Working with

Search & Rescue Helicopters

Master Aircrew Duncan Tripp RAF

ROYAL AIR FORCE
SEARCH AND RESCUE

WORKING WITH SEARCH & RESCUE HELICOPTERS

This handbook is designed to enhance and complement the previously issued 'Working with search and rescue helicopters' and the 'Sea King safety briefing' videos and DVDs.

It also provides a reference document to the safety briefing given by crews that all emergency services should ideally receive prior to flying in a Search and Rescue (SAR) helicopter. There is additional information which will give an insight into what the SAR crews require and their procedures once they arrive on scene. Where possible, the information is generically applicable to most SAR operators but mainly focuses on RAF SAR.

There is a section on the operation and limitations of Night Vision Goggles (NVGs) and the STAR-Q Multi Sensor System (MSS) – Thermal Imaging (TI) and TV system. Also included is a section on a 'suggested' system of back belaying a stretcher that allows it to be secured to both the belay and the helicopter hook at the same time during recovery. This is the 'Helicopter Double Italian Hitch Stretcher Belay System.'

Duncan Tripp RAF
Master Aircrew
Winchman Paramedic

COVER PHOTO: JOHN PAUL

PHOTO: JOHN PAUL

Contents

1. Acronyms

AAA	Air Ambulance Association
ACPO	Association of Chief Police Officers
ACPOS	Association of Chief Police Officers in Scotland
ACS	Airwave Comms System
ALSAR	Association of Lowland Search and Rescue
ARCC	Aeronautical Rescue Coordination Centre
ASR	Apparatus Sea Rescue
ASU	Air Support Unit
BCRC	British Cave Rescue Council
CFOA	Chief Fire Officers Association
CHC	Canadian Helicopter Company
DfT	Department for Transport
EOD	Explosive Ordnance Disposal Teams
FLIR	Forward Looking Infra Red
GPS	Global Positioning System
HELP	Helicopter Emergency Liaison Planning
HEMS	Helicopter Emergency Medical Service
HMCG	Her Majesty's Coast Guard
HPC	Health Professional Council
JRLO	Joint Regional Liaison Officer
MACA	Military Aid to the Civil Authorities
MACC	Military Aid to the Civil Community
MACP	Military Aid to the Civil Power
MAGD	Military Aid to other Government Departments
MCA	Maritime and Coastguard Agency
MIRG	Maritime Incident Response Group
MoD	Ministry of Defence
MRCC	Maritime Rescue Coordination Centre
MREW	Mountain Rescue England and Wales
MRCofS	Mountain Rescue Committee of Scotland
MRTs	Mountain Rescue Teams
MRS	Mountain Rescue Service
MSS	Multi Sensor System
NVGs	Night Vision Goggles
RAF	Royal Air Force
RAFRLO	RAF Regional Liaison Officer
RN	Royal Navy
RNLI	Royal National Lifeboat Institution
RCC	Rescue Coordination Centre
RCS	Rescue Coordination System
SG	The Scottish Government
SAR	Search and Rescue
SARDA	Search and Rescue Dog Association
SARF	Search And Rescue Force
SOPs	Standard Operating Procedures
TETRA	Terrestrial Trunked Radio
TI	Thermal Imaging
UKARCC	United Kingdom Aeronautical Rescue Coordination Centre

2. Disclaimer

The information and procedures presented in this handbook represent current best practice and standard operating procedures (SOPs) employed by RAF SAR helicopter crews when operating with trained members of official emergency service organisations. These SOPs are in common use with other SAR helicopter operators and, as such, there is a high degree of commonality.

This handbook will be subject to regular update. Therefore, it is essential that emergency service organisations regularly check for updates and/or follow alternative procedures that may well be briefed or updated by the SAR helicopter crews.

As working with any helicopter is inherently dangerous, no responsibility can be accepted for any divergence from these procedures, unless prebriefed.

For any emergency service organisation to train with Military SAR they must have signed up to the SAR Insurance Policy Indemnity with the Directorate of Business Resilience, Common Law Claims & Policy Division, MOD. There are exemptions to this such as the RNLI, however, if any organisation is unsure they should consult the Emergency Services Liaison Officer at their local SAR unit.

