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## 17. UNMANNED AERIAL VEHICLE (UAV) TESTING

### 17.1 Introduction

- 17.1.1 Unmanned Aerial Vehicle operations including testing and development take place in various Danger Areas and military Restricted Areas.
- 17.1.2 Temporary Danger Areas may be promulgated for other UAV operations if CASA considers there is a risk to other flights such that pilots need to be warned of the danger in order to take appropriate precautions.

### 17.2 UAV Operations

- 17.2.1 UAVs may be flown autonomously within the designated areas, but are subject to operator input. The operator will maintain continuous two way communications on the appropriate aeronautical frequencies, make regular broadcasts advising location, altitude and intention of the UAV and will respond to calls.
  - 17.2.2 Pilots wishing to operate within a Danger Area designated for UAV activity are advised to contact the UAV ground station on the appropriate FIA/CTAF e.g. "UAV TRAFFIC - [location] AREA THIS IS...". While no response from the ground station would normally mean that no UAV is airborne, pilots are encouraged to maintain an enhanced lookout.
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**NAVIGATION AND COMMUNICATION**

**1. ADF MODERNISED HIGH FREQUENCY COMMUNICATIONS SYSTEM (MHFCS)**

- 1.1 The ADF MHFCS is a high frequency (3-30MHz) radio network providing communication services for the operational control and support of ADF and allied aircraft, marine craft and land units. Visiting military aircraft may use either the ADF or RNZAF system when contact with Australian/New Zealand based military authorities is required. Neither system provides a civil or military Air Traffic Control Service.
- 1.2 The ADF MHFCS is centrally controlled by the Defence Communications Station Canberra (DCSC) at the Network Management Facility (NMF) located in Canberra, ACT, Australia.
- 1.3 The MHFCS system consists of four Transmit and Receive Nodes located at:

EXMOUTH, Western Australia	TOWNSVILLE, Queensland
DARWIN, Northern Territory	RIVERINA, New South Wales

These nodes are remotely controlled from the NMF.

- 1.4 DCSC provides 5 continuously monitored Voice Contact Net (VCN) frequencies from each of the four nodes as follows:

VCN	Assigned	Dial/Suppressed carrier	Hours of Operation
VCN 1	22869.5kHz	22868kHz	Continuous
VCN 2	5879.5kHz	5878kHz	Continuous
VCN 3	9048.5kHz	9047.0Hz	Continuous
VCN 4	15963.5kHz	15962kHz	Continuous
VCN 5	12173.5kHz	12172kHz	Continuous

- 1.4.1 Emission: 3K00J3E (Offset - subtract 1.5kHz from assigned)
- 1.4.2 Discrete frequencies are available as required and allocated after initial contact on the VCN.
- 1.4.3 Telephone patch facilities between aircraft and ground appointments are available as required, after initial contact on VCN.
- 1.4.4 Continuous monitoring of military distress frequency 5696kHz.
- 1.4.5 SELCAL. Available to suitably equipped aircraft/vessels.
- 1.5 **Hours of Operation**  
DCSC - H24.
- 1.6 **Mode Of Operation**  
DCSC is capable of operating independent side band (ISB) or AM modes however, the normal mode of operation is Upper Side Band (USB) or suppressed carrier.
- 1.7 **Callsign**  
DCSC uses the following self evident callsign: "Canberra Control".
- 1.8 Telephone/fax contact numbers:

Location	Telephone	Fax
DCSC	+61 2 6263 8126	+61 2 6263 8143

**2. RNZAF AIR OPERATIONS COMMUNICATIONS CENTRE AUCKLAND (AOCCAK)**

- 2.1 AOCCAK is a high frequency (3-30MHz) station providing HF communications services to RNZAF, RAAF and other allied aircraft. Visiting military aircraft may use either the ADF or RNZAF system when contact with Australian/New Zealand based military authorities is required. Neither system provides a civil or military Air Traffic Control Service.
- 2.2 AOCC Auckland is located at RNZAF Whenuapai, Auckland, New Zealand.
- 2.3 AOCCAK provides 4 General Purpose Net (GPN) frequencies, which consist of the following (note station hours of operation are currently not 24/7):

Assigned	Dial/Suppressed Carrier	Normal Hours of Operation	When 24HR Operations
3033.4kHz	3032kHz	0900-1000Z 1900-2100Z	0900-2100Z
5688.4kHz	5687kHz	1900-1000Z	CONTINUOUS
8975.4kHz	8974kHz	1900-1000Z	CONTINUOUS
11236.4kHz	11235kHz	1900-1000Z	CONTINUOUS
13207.4kHz	13206kHz	2100-0900	2100-0900

- 2.3.1 Emission 2K80J9W (Offset - Subtract 1.4kHz from assigned).
- 2.3.2 Discrete frequencies are available as required and allocated after initial contact on the GPN.
- 2.3.3 Telephone patch facilities between aircraft and ground appointments are available in emergencies or at supervisor's discretion.
- 2.3.4 SELCAL. Available to suitably equipped aircraft/vessels.

2.4 **Hours of Operation**

AOCCA - 1900Z - 1000Z daily

2.5 **Mode of Operation**

AOCCA is capable of operating Independent Side Band (ISB), the normal mode of operation is Upper Side Band (USB) or suppressed carrier.

2.6 **Callsign**

AOCCA uses the following self evident callsign: "Air Force Auckland".

2.7 Telephone contact number.

AOCCA -: +64 9 417 7831.

3. **MILITARY HF COMMUNICATIONS**

- 3.1 In addition to that which DCSC supplies, the following HF nets are available:
  - a. RAAF Butterworth. Aircraft transiting to/from Butterworth may relay message traffic via DCSC. Aircraft requiring HF contact with Butterworth are to make prior arrangement through DCSC.
  - b. PNGDF General Purpose Network

Location	C/S	Frequencies	HR of OPS
Port Moresby	P2A2	5746(P) LGG 7496(S) LGH 3175 (S) LGF	H24
Lae	P2A3	5746 (P) LGG 7496 (S) LGH 3175 (S) LGF	2200-0700 JO

4. **AIR-TO-AIR COMMUNICATIONS - CIVIL**

- 4.1 Interpilot air-to-air communications in Australian FIRs may be conducted on frequency 123.45MHz. Aircraft engaged in flights over remote and oceanic areas, out of range of VHF ground stations, and not in the vicinity of a charted non-controlled aerodrome, should use this channel to exchange operational information. Communications between aircraft on this frequency are restricted to the exchange of information relating to aircraft operations. Communications are to be established by either a directed call to a specific aircraft or a general call, taking into account conditions pertaining to the use of the particular channel. As target aircraft may be guarding more than one frequency, the initial call should include the distinctive channel identification "INTERPILOT" or identification of the air-to-air frequency.
- 4.2 The following examples illustrate the application of the calling procedures.
  - a. Qantas 2, SPEEDBIRD 15, INTERPILOT, DO YOU READ?; or
  - b. ANY AIRCRAFT VICINITY 10S 135E, QANTAS 5, 123.45, OVER.

