of position when unit must break or search at the same end of track as start point
SE	Expanding Square Single Unit	1 Aircraft	For use when position of distress of survivors is known within close limits and area to be searched is extensive
VS	Sector	1 Aircraft	Object being searched for is small and position of distress is known within close limits For search of mountainous or hill terrain.
O	Contour	1 Aircraft	

Appendix Qs

INCERFA-Checklist

As guidance when performing actions, the following checklist may be used.

	Time	Time	
INCERFA declared at time	INITIATED	COMPLETED	SIGN
Recheck ETA calculations			
"Initial report form' sent to			
Recheck all info, available			
Notify Operator/SAR (unit air Police)			
Obtain infor. About weather			
Call aircraft on all appropriate freq.			
Contact airport of departure ask for physical check of landing area and hangers			
Contact airport of arrival , ask for check as above			
Contact alternatives, ask for check as above			
Contact all airports along route, ask for check as above			
Contact other aircraft within comm.. range for check as above			
Other actions taken			
Incident closed at time			
Notify all concerned			
Incident progressed to ALERFA at Time			

Appendix R

ALERFA- Checklist
As guidance when performing actions, the following checklist may be used.

ALERFA declared at time	TIME	TIME	Sign
Supervisor RCC (Chief)			
Supervisor ACC			
Operator/ RESCUE UNITS			
Head of SAR- Service			
Fill in Initial report form			
Contact Units as appropriate to obtain Further Information ;- _____ _____ _____ ----------			
Evaluate flight plan			
Weather, terrain, Comm. Delays			
Estimate time of fuel exhaustion and maximum range of action from last known position			
Notify SAR- units that may take part in search			
Plot all relevant data and information			
Prepare anxiety message to be broadcasted			

Appendix S

DETRESSFA Check List
As guidelines when performing actions, the following check list may be used.

DETRESSFA	Declared at Times	Time	Time
	Supervisor RCC		
	RCC Chief		
	Supervisor ACC		
	Operating Agency/Rescue Units		
	Head of SAR Service		
Fill in the Initial Report Form			
Decide on plan of action (POA)			
	Supervisor ACC		
	Other ATS Unit concerned		
	Other relevant RCC		
	Operating Agency		
	Obtain Latest Weather Information		
	Calculate/Determine Search Area		
	Prepare Briefing Material for SAR Unit Crews		

Appendix T

The address of the designated authorities concerned:

1 Director General Of Civil Aviation Civil Aviation Authority Of Sri Lanka No 64 Galle Road Colombo 03. Tel: +94 +11+ 2433213 ext. TO All Telefax:+94+11+2440231 AFS VCCCYAYX Email:sldgca@caa.lk	
2.Chairman/ Head of ANS Airport & Aviation Services (SL) Ltd. TEL: 2252861to2252865 Telefax; +91 11 2252062 Email: Chairman@airport.lk or chrisanthi@airport.lk AFS: VCCCYVYX	
3. Director General of Meteorology Department Of Meteorology Bauddhaloka Mawatha Colombo 7 T 269 4104 F 269 8313 E mail meteo1@sltnet.lk	

Appendix U

CLASSIFICATION OF AIRCRAFT SUITABLE FOR SAR PURPOSES.

The abbreviations listed below for categories of aircraft should be used when referring to aircraft made available for SAR purposes.
Aircraft made available for use in search and rescue should be referred to in correspondence and dispatches and on facility charts and tabulations according to the following abbreviated classification:

Category	**Abbreviation**
Short range (radius of action of 280Km (150 NM) plus ½ hour search remaining)	SRG
Medium range (radius of action of 740Km (400 NM) plus 2 ½ hours search remaining)	MRG
Long range (radius of action of 1390Km (750 NM) Plus 2 ½ hours search remaining)	LRG
Very long range (radius of action of more than 1850 Km (1000NM) plus 2 ½ hours search remaining)	VLR
Extra long range (radius of action of 2780Km (1500 NM) or More, plus 2 ½ hours search remaining)	ELR
Helicopters, further classified as;	
Light helicopter (radius of action, for rescue purposes, Up to 185Km (100 NM) and capacity for evacuating one to five persons)	HEL-L
Medium helicopter (radius of action, for rescue purposes, up to 185 to 370Km (100 to 200 NM) and capacity for evacuating 6-15 persons)	HEL-M
Heavy helicopter (radius of action, for rescue purposes, more than 370Km (200 NM and capacity for evacuating more than 15 persons)	HEL-H

Note:

The categories L,M and H refer to the load carrying capabilities.

Appendix V

Reference Documents:

1. ICAO Annex 6 (Operation of Aircraft) requires aircraft to carry certain emergency equipment.
2. ICAO Annex 9 (Facilitation) establishes procedures for SRU entry into different countries.
3. ICAO Annex 10 Aeronautical Telecommunications) specifies certain emergency communications and equipment.
4. ICAO Annex 11 (Air Traffic Services) provides for the alerting of SAR services by use.
5. ICAO Annex 12 (Search and Rescue) for use SAR operation
6. ICAO Search and Rescue Manual Doc 7333-AN/859
7. WP/30, ATM/AIS/SAR/SG/15 Dated 25/7/05.
8. ICAO Convention Doc 7300 Article 25.
9. Airport Emergency Planning 2nd Edition
10. Sri Lanka AIP
11. International Convention on Maritime Search and Rescue , 1979
12. Recommendations of APPANPIRG.
13. IAMSAR Manual Part I, II and III