3. Outline of 'The UK SAR Operators Group Standard Operating Procedures for Deployment of Air Assets'

Introduction

The purpose of these SOPs is to standardise and clarify the procedures for the involvement of air assets in emergency incidents within the UK Search and Rescue Region.

Background

There are a number of statutory and volunteer organisations who are capable of conducting an emergency response. The decision on which type of search asset, or assets, responds to an incident rests with the appropriate controlling authority. For a land incident this will be the Police Incident Control Room and, for a maritime/coastal incident, this will be the Maritime Rescue Coordination Centre.

PHOTO: DUNCAN TRIPP

Land and Maritime based emergency response assets are likely to respond to ten to twenty times as many incidents as air assets. Although air assets can respond and complete an incident in isolation, the vast majority of incidents are undertaken in conjunction with other emergency response organisations.

The ambulance service has a statutory responsibility to respond to traumatic and medical emergencies, these may include HEMS assets. Under the Fire and Rescue Service Act 2004, a fire and rescue authority has a statutory duty to deal with fires, road traffic accidents and, under order of the Secretary of State, certain types of terrorist related incidents such as mass decontamination. The Act also provides fire and rescue authorities with discretion to equip and respond to events beyond its core functions such as flooding or animal rescue.

It is recognised that current air ambulances and Police Air Support aircraft are not rescue platforms, although they may be used as such in some circumstances in order to preserve life.

Minor incident

A Minor Incident may be defined as an incident that can be completed through the deployment of assets held at normal readiness and be coordinated by the extant command and control organisation. An incident may be reported by numerous sources and more than one Level 1 responder may be alerted to the same incident. Accordingly, a clear understanding of who may request and task assets is essential to ensure the incident is completed in the most expeditious way for the casualties benefit.

PHOTO: JAMES LYNE

An incident may need the deployment of a number of assets. The outcome for the casualty should be the prime consideration but the overall safety and totality of the incident has precedence. For example, an MRT may secure a casualty, an air ambulance may deploy a paramedic to stabilise the casualty and finally a SAR helicopter may recover a stretcher casualty for onward transportation to hospital.

Major incident

The Police or MCA may declare a Major Incident. In the case of a land incident, the police will establish a Gold Command and if substantial air support[1] is needed a Combined Silver Air Cell will be established consisting of aviation advisers, communication facilities and life support.

[1]The MOD defines substantial air support as the deployment of 3 or more air assets to the same incident.

In the first instance, these are likely to be drawn from the same units providing the air support and may be augmented or replaced by other specialists from HQs or adjoining areas in due course. The location of the Combined Silver Air Cell will be at the direction of the Gold Commander. Recent experience would indicate that the Combined Silver Air Cell will be located adjacent to Silver Control; although Gold or an independent location may be considered eg. airfield.

The purpose of the Combined Silver Air Cell is to ensure air assets are used in the safest manner to achieve the Gold Commanders objective. The Combined Silver Air Cell will have ground to air communications and other reach back communications to other HQs, including the ARCC.

For a Major Maritime Incident the designated MRCC may function as Gold and Silver Command. Air advisers may be requested by the MRCC. The MRCC may nominate an Aviation On-Scene Commander to co-ordinate and deconflict air assets.

Coordination of air activity at a major incident will be by SPECIAL procedures.

EXERCISE WITH RAF MRT

Operating procedures general

- Police Air Support Units may only be tasked by Police Incident/Operations rooms.
- HEMS helicopters may only be tasked by Ambulance Control Centre.
- HEMS helicopters must receive approval to partake in Land SAR incidents by the controlling police incident/operations room.
- SAR helicopters may only be tasked by the ARCC.

In order to minimise delay in incidents where there is an imminent threat to life, organisations directly involved in the incident may alert SAR helicopter units of the impending request for assistance, whilst formal ARCC tasking is sought. The aircraft captain may respond at his discretion whilst formal tasking is undertaken. Should the ARCC elect to deploy a different asset, then the original asset would be stood down.