**5. AIR TRAFFIC SERVICES DATALINK SERVICES****5.1 HF SELCAL Check**

- 5.1.1 For aircraft departing Australian airspace, a SELCAL check is not mandatory. However, flight crews wishing to satisfy themselves with HF performance should perform a SELCAL check after departure, but prior to being transferred to CPDLC. The primary HF frequency will be advised with the transfer instruction. The HF operator will confirm the primary and secondary HF frequencies on first contact.
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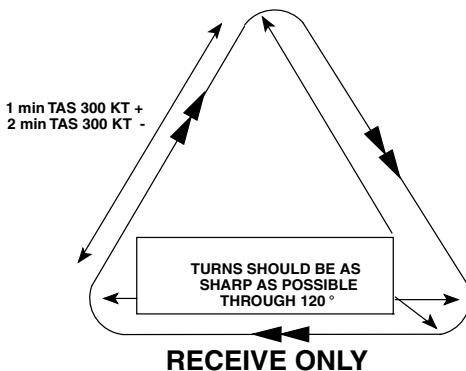
## AIRCRAFT EMERGENCY PROCEDURES

### 1. RECOMMENDED PROCEDURES FOR ANY EMERGENCY PHASE

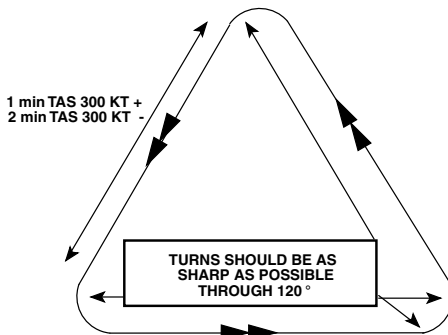
#### 1.1 Emergency SSR Codes - EMERGENCY 7700 - RADIO FAILURE 7600

Circumstances	Phraseologies * Denotes pilot transmission
1. Distress message	a.* MAYDAY [MAYDAY, MAYDAY] <i>followed as necessary by:</i> (i) (station addressed) (ii) (aircraft identification) (iii) (nature of distress condition, e.g. FUEL or EMERGENCY DESCENT) (iv) (intentions) (v) (position, level and heading) (vi) (any other useful information).
2. Acknowledgement of distress message ATC acknowledgement of MAYDAY call ATC acknowledgement of MAYDAY on frequency transfer Imposition of radio silence ATC broadcast for emergency descent traffic Cancellation of distress condition Termination of distress and radio silence	a. ROGER MAYDAY b. MAYDAY [(type of emergency)] ACKNOWLEDGED c. STOP TRANSMITTING MAYDAY d. EMERGENCY DESCENT AT (significant point or location) ALL AIRCRAFT BELOW (level) WITHIN (distance) OF (significant point or navigation aid) [LEAVE IMMEDIATELY] [(specific instructions as to direction, heading or track, etc.)] e.* CANCEL DISTRESS (information) f. DISTRESS TRAFFIC ENDED
3. Urgency message ATC acknowledgement of PAN call ATC acknowledgement of PAN on frequency transfer	a.* PAN PAN [PAN PAN, PAN PAN] <i>followed as necessary by:</i> (i) (station addressed) (ii) (aircraft identification) (iii) (nature of the condition e.g. MEDICAL PRIORITY REQUIRED or WEATHER DEVIATION REQUIRED) (iv) (intentions) (v) (position, level, heading) (vi) (any other useful information). b. ROGER PAN c. PAN [(type of emergency)] ACKNOWLEDGED

- 1.1.1 If no answer to distress/urgency, call/message, use the following appropriate frequencies, broadcasting before changing to the next selected frequency.
- Any other aeronautical en route frequency.
  - 121.5 MHz or 243.0 MHz (R/T): International and Military emergency.
  - 5696 USB DCSA HFCS distress frequency.
  - 4125, 6215 and 8291 kHz (R/T, USB): Australian coastal/ship.
  - 3023 and 5680 kHz. World wide A/G frequencies.
  - 2182 kHz (R/T): International small ships. DF available.
- 1.2 **Notification of Emergency Using Datalink**
- 1.2.1 Depending on the nature of the emergency condition experienced, flight crew should notify ATS of the circumstances by the most efficient means (voice or data link).
- 1.2.2 If a CPDLC MAYDAY or PAN message is received by the ground system, the controller will respond with the free text uplink message ROGER MAYDAY (PAN). The controller will not expect a ROGER response to the uplink until being notified that the emergency situation has been cancelled or stabilised to the extent that messages are able to continue being exchanged (if data link is considered to be the best communications medium for the situation).
- 1.2.3 If the emergency situation no longer exists, the pilot should cancel the ADS emergency mode (if activated).
- 1.3 **Imposition of Silence**
- 1.3.1 Only the ACFT in distress or the unit in control of distress communications is permitted to impose silence on any station which interferes with distress communications. The call should be addressed to ALL STATIONS or one station only, depending on circumstances. The call should be as follows:  
"STOP TRANSMITTING; MAYDAY"
- 1.4 **Alerting Surveillance Unit (MIL OPS only)**
- 1.4.1 If in an emergency within coverage of a surveillance unit and unable to make radio contact with any ATS unit and outside civil controlled airspace, the surveillance unit can be alerted as follows:
- Switch transponder to emergency, squawk mode 3A, code 7700.
  - Continue attempts to make communications and monitor the appropriate frequencies (see communications failure instructions for appropriate frequencies).
- 1.4.2 Fly applicable pattern shown below.