- Normally, only Category 1[2] responders may request the use of aviation assets for SAR.
- Responsibility for the safety of the helicopter and the crew rests with the Aircraft Captain whose decisions must be accepted.
- On the ground at the incident site, the responsibility for the safety of all at the site rests with the senior SAR team member present.
- The overall clinical responsibility for any casualty rests with the most senior medical person present.
- If a helicopter en-route to an incident is diverted to a more serious incident, or cannot attend due to technical problems or adverse weather, the helicopter operator must immediately inform the appropriate services so that the responses may be adjusted as required.

TOP: RAF SAR CREWS ON SWIFTWATER COURSE, GLENMORE LODGE

ABOVE: AVALANCHE BEN NEVIS

[2]Category 1, are those organisations at the core of the response to most emergencies (e.g. emergency services, local authorities, NHS bodies). Category 1 responders are subject to the full set of civil protection duties.

4. Introduction

Helicopters can be an extremely valuable and versatile asset in any Search And Rescue (SAR) incident. However, like any mechanical device – and specifically one that flies in generally poor weather – it has its limits and as such must be managed and used with this in mind. Emergency services personnel are increasingly calling on the support of an air asset. This could be in the form of:

- Sea Kings from the RAF Search And Rescue Force (SARF) – 22 or 202 Squadron.
- Sea Kings from the Royal Navy – 771 or 819 Naval Air Squadron.
- Sikorsky S92s (Stornoway and Sumburgh) or Augusta Westland AW 139s (Portland and Lee-on Solent) operated by the Canadian Helicopter Company (CHC) on behalf of the Maritime Coastguard Agency (MCA).
- Air Ambulance – very limited SAR capability.

In times of large-scale incidents, supplemental support under the auspice of Military Aid to the Civil Authorities (MACA) may be provided. MACA comprises Military Aid to the Civil Community (MACC), Military Aid to the Civil Power (MACP) and Military Aid to other Government Departments (MAGD). MACC also covers the support provided to major incidents; in such cases the Aeronautical Rescue Coordination Centre (ARCC), based at RAF Kinloss, would liaise with the Joint Regional Liaison Officer (JRLO) and the RAF Regional Liaison Officer (RAFRLO) in whose area assistance is being given.

These air assets, excluding the Air Ambulance, provide full SAR cover for land and sea rescues within the UK area of responsibility, approximately one million square miles. The coordination, prioritisation and management of the military and MCA assets, including the RAF Mountain Rescue Service (MRS), are the responsibility of the ARCC.

The general composition of crews on all SAR helicopters is similar. They consist of four crew: two Pilots, a Winch/Radar/Sensor Operator/Observer and a Winchman. All the crew are medically qualified: the Pilots are basic first aid; the rear crew hold a minimum qualification equivalent to that of Emergency Medical Technician and the majority of the Winchmen are state registered (Health Professional Council – HPC) paramedics.

This chapter contains basic procedures when operating with helicopters and important safety precautions that all emergency services personnel working with SAR helicopters must be aware of – these basic procedures are also applicable when working with air ambulances.

Operating helicopters is hazardous and leaves little margin for error. However, the helicopter is extremely flexible and when used in coordination with ground assets most SAR tasks, though not all, can be completed with a reduction in time. This in turn reduces the time taken to get the casualty to definitive care. By observing the safety precautions and procedures outlined in this book, risks will be reduced to a minimum.

5. Types of operation

The ways in which helicopters can be used are many and varied and can be placed in four general categories:

Searches

The helicopter is capable of searching comparatively large areas of difficult terrain in a relatively short time. It has limitations when searching over forested areas and is best used to search specific features, night or day, such as climbing routes, paths, bothies, streams, gullies, coastlines or open areas in the urban environment. Searches are generally carried out visually but can be enhanced with the use of the Multi Sensor System (MSS) – this has a Forward Looking infrared (FLIR) and high quality digital TV cameras, or with the use of Night Vision Goggles (NVGs) in specific circumstances. More in-depth information and limitations of the MSS and the NVGs will be discussed later.