### NO TRANSMIT OR RECEIVE

- 1.4.3 If adopting this procedure:
- fly at best endurance speed;
  - complete at least two patterns before resuming heading;
  - make turns as tight as practicable;
  - attempt to maintain VMC to facilitate interception by a shepherd aircraft; and
  - at night or in VMC, turn on navigation and anti-collision lights.
- 1.5 **Communication Failure**
- 1.5.1 In the event of communications failure, maintain terrain clearance throughout all procedures.
- 1.5.2 **Indications by an Aircraft:**
- In Flight
    - during the hours of daylight - by rocking the aircraft's wings; and  
*Note: This signal should not be expected on the base and final legs of the approach.*
    - during the hours of darkness - by flashing on and off twice the aircraft's landing lights or, if not so equipped, by switching on and off twice its navigation lights.
  - On the Ground
    - during the hours of daylight: by wagging the aircraft's ailerons or rudder; and
    - during the hours of darkness: by flashing on and off twice the aircraft's landing lights or, if not so equipped, by switching on and off twice its navigation lights.
- 1.5.3 **If VFR in Class G Airspace**
- Remain in VMC.
  - Broadcast Intentions (assume transmitter is operating and prefix calls with "TRANSMITTING BLIND").
  - Remain VFR in Class G airspace and land at the nearest suitable aerodrome.
  - Report arrival to ATS if on SARTIME or reporting schedules (SAR telephone number: 1800 815 257).
- 1.5.4 **If in Controlled/Restricted Airspace or if IFR in any Airspace:**
- Squawk 7600
  - Listen out on ATIS and/or voice modulated NAVAIDs.
  - Transmit intentions and make normal position reports (assume transmitter is operating and prefix calls with "TRANSMITTING BLIND").
- AND**
- if in VMC and are certain of maintaining VMC
- Stay in VMC and land at the most suitable aerodrome (note special procedures if proceeding to a Class D).
- OR**
- If in IMC or are uncertain of maintaining VMC
- If no clearance limit received and acknowledged, proceed in accordance with the latest ATC route clearance acknowledged and climb to planned level.

- f. If a clearance limit involving an altitude or route restriction has been received and acknowledged:
  - (i) maintain last assigned level, or minimum safe altitude if higher, for three (3) minutes, and/or
  - (ii) hold at nominated location for three (3) minutes, then
  - (iii) proceed in accordance with the latest ATC route clearance acknowledged, and climb to planned level.
- g. If receiving an ATS surveillance service:
  - (i) climb to MSA/LSALT, and,
  - (ii) if being vectored, maintain last assigned vector for two (2) minutes, then
  - (iii) proceed in accordance with the latest ATC route clearance acknowledged.
- h. If holding:
  - (i) fly one more complete holding pattern, then
  - (ii) proceed in accordance with the latest ATC route clearance acknowledged.

**Notes:**

1. *Initial and subsequent actions by the pilot at the time of loss of communications will depend largely on the pilot's knowledge of the destination instrument approaches, the air traffic/airspace situation and meteorological conditions en route and at the destination. Publishing procedures that cover all radio failure circumstances is not possible. The above procedures ensure that ATS and other traffic should be aware of the pilot's **most likely actions**. Pilots should follow these procedures unless strong reasons dictate otherwise.*
2. *In determining the final level to which a pilot will climb after radio failure, ATC will use the level provided on the flight notification, or the last level requested by the pilot and acknowledged by ATC.*

1.5.5 **Destination Procedures:**

- a. Track to the destination in accordance with flight plan (amended by the latest ATC clearance acknowledged, if applicable).
- b. Commence descent in accordance with standard operating procedures or flight plan.
- c. Descend to the initial approach altitude for the most suitable instrument approach in accordance with the published procedures.
- d. Carry out the approach to the prescribed minima.

**Notes:**

1. *The most suitable approach is normally the approach that facilitates the most accurate track keeping, however, if the pilot is in receipt of ATIS or directed information (e.g. voice modulated navigation aid) that a specific approach is required, that approach should be used.*
2. *If an approach time has been given by ATC and acknowledged, adhere to this time.*
3. *When within 25NM of the destination, the pilot may track direct to the IAF for the most suitable approach.*
4. *At Sydney during Independent Visual Approaches, refer to Sydney/Kingsford Smith entry in FAC section.*

1.5.6 **Actions at Minima**

- a. If visual at the minima at an uncontrolled aerodrome, continue to land provided that a safe landing can be accomplished. If visual at the minima at a controlled aerodrome continue to land provided that a clearance to land is received via a voice modulated NAVAID and/or light signal from the Tower.
- b. If not visual at the minima, depart for a suitable alternate aerodrome.
- c. If insufficient fuel is carried to divert to a suitable alternate, the pilot may hold or carry out additional approaches until visual.
- d. Certain Class D aerodromes have specific communications failure procedures which are shown at each aerodrome entry in the FAC section

LIGHT SIGNAL	Meaning to ACFT in Flight	Meaning to ACFT on Airfield
<b>STEADY GREEN</b>	Authorised to land if pilot satisfied no collision risk exists	Authorised to takeoff if pilot satisfied no collision risk exists
<b>STEADY RED</b>	Give way to other aircraft and continue circling	Stop
<b>GREEN FLASHES</b>	Return for landing	Authorised to taxi if pilot satisfied no collision risk exists
<b>RED FLASHES</b>	Airfield unsafe - do not land	Taxi clear of landing area in use
<b>WHITE FLASHES</b>	No significance	Return to starting point on airfield

### 1.6 Speechless Radar Approach Procedures

Situation	Transmission
1 Pilot request for Speechless Radar approach when microphone/s are unserviceable (carrier wave only available).	Pilot transmits four (4) separate and distinct unmodulated transmissions of one second duration
2 Pilot responses to subsequent control questions: A. affirmative or acknowledgment, B. negative, C. say again	A. one distinct transmission B. two separate and distinct transmissions C. three separate and distinct transmissions
3 Pilot indication of a further and pertinent unserviceability or an emergency	Five (5) separate and distinct transmissions
4 Pilot indication of abandoning the aircraft	A single continuous transmission as long as practicable. Where possible the transmitter key is to be locked on.
5 Controller requires pilot to indicate when an instruction has been completed	WHEN (condition or instruction is completed) MAKE A TWO SECOND TRANSMISSION

#### 1.6.1 Communication and NAVAID Failure

In the event of complete failure of communications and NAVAIDs, maintain terrain clearance and proceed as follows:

- a. If VFR in Class G Airspace
  - (i) Remain VMC.
  - (ii) Broadcast intentions (assume transmitter is operating and prefix calls with "TRANSMITTING BLIND").
  - (iii) Remain VFR in Class G airspace and land at the nearest suitable aerodrome.
  - (iv) Report arrival to ATS if on SARTIME or reporting schedules.
- b. If in Controlled / Restricted Airspace or if IFR in any Airspace:
  - (i) Squawk 7600.
  - (ii) Listen out on ATIS and/or voice modulated NAVAIDs.
  - (iii) Transmit intentions and normal position reports (assume transmitter is operating and prefix calls with "TRANSMITTING BLIND"). if practicable, leave/avoid controlled/restricted airspace and areas of dense traffic.
  - (iv) As soon as possible, establish visual navigation.
  - (v) Land at the most suitable aerodrome (note special procedures if proceeding to a Class D - see above).
  - (vi) Report arrival to ATS.

## 1.7 Emergency Change of Level in Controlled Airspace

1.7.1 When an aircraft in controlled airspace is required to make a rapid change of flight level or altitude because of technical trouble, severe weather conditions, or other reasons, the change will be made as follows using urgency message format, stating level changes involved and diversions, if applicable:

- a. Squawk SSR Code 7700.
- b. Transmit: PANPAN, PANPAN, PANPAN, then
  - (i) agency being called,
  - (ii) aircraft identification;
  - (iii) nature of urgency problem;
  - (iv) intention of person in command;
  - (v) present position, flight level or altitude and heading; and
  - (vi) any other useful information.

## 1.8 Pre/Post Impact Actions

1.8.1 The following actions should be carried out pre-impact:

- a. Activate Crew Impact Instruction. If no prescribed drill, check:
  - (i) preparation of aircraft for impact;
  - (ii) positioning of personnel;
  - (iii) activate ELT (see separate section following);
  - (iv) crew procedure for directing evacuation of aircraft in orderly manner; and
  - (v) ready availability to crew members of charts showing emergency and distress communication facilities; i.e. location, callsign, frequency of:
    - aeronautical stations;
    - DF stations; and
    - coast radio stations guarding international distress frequencies.
- b. Instruct passengers that they will be required to
  - (i) recognise the absolute authority of the pilot in command;
  - (ii) apply safety apparatus as instructed;
  - (iii) prepare for impact shock as instructed;
  - (iv) don protective clothing;
  - (v) make an orderly exit from the aircraft; and
  - (vi) remain near the aircraft after the evacuation (at sea, secure life rafts and set sea anchor).

1.8.2 Immediately prior to impact, set radio apparatus for continuous operation unless the additional risk of fire is too great.

1.8.3 The following should be carried out post-impact:

- a. Activate post impact instructions.
- b. If no prescribed drill, check the following:
  - (i) account for all personnel;
  - (ii) account for all distress facilities;
  - (iii) tend to the injured;
  - (iv) try to attract attention (radio, flares, smoke, mirrors, etc.);
  - (v) display appropriate visual rescue signals;
  - (vi) keep personnel together;
  - (vii) utilise passenger resources, i.e. skill, knowledge, effort, etc.;
  - (viii) delegate duties as equitably as possible;
  - (ix) conserve resources, i.e. water, food, manpower, facilities;
  - (x) maintain passenger morale; and
  - (xi) ensure ELT is activated.
  - (xii) collect all food/water and useful equipment from the aircraft.

## 1.9 Inadvertent Activation of Emergency Locator Transmitter (ELT)

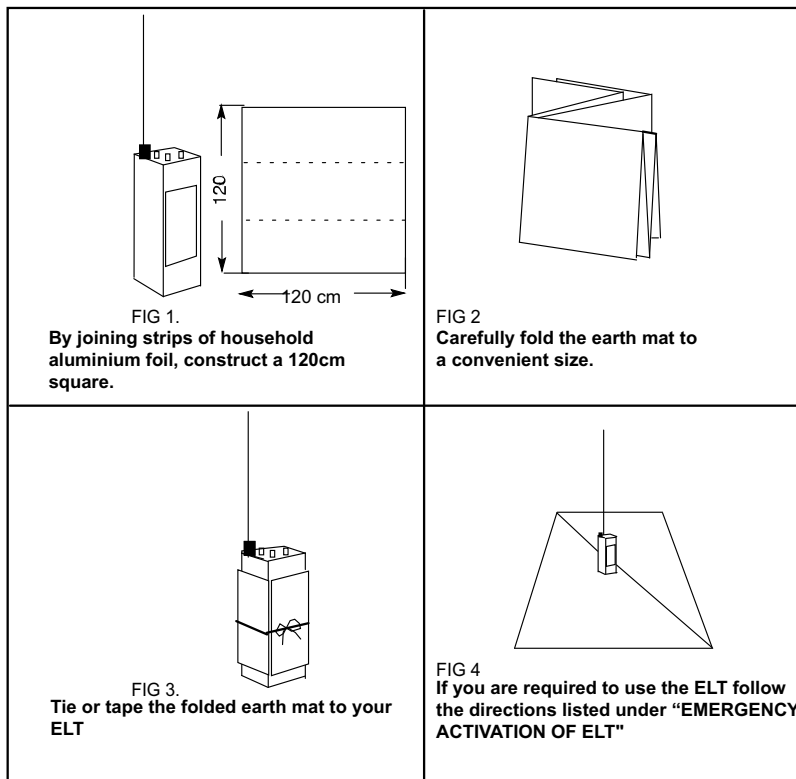
1.9.1 If the ELT has inadvertently been activated for more than 10 secs contact SAR on 1800 815 257.

### 1.10 Activation of ELT

1.10.1 An Emergency Locator Transmitter (ELT) is a valuable search aid if an aircraft is forced down. However, to obtain maximum benefit from the beacon and to assist search aircraft, pilots need to observe a few guidelines for activation of the ELT.

- 1.10.2 If in water and the beacon is buoyant, the ELT should be activated in the water and allowed to float to the end of the lanyard with the aerial vertical. Do not hoist the ELT up a mast. The performance of an ELT may be degraded if it is raised above the water surface.
- 1.10.3 Lives may depend on the correct use of the ELT. The manufacturer's instructions should be studied thoroughly, and kept in the aircraft emergency kit.
- 1.10.4 If you are forced down the following procedure is recommended:
- Activate the ELT immediately;
  - Where the ELT is permanently installed in the aircraft, activate the beacon *in situ*;
  - Where the ELT is not permanently installed in the aircraft, select an elevated site clear of trees, boulders etc. and reasonably close to the aircraft.
  - Place the beacon on the ground on an earth mat. If an earth mat is not available, place the ELT on the wing of the aircraft or another metal reflective surface.
  - Secure the ELT with rocks, sticks, tape etc. so that the aerial will remain vertical. avoid anything touching the antennae as this will degrade ELT performance.
  - Remain clear of the ELT. Obstacles near the ELT will distort the radiation pattern.
  - An ELT which is damaged or under wreckage may still transmit some signal. (Always activate the ELT).
  - Do not switch off the ELT unless rescue is no longer required.
  - To avoid confusing COSPAS/SARSAT and direction finding equipment, avoid activating two or more ELTs within 1NM of each other.

*Note: In many cases, using an earth mat will increase the effective range of a portable ELT by 50%. A simple and effective earth mat can be made by using household aluminium foil to make a 120CM square, folded, and taped to the unit. To use the earth mat, unfold and place it flat on the ground, securing edges with dirt or rocks. Activate the ELT and place it on the mat.*



## 1.11 ELT Characteristics

1.11.1 The following characteristics pertain to ELTs:

- a. Frequency 406 MHz (digital) and 121.5 MHz (analog) and, in some instances, 243 MHz.
- b. 121.5 and 243MHz modulation.
  - (i) continuous carrier continuously modulated at the rate of three swept tones per second, no pauses;
  - (ii) some older marine beacons transmit the carrier on for one second then off for one second, modulation three swept tones per second. This results in the tones being received in evenly spaced groups of three with a distinct one-second pause between groups; and
  - (iii) some foreign marine beacons vary from the above; e.g. there is a European beacon pulsing in groups of two tones.