Winch operations

This type of operation is particularly useful in the mountains, cliffs and maritime situations or when it is not possible for the helicopter to land. The helicopter comes to the hover and the winchman is then lowered by the winch. He will bring with him his medical equipment and rescue or recovery kit. This may be a strop(s) or stretcher to rescue or pick up the casualty. If the area the winchman is lowered to is exposed, steep, slippery or icy, it may be advisable for ground


PHOTO: JOHN PAUL

PHOTO: MCA


PHOTO: MCA


PHOTO: CHRIS BOYLES

parties to set up a belay and/or assist the winchman with security; he is probably not a mountaineer, may not have crampons in winter conditions and will almost certainly be loaded down with equipment.


PHOTO: DAVID HIGGS


PHOTO: JAMES LYNE

Casualty evacuation

In many cases the helicopter can reach the scene of the incident, land nearby, pick up the casualty and take them to definitive care in the shortest possible time.


PHOTO: JAMES LYNE

Deployment of emergency service personnel

If the weather precludes the use of helicopters in the search areas, they can be used to ferry emergency service personnel, MRTs, MCA, SAR dogs and any equipment required as close to the area as possible, so saving time and effort.

PHOTO: JAMES LYNE

6. Operating limitations

The main limitations for helicopter operations are:

Weather

Low cloud, high winds, snow and icing are the major hazards. In general the helicopter will not be able to operate in cloud at low level unless it is possible to hover taxi in visual sight of the ground. In this situation it may be best for the casualty to be carried down below the cloud base. Similarly, high winds and the associated turbulence will severely limit the helicopter's ability to make a pick up and may require the casualty to be moved further down the mountain to a more sheltered location.

A wind across a mountain ridge can cause violent up and down draughts; the up-draught on the windward side of the mountain may have a greater upward velocity than the maximum rate of descent of the helicopter, or even worse, the down-draught on the lee side may be greater than the aircraft's maximum rate of climb or power the engines can provide with obvious implications! In heavy snow and/or icing, operations at all heights will be severely restricted and in these cases operations may not be possible.


PHOTO: JACK KASSAPIAN

Aircraft performance

The helicopter's payload greatly depends on the amount of fuel it is carrying and the ambient weather conditions. For the crew it is a constant trade-off between fuel, payload and, most importantly, having a good power margin, especially in the mountains. For operations in the mountains, the crew will try and keep the fuel load low in order to give a reasonable payload and power margin. This, however, has the disadvantage of increased trips for fuel. Refuelling in the field can take up to thirty

TOP: LOST WALKERS, FAINDOURAN BOTHY, CAIRNGORM

CENTRE: JOINT EXERCISE WITH BASICS, SCOTLAND

FAR LEFT TOP: RAF SAR 'WET' WINCHING

FAR LEFT CENTRE: CASUALTY ON RIG SUPPORT VESSEL. NORTH SEA

FAR LEFT BOTTOM: MEDEVAC FROM OIL RIG

minutes and this does not include transit to and from the scene, so do not be surprised if the helicopter is away for up to an hour, this must be factored into the search manager's plans.

Night operations

Some sort of visual references are essential for night hovering and the weather conditions described above may render many night operations out of the question. RAF and Royal Navy SAR helicopter crews extensively train and operate with NVGs giving an improved and enhanced night flying capability. Under ideal conditions, clear sky, full moon and in close proximity to cultural lighting, they can 'turn night into day.'

HOWEVER, the majority of mountain incidents will normally mean flying in bad weather, low cloud and with little or no cultural lighting which all severely degrade the 'picture.' Additionally, because NVGs are monochromatic, everything is in various shades of green; there is very little depth perception or texture. NVGs are useful tools but do have their limitations. Individual crews will make their own decisions based on light levels, weather, their knowledge of the incident area, their own level of experience and the state of the casualty. For further details regarding NVG operations, see the 'Working at night with helicopters using night vision goggles' later in this handbook.

7. Callout procedure

The helicopter should be alerted at the earliest opportunity if there is the slightest chance of it being useful. You do not have to pay for the use of a UK SAR helicopter, providing it is being used when there is an imminent danger to life. For land incidents initial contact should be through the emergency services, usually the police who, in turn, should contact the ARCC. For coastal and offshore incidents requests should be made through the MCA who will liaise with the ARCC; however, in an extreme emergency where immediate lifesaving is required, the local MCA has authority to task a helicopter directly. They will then deploy the most suitable and appropriate asset; this also includes the deployment of RAF MRTs. On any operation, accurate information is essential and care should be taken to ensure the correct details are passed to the ARCC. This will in turn provide considerable help to the helicopter crew. There is a standardised template of 'Information Requirements' at the end of this section to help correlate the information.

In many cases the helicopter is called to a rendezvous for a face-to-face briefing. At this stage an accurate brief and marked map giving the following details is most helpful:

- Location of casualty/ground parties.
- Estimated height of incident above sea level, if applicable.
- Plan of action and progress to date. If immediate pick up is not possible, estimated time of ground party getting below cloud or to suitable pick up area.
- Details of casualty and medical help available/required.
- Type of stretcher in use.
- Tasking and/or search tactic for the helicopter.
- Call sign and frequency/ channel for radio comms.

There may be occasions when, to save time, this briefing must be passed over the radio. For landing

PHOTO: JOHN PAUL

LOSSIEMOUTH HELICOPTER PREPARES FOR NIGHT FLIGHT

sites that are not normally used, either a vehicle flashing light or a hand-held strobe light should be positioned at the edge of the landing site (however, there are some precautions with this – see Night Operations).

Smoke in the form of Day/Night flares should also be made available. It may be beneficial for the helicopter to proceed direct to the search area. This is for a number of reasons, it will give the crew an opportunity to check the weather and ascertain their power margins to ensure that they can compete and overcome powerful turbulence. This is especially important in mountain environments where localised conditions need to be assessed.

This, in turn, will allow the crew to calculate how many personnel and how much equipment they can pick up whilst still maintaining a safe power margin. There may also be potential for the crew to deploy the winchman to the scene to start to stabilise the casualty whilst the emergency services assemble. This will also lighten the helicopter and allow additional personnel to be picked up and deployed.

These decisions are the responsibility of the aircraft captain and crew, taking into consideration all factors. Another factor during fading light is that searches carried out in daylight far exceed NVG searches in efficiency, unless the casualty is known to have a torch or other light source.

CASUALTY, LAIRIG GHRU, CAIRNGORM

Information requirements[3]

SITUATION
- A brief description
- Incident
- Number of persons requiring rescuing
- Extent of injuries (reported)
- Amount and type of survival equipment
- Weather on scene
- Weather forecast
- Any SAR facilitates on-scene

RESCUE AREA
- The position of the incident, name and grid ref (land incident)
- Routes to be followed by SAR facilities including known hazards

EXECUTION
- List SAR facilities assigned, including facility call sign and parent agencies providing them.
- Rescue methods to be attempted.
- List supplies, personnel or equipment to be delivered.

COORDINATION
- Designate the SAR Mission Coordinator and On Scene Commander, if required.
- Declare on-scene time for SAR facilities or limiting factors
- Advise any change of operational co-ordination
- State parent agency relief instructions
- Detail temporary flight restrictions
- Authorise non-SAR aircraft into the area

COMMUNICATIONS
- Prescribes co-ordination and on-scene frequencies
- State call signs of aircraft assigned and has high-altitude communications relay duties
Other relevant communications information

POST INCIDENT REPORTS
- Post incident reports should be raised.
- De-brief involving all agencies following any major (or problematical) incident.
- Forums should be established to identify lessons learned, these should be recorded and used to modify these SOPs[3].
- These SOPs[3] should be reviewed every two years.

[3] UK SAR Operators Group Standard Operating Procedures for the deployment of Air Assets

8. Helicopter communications

Communications between, Air Ambulance/Police Air Support/ SAR helicopter and land SAR teams will be via the ground to air channel as identified in the National Band Plan given in the current version of the document – Implementation and Control of the United Kingdom VHF High Band Land Search and Rescue Radio Channels.