## 1.12 Reports

- a. report all beacons received;
- b. state characteristics;
- c. when giving signal heard/strength fade positions, include ACFT level and squelch disabled (MAX hash) information. This is necessary for plotting;
- d. advise if signal commenced/ended gradually or abruptly; and
- e. do not alter squelch setting unless requested.

*Note: Rescue Co-ordination Centres can demonstrate the above signals on request.*

## 2. AIR SEARCH PATTERNS

### 2.1 General

2.1.1 This section is included to assist pilots of aircraft engaged in air search operations. The information is necessarily brief and the SAR Centre recommends that a full preflight briefing be obtained whenever time and/or circumstances permit.

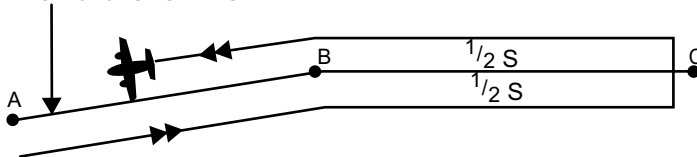
### 2.2 Visual Search

2.2.1 Visual search patterns are divided into six main groups, which are described briefly below. In the diagrams "S" represents track spacing, i.e, the distance in nautical miles between successive tracks flown by the search aircraft and will be specified by the RCC as part of the briefing or by the assessed visual range of the day.

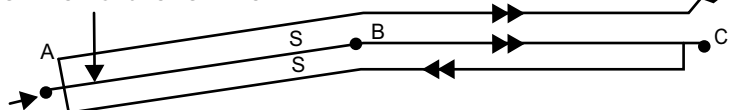
a. **Trackline Search-** (See *DIAGRAM 1*)

- (i) A trackline pattern is most often used in an initial reaction.
- (ii) It is very suitable for use by an aircraft available at, or near, the time of a reported distress.
- (iii) The assumptions made are that survivors will be found on, or close to, the planned route of the missing craft, that the distressed craft is easily discernible, or that survivors will be capable of signalling should an aircraft be seen or heard.
- (iv) It provides a rapid and reasonably thorough coverage of a missing craft's planned route, and the immediately adjacent area.

SEARCH OBJECT'S TRACK LINE



SEARCH OBJECT'S TRACK LINE

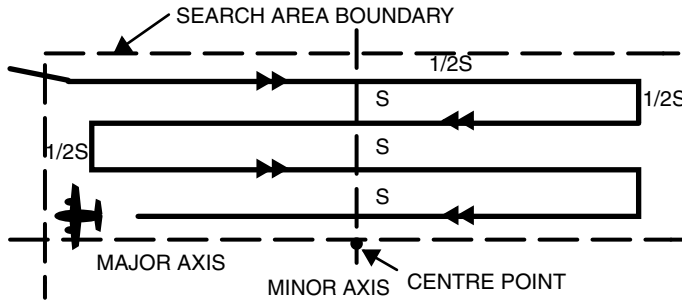


**DIAGRAM 1 - TRACKLINE PATTERN**

b. **Parallel Track Search-** (See *DIAGRAM 2*)

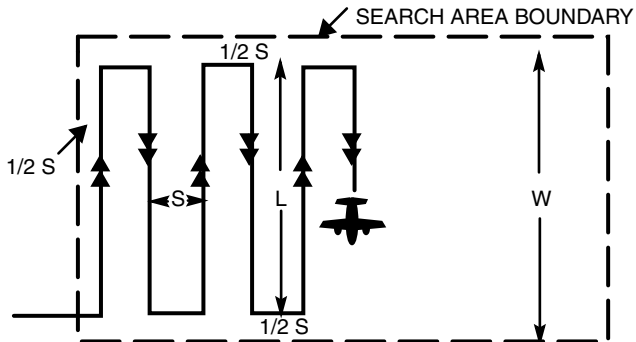
- c. Search legs are aligned parallel to the major axis of the search area.

- d. The pattern is best used in rectangular or square areas.
- e. This pattern is very suitable for a search conducted over water.



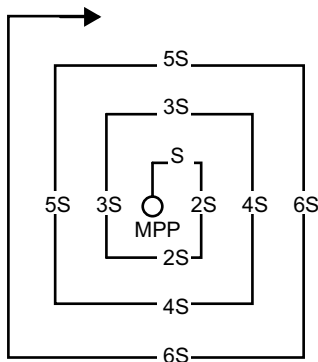
f. **Creeping Line Search-** (See *DIAGRAM 3*)

- (i) The creeping line pattern differs from the parallel track pattern in that the search legs are parallel to the minor axis.



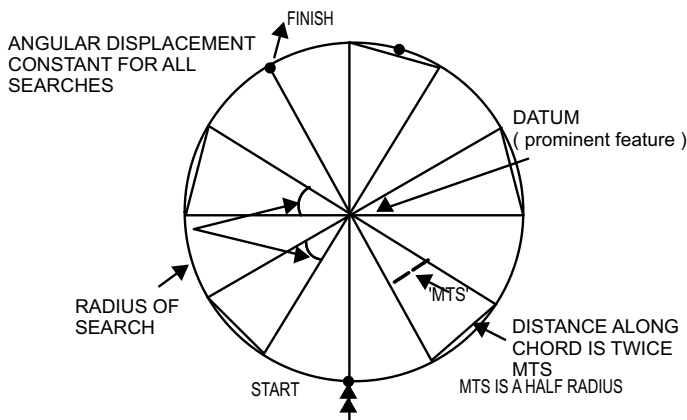
NOTE : WIDTH (W) = LEG (L) + SPACING (S)

**DIAGRAM 3 - CREEPING LINE**



**DIAGRAM 4 - SQUARE SEARCH**

- g. **Square Search-** (See *DIAGRAM 4*)
- (i) The aircraft is flown to make good the tracks shown in the diagram.
  - (ii) Turns may be to the left, or right, depending upon the observer positions.
  - (iii) The first two tracks are flown for a distance equal to "S", the third and fourth for a distance equal to twice "S", the fifth and sixth for  $3 \times S$ , and so on.
  - (iv) The final track to the start point should be the same as the initial search track.
  - (v) Observations should start at a distance of "S" before reaching the most probable position to avoid leaving an unscanned portion near the start point.
  - (vi) Observers should be briefed to pay particular attention to the scanning of the areas outwards of each turn to avoid leaving unscanned areas during the turns.
  - (vii) A square search should be planned so that, whenever possible, the approach to the most probable position (MPP), and the first leg, is made into wind.
- h. **Sector Search-** (See *DIAGRAM 5*)
- (i) This pattern is employed when the position of distress is known within close limits and the area to be searched is not extensive.
  - (ii) It is simple to execute and provides greater navigational accuracy than a square search.
  - (iii) The track spacing reduces towards the centre, resulting in a greater probability of detection in the area where the target is most likely to be located.
  - (iv) Radius of search, angular displacement and mean track spacing (MTS) are specified with the briefing.