Communications with Coastguard rescue teams, in the first instance, will be on VHF Channel Ø, 156.000 MHz.

As per the Helicopter Emergency Liaison Planning (HELP) document, communication between responding helicopters will be via Scene of Search 123.1 MHz AM and as stated above.

All SAR helicopters are fitted with VHF/UHF/HF and FM radios, as are some air ambulances.

RAF SAR helicopters carry the Airwave Communications System (ACS), providing Terrestrial Trunked Radio (TETRA) communications used by police and other emergency services through various talk groups. In addition, the ACS provides a means to make telephone calls from the helicopter to any PSTN or mobile telephone number.

RAF SAR helicopters also carry a spare FM radio that can be deployed to incident control or to mobile ground units.

The MCA helicopters have Satcom and there is potential to communicate direct by phone.

Specific aspects of operations – hovering, winching or refuelling, may make it difficult to contact or get a reply from the crews.

PHOTOS: DEFENCEIMAGES.MOD.UK

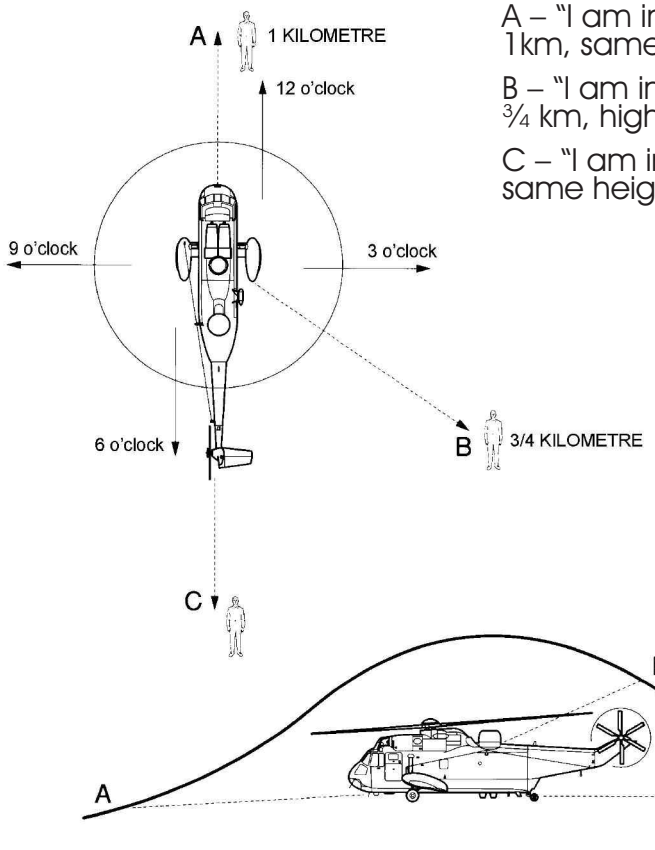
However, throughout the co-pilot will monitor all radios. If the message is urgent or life threatening, agencies should use the key word 'immediate' after the call sign ie. 'Rescue 137 this is call sign immediate', or a 'blind call' can be made for routine information calls. Terrain masking can also be a factor and, in this case, emergency services may consider using local MCA units or MRTs to enhance communications or to act as a relay.

During major or specific incidents assets such as Tornados, Chinooks, Merlins, Pumas, Hercules or other military/civilian foreign/UK aircraft may be used under MACA and will be allocated call signs accordingly.

SAR Aircraft call signs

BASE/TYPE	CALL SIGN	HF TRAINING PREFIX	FM TRAINING PREFIX	SAR OPS PREFIX
Sumburgh S92	102/103	Coastguard	Coastguard	Rescue
Stornoway S92	100/101	Coastguard	Coastguard	Rescue
Lossiemouth Sea King	137/138/139	Sierra Romeo Golf	Helicopter	Rescue
Prestwick RN Sea King	177/178/179	Navy	Navy	Rescue
Boulmer Sea King	131/132/133	Sierra Romeo Golf	Helicopter	Rescue
Leconfield Sea King	128/129/130	Sierra Romeo Golf	Helicopter	Rescue
Valley Sea King	122/123/124	Sierra Romeo Golf	Helicopter	Rescue
Wattisham Sea King	125/126/127	Sierra Romeo Golf	Helicopter	Rescue
Chivenor Sea King	169/170/171	Sierra Romeo Golf	Helicopter	Rescue
Culdrose RN Sea King	193/194/195	Navy	Navy	Rescue
Lee-on-Solent AW 139	104/105	Coastguard	Coastguard	Rescue
Portland AW 139	106/107	Coastguard	Coastguard	Rescue