**DIAGRAM 5 - SECTOR SEARCH**

- i. **Contour Search-** (See *DIAGRAM 6 AND DIAGRAM 7*)
- 2.2.2 This procedure requires an aircraft to be flown at selected contour levels, adjacent to the side of the mountain, starting at the highest selective level.



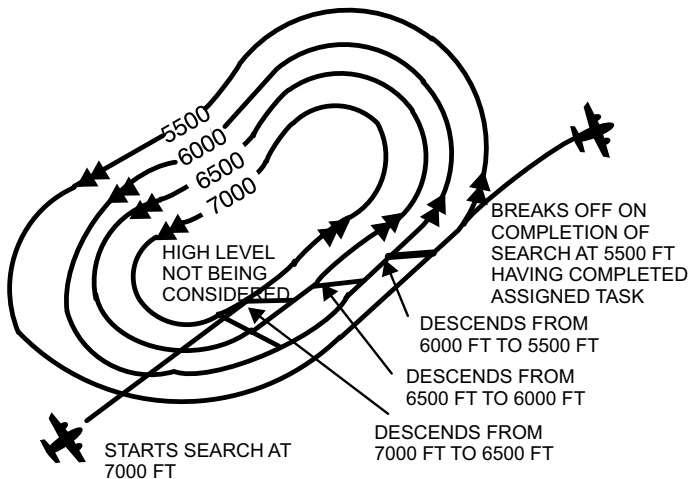


DIAGRAM 6 - CONTOUR SEARCH (PLAN VIEW)

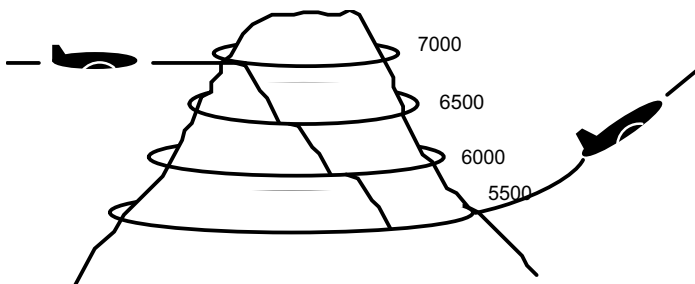
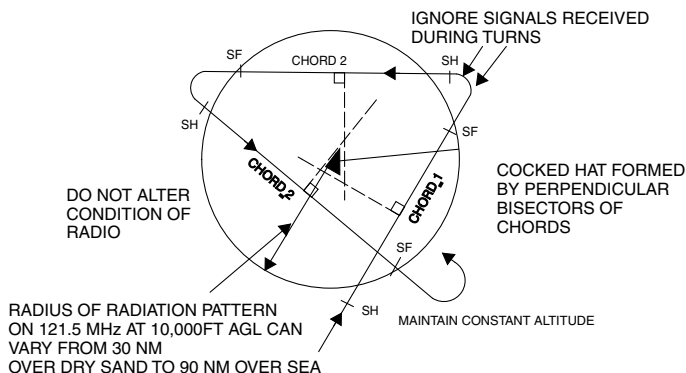


DIAGRAM 7 - CONTOUR SEARCH

2.3 Electronic Search - (See DIAGRAM 8)



- 2.3.1 Electronic searching is used to search for survivors who may have activated a VHF (or VHF/UHF) locator transmitter. An aircraft equipped with a VHF receiver may locate a survival transmitter using procedures which are based on the assumption that an undistorted radiation pattern is approximately circular. A searchmeter may be used to assist a search operation and is basically a signal strength meter which can be plugged into an aircraft VHF receiver.
- 2.3.2 The following procedures should be used during initial aural search without a searchmeter:
- Set the aircraft receiver to its most sensitive condition-squelch disabled;
  - Note and report the position at which the signal is first heard (SH) and fades (SF) and do not change altitude or the condition of the radio;
  - After the signal has faded select a heading estimated to take the aircraft through the radiation pattern, but ignore any beacon signals received during the turn; and
  - Continue chording the radiation pattern until it is possible to establish a cocked hat for the probable position of the beacon, (See Diagram 8).
- 2.4 Carry out a final homing (See DIAGRAM 9).

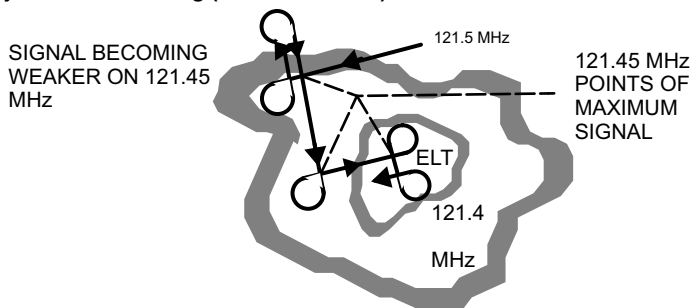
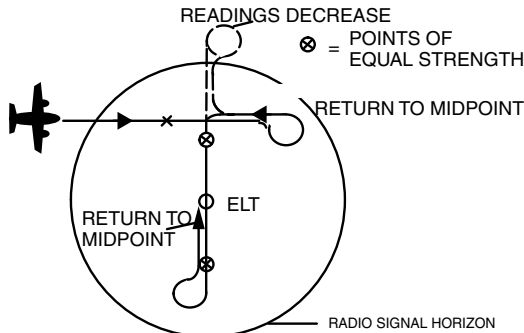


DIAGRAM 9 - FINAL HOMING

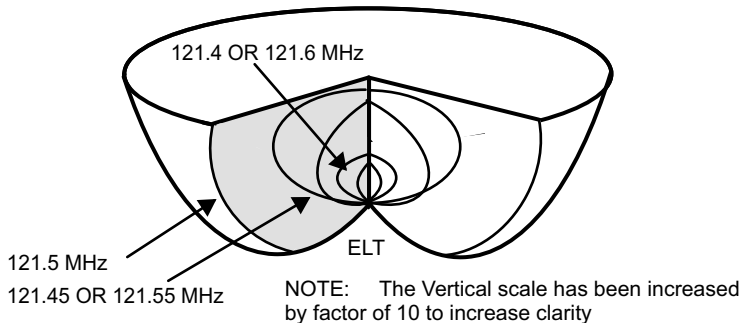
- 2.4.1 The final homing procedures without a searchmeter are:
- Track towards the estimated centre of the radiation pattern.
  - Set the aircraft receiver to its most sensitive condition and descend, if possible, to be between 1000 and 2000 feet above ground level in the estimated centre. When the signal from the beacon is very strong and very clear, check on the adjacent frequencies of 121.45 or 121.55 MHz;
  - Traverse the area bounded by the cocked hat, listening for the beacon on the adjacent frequency;
  - On hearing the signal on the adjacent frequency, select and fly a heading which results in a stronger signal. As the signal increases in strength, check further off frequency and descend as required.
- At this stage it is most important that each track should be a straight line. Helicopter pilots should avoid any tendency to orbit a suspected site;*
- The accuracy of the homing will usually depend upon how far off frequency the signal can be heard. Observers will find that a signal being received on, for example, 121.3 or 121.7 MHz (over land) will rise to a sharp peak only as the search aircraft passes over the beacon site at 500FT above ground level. Where the terrain is heavily timbered (e.g. rain forest,), helicopter pilots should descend to lower levels and tune further off frequency to achieve greater accuracy. Information gained during straight and level flight only is most important and is the only data that should be used.*
- Where the signal is irregular, it is usually because the beacon is located amongst obstacles such as trees, rocks, wreckage, etc. The resultant radiation pattern is no longer circular and the signal heard/signal fade principles no longer apply.*
- 2.4.2 The following procedures should be used during aural search with a searchmeter:
- Set the aircraft receiver to its most sensitive condition-squelch disabled.
  - Plug the searchmeter into the SAR outlet.
  - Fly as high as practicable for aircraft type and weather conditions.
  - On receiving the emergency signal, advise the Rescue Co-ordination Centre (RCC) of position, heading and indicated airspeed.

- e. The radiation pattern from a beacon can either be approximately circular (regular) or lobular (distorted). Where the signal received from the beacon is constant the following procedures should be used:
- (i) Fly a heading which will result in an increase in the reading on the search meter. Maintain this heading at a constant altitude and airspeed (*See DIAGRAM 10*).

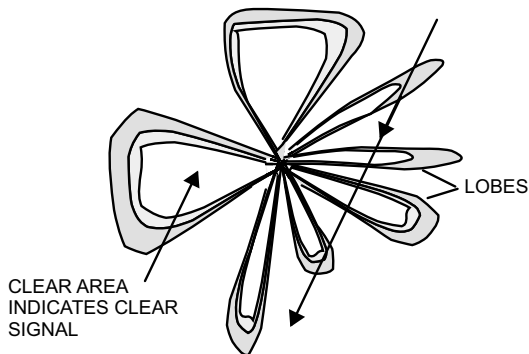


**DIAGRAM 10 - SEARCHMETER PROCEDURES**

- (ii) Note the time and aircraft position at each half division on the searchmeter.
- (iii) Continue (i) until readings on the searchmeter decrease. Select two positions of equal reading and return to the midposition.
- (iv) On arriving at the midposition turn 90DEG and note the readings on the search meter. If the meter readings decrease turn 180DEG and proceed to determine two further positions of equal signal strength then return to the mid-position.
- (v) When apparent that the beacon is close, descend, if possible, to an altitude giving approximately 2000FT clearance above terrain within approximately 10NM of the search aircraft.
- (vi) By continuing the boxing-in technique the observer should be able to estimate the position of the beacon to within an area of 24 square miles.
- (vii) The beacon site may be located with greater accuracy by detuning the VHF receiver to 121.45 or 121.4 whilst close to the beacon and noting the position on the ground over which there is maximum searchmeter deflection. The receiver may also be detuned to 121.55 or 121.6. With the search aircraft 500FT above ground level and the receiver tuned to 121.3 or 121.7, the signal will only be heard within 200-300 metres of the beacon site (*See DIAGRAM 11*).



**DIAGRAM 11 - DETUNING PATTERN**

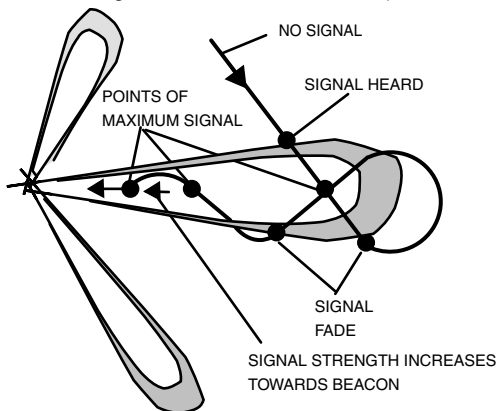


INTENSITY OF STIPPLING INDICATES AMOUNT OF BACKGROUND HASH

**DIAGRAM 12 - DISTORTED RADIATION PATTERN**

*Note: Where the signal from the beacon is broken and distorted, the most probable cause is that the beacon is amongst obstacles such as wreckage, trees, rocks, etc. which cause the signal to be absorbed or reflected, forming lobes.*

*With the search aircraft flying along the track indicated in Diagram 12, the searchmeter needle would rise and fall, corresponding with the passage of the aircraft through successive lobes where the signal could be heard. In between the lobes there would be receiver noise and no signal. Provided the aircraft is several thousand feet above terrain, the observer may assume that the signal is being received direct from the beacon rather than by reflection from surrounding terrain. Thus by following a lobe the search aircraft will be guided direct to the beacon, (See DIAGRAM 13).*



**DIAGRAM 13 - INTERCEPTING A LOBE**

- f. When the ratio between the beacon signal and the background hash begins to favour the latter, alter heading until only a clear signal can be heard. The signal from the beacon should be continuous with clarity improving as the search aircraft approaches the beacon.
- g. Once a heading has been established, note the searchmeter readings. The readings will increase as the aircraft approaches the beacon site, reaching a maximum when about to overfly. The position of the beacon may be located with greater accuracy by progressively detuning the VHF receiver to 121.3 or 121.7MHz.

## 2.5 Overwater Searches

- 2.5.1 The principles of an overwater search using a searchmeter are similar to those used for a regular pattern. However, the following differences should be noted:
- The radiation pattern from a beacon transmitting overwater will generally be much larger than if the beacon were on land. This could be up to 90NM to an aircraft flying at 10000FT, and 180NM at 30000FT.
  - Some older marine beacons have an interrupted carrier.
  - Where a search aircraft is operating at an altitude of 10000FT or less and has a searchmeter reading of more than four, the pilot should check on the adjacent frequency of 121.45 or 121.55. If the signal can be heard on that frequency, albeit faintly, the search aircraft will be within 15 NM of the beacon.

## 2.6 Mountainous Terrain

- 2.6.1 A beacon which is activated in mountainous terrain may be likened to an electric light bulb illuminated in a model of the same area. The pilot of an aircraft flying in areas where the light is reflected would be able to receive signals which are reflected. From positions where the light could be seen direct, signals would be received directly from the beacon or, conversely, where there were no reflections and the light could not be seen, there would be no signals. Signals radiating from a beacon in rough country are absorbed, reflected and reinforced to form isolated patches of strong signal which tend to hinder rather than assist the location of the beacon.
- 2.6.2 To avoid possible confusion from reflected signals, it is essential that the search aircraft should conduct a homing from an altitude above all terrain in the general area. This does not apply to search aircraft flying in valleys or behind mountains in order to ascertain where the beacon signal cannot be heard.