BUXTON MRT AT CHEE DALE, DERBYSHIRE



Examples in diagram, if you are standing at point:

A – "I am in your 12 o'clock, 1km, same height."

B – "I am in your 4 o'clock, ¾ km, high."

C – "I am in your 6 o'clock, same height."

9. Ground procedures

On sighting the helicopter, the ground party should use smoke or flares, when requested. If using a day/night flare, the night end should be ignited initially to indicate your position to the helicopter while it is still some distance away, and the smoke (day) end used to give the helicopter crew some indication of the wind direction and strength. This all helps the crew build a visual picture of any up/down draughting and the presence of turbulence at the landing site as it makes its approach.

If it is possible, move to an open area especially in poor weather. If in radio contact with the aircraft, the 'clock method' may be used to indicate your relative position, from the helicopter ie. the front of the helicopter is the 12 o'clock – if you are looking at the helicopter, and it is heading straight for you, then you are in the 12 o'clock position.

If the party has neither flares nor radio contact and urgently needs to communicate with the helicopter or needs to attract its attention, a member of the ground party should stand apart from the party and wave an orange bivvy bag or similar. Or face the helicopter, with his arms above his head forming a 'Y.' Remember most people wave at helicopters and consequently it is difficult for the crew to distinguish rescue personnel from bystanders. It may be worth the party leaders wearing high visibility waistcoats to aid helicopter crews in this respect. If practicable, the helicopter will land nearby or lower a winchman to take the message. Should the helicopter move in close before you are ready, or you see a

problem, face the helicopter, cross and uncross your arms above your head in a wave-off signal.

10. Helicopter landing sites

When helicopter crews recce a landing site they use the five 'S's and discuss the wind. This is also applicable if ground parties are selecting or preparing a site:

Wind

Direction and strength, it is worth passing this information to the crew. Remember that 'wind direction' is the direction the wind comes from.

Size

Ideally as big as a football pitch but may be as small as a tennis court.

Shape

Note the shape and tell the pilot, as this will also aid identification of the site.

Surroundings

Ideally, no wires, pylons, trees or buildings, including on the approach or overshoot.

Surfaces

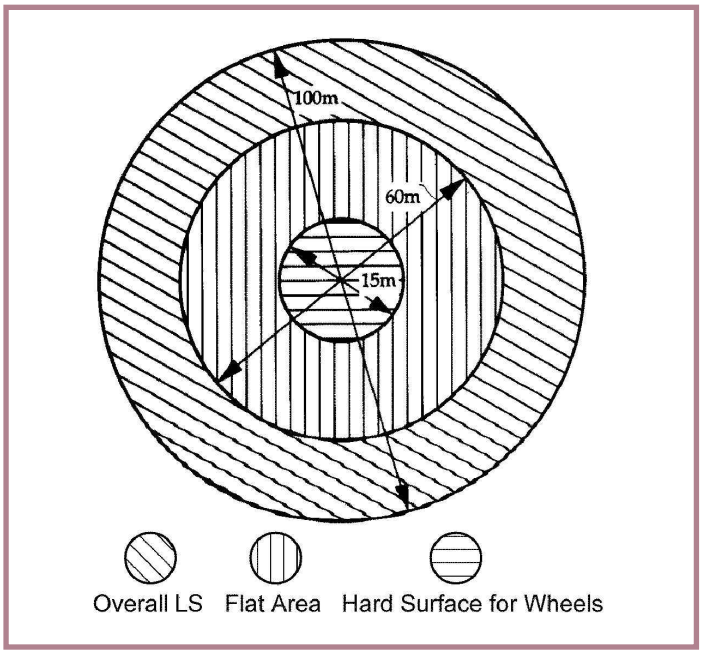
If boggy, warn the pilot. The landing surface should be firm (a Land Rover type vehicle should be able to stop and move off again without sinking). Check for loose articles including personal kit and clothing.

Slope

As level as possible.

PHOTO: JAMES LYNE

CLIMBER ON CASTLE RIDGE, BEN NEVIS



11. Working at night with helicopters using Night Vision Goggles (NVGs)

Night Vision Goggles (NVGs) are light intensifying binoculars that are worn strapped to the front of aircrew flying helmets to allow hands-free operation. They work by amplifying whatever light is available from external sources and can function in conditions of low light.

Performance

NVGs greatly enhance a helicopter crew's ability to operate safely at night; given the right conditions, the backlight on a mobile phone can be seen from 2-3 miles.

However, certain conditions adversely affect their performance:

- **Moisture:** The performance of NVGs is affected by moisture in the air. Mist, cloud, falling snow or heavy rain will all reduce their effectiveness.
- **Artificial Light Levels:** If too much light is directed at NVGs they will 'close down', producing the same effect as the naked eye being dazzled by car headlights at night (although the effect is only temporary; NVGs will recover more quickly than the naked eye).

Procedures

These procedures are aimed at controlling the levels of artificial light in the vicinity of an NVG-equipped helicopter whilst maintaining sufficient light to ensure safe operations on the ground. **As a general rule, never shine a light directly at a helicopter and do not use flash photography in or near the helicopter unless you have asked the crew first.**

Indicating your position

When asked to identify yourself, use a flashing light to help to distinguish you from other personnel in the vicinity. A 'Firefly' type strobe is an ideal location aid for both conventional and NVG night work (the pulse is so short it does not close the goggles down). However, a torch will usually be sufficient to identify your position and on a dark mountain it could be visible from at least 2+ miles away. Once it is obvious that the helicopter crew has identified you and are approaching your position, shine a steady light, aimed at your feet and not at the helicopter.

Arrival at landing site or winching situation

Landing a helicopter at night in a remote or unlit environment is potentially dangerous and, unless the crew has made a thorough reconnaissance of the Landing Site (LS), he will be most reluctant to land there. However, if the emergency services are aware of the factors which the crew need to consider, and have recced the area themselves, the crew may make a precautionary or 'dummy' approach which may be converted to a landing if the crew is satisfied it is safe to do so.

To help identify a landing site, the crews may ask for the emergency services to switch on blue lights. If this is not available then head torches, a strobe or flashing lights may be requested.

- **AT NIGHT ASSUME THAT NVGs ARE IN USE**

PHOTO: DAVID HIGGS

CREW FLYING USING NVGs

- Once the site has been identified by the crew, and if safe to do so, switch off vehicle lights. Flashing warning/hazard lights are especially disruptive to NVGs.
- As the helicopter nears the landing site or situation you should aim to reduce the amount of white light used to a minimum, whilst maintaining your own safety, but keep lights pointing downwards. Keeping some of the lights on may actually help the crews as it acts as a reference for them on their final approach.
- On the final approach to the landing site, the pilot will progressively convert from NVGs to white light using the helicopters floodlights. These are carefully controlled to remain NVG compatible. Once these lights are all on, and the helicopter has landed or is established in the hover, treat the situation as for daylight.
- Flash photographs must not be taken near the helicopter unless you have asked the crew. Stress the importance of this to all personnel and be aware of onlookers at the LS.

Searching

An NVG search will be most effective in areas where there are good light levels. If, during a search, you need to use paraflares for ground illumination inform the crew of your intentions, as the NVGs will be ineffective in the bright light produced by the flares, and could pose a danger to the crew.

Boarding and exiting

If you board a helicopter where the crew is using NVGs, do not use a normal torch inside the aircraft, as this will adversely affect the NVGs. A torch fitted with a blue/green filter is compatible with