## 3. SEARCH AND RESCUE SIGNALS

### 3.1 Third Party Emergency Reporting

- Remain in the vicinity or as directed otherwise and keep the aircraft, surface craft or distressed personnel in sight.
- Turn on automatic emergency radio equipment unless:
  - accurate position fixing is possible, and
  - two way communications exist with ATS.
- Report the following information as applicable to the responsible ATS:
  - TYPE** of aircraft or surface craft;
  - LOCATION** of distress incident in latitude and longitude, geographical point or bearing and distance from some fixed point; and
  - DETAILS** regarding the number of personnel concerned, whether known to be afloat and the apparent physical condition of survivors.
- Alert coast and ship stations by transmitting on international distress frequencies 2182, 4125, 6215 or 8291kHz.
- Transmit to any frequency which will enable other craft to home to the distress location.
- Call to surface craft to render assistance by use of manoeuvres set out below, or otherwise by communication on 2182, 4125kHz or 156.8MHz (VHF channel 16).
- Attempt to establish communication with the aircraft in distress when requested by ATC.
- Before departing from the area, turn off automatic emergency radio equipment.

### 3.2 Assistance of Surface Craft

- 3.2.1 To direct a surface craft to distress incident:
- circle the vessel at least once;
  - fly across the bow of the vessel at low level while rocking the wings, opening and closing the throttles or changing propeller pitch if possible; and
  - head in the direction required.

*Note: Visual signals by the surface craft:*

*ACKNOWLEDGE - red and white vertical striped flag or flashing of a series of 'T's by light.*  
*UNABLE TO COMPLY - square blue and white checkered flag signal or the flashing of a series of 'N's by light.*


- 3.2.2 When assistance is no longer required fly across the stern of the vessel at low level, rocking the wings, opening and closing the throttles or changing propeller pitch if possible.
-

### 3.3 Emergency Management Australia (EMA)

- 3.3.1 During relief operations mounted in time of floods, bushfires or other disasters, ground/air signals may be used to indicate requirements.
- 3.3.2 Aircraft engaged by the relevant State Emergency Service to survey the area, will be briefed to watch for emergency signals. Pilots of other aircraft, not involved in the relief operation, should report sightings to the nearest ATS unit.
- 3.3.3 Pilots need to be aware of the importance of indicating the actual signal seen (e.g. Civil Emergency Signal No 3), as an attempt to interpret, the signal may be confusing to those receiving the message.

### 3.4 Ground/Air Emergency Signals in Use for Australian Civil Emergencies

GROUND - AIR VISUAL SIGNAL CODE FOR USE IN CIVIL EMERGENCIES		
No	Message	Code Signal
1	Require Fodder	<b>FF</b>
2	Require Evacuation	<b>III</b>
3	Power Failure	<b>VI</b>

GROUND - AIR VISUAL SIGNAL CODE FOR USE BY SURVIVORS		
No	Message	Code Signal
1	Require Assistance	<b>V</b>
2	Require Medical Assistance	<b>X</b>
3	Proceeding in this Direction	
4	Yes or Affirmative	<b>Y</b>
5	No or Negative	<b>N</b>
	<b>If in doubt use International Symbol</b>	<b>SOS</b>

#### Notes:

##### 1. Aldis lamp signals

*Red flashes - not understood*

*Green flashes - message understood.*

##### 2. Air Ground Signals

*The following signals by aircraft mean that the signals have been understood*

*a During the hours of daylight - rocking the aircraft's wings*

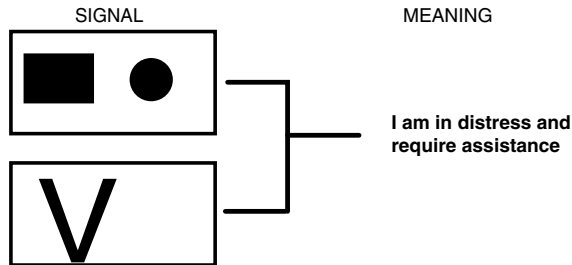
*b During the hours of darkness - by flashing the aircraft's landing or navigation lights on or off twice.*

3. Lack of the above signal indicates that the message has not been understood.

4. The "GROUND - AIR VISUAL SIGNAL CODE FOR USE BY SURVIVORS" conforms to ICAO and NATO standards.

### 3.5 Visual Distress Signals - Small Vessels

Either of the two signals shown below may be displayed by small vessels. The signals are for use **ONLY** in the Australian Search and Rescue Area. The signal sheet is rectangular, coloured international orange, with black symbols.



## 4. SURVIVAL

### 4.1 Introduction

4.1.1 Alone and injured, people have survived in almost impossible circumstances. The determination to beat the situation and the will to survive is the survivor's strongest weapons. Military SAR will not give up searching for downed aircrew.

4.1.2 The peacetime priorities of survival are listed below:

a. **PROTECTION:** The elements of protection are:

- (i) First Aid - breathing must be restarted within 3 minutes;
- (ii) Clothing;
- (iii) Shelter - in harsh weather a shelter will be required in less than 3 hours; and
- (iv) Fire.

b. **LOCATION:** Most survivors are located within 3 days.

c. **WATER:** In Australia's arid centre water must be found within 3 days.

d. **FOOD:** Survival without food for at least 30 days is possible. Therefore, food is the lowest priority. Food information is contained in the JUNGLE SURVIVAL section.

4.1.3 Basic survival rules are outlined in the following sections:

- a. Location;
- b. First Aid;
- c. Desert Survival;
- d. Sea Survival;
- e. Jungle Survival; and
- f. Cold Weather Survival;

4.1.4 Rapidly adapt to the new situation - **DO NOT WASTE TIME**. Even if SAR is expected quickly develop a plan of action that will assist SAR and improve living conditions. Start working to beat the situation as soon as possible.

### 4.2 Location

4.2.1 Safety Equipment

4.2.2 When moving always carry location aids and protect them from deterioration. Do not fire pyrotechnics until SAR is sighted. Consider the best use of aids:

- a. survival radios/beacons,
- b. signal mirror,
- c. day/night flares,
- d. rockets,
- e. strobe,
- f. signal panels, and
- g. sea dye marker.

4.2.3 Improvised Aids.

a. Improve rescue chances by constructing fires and ground signals.

b. Signal Fires:

- (i) Initially use campfire
- (ii) 3 fires 30M apart in line or triangle.
- (iii) Burn greenery or wreckage to produce smoke during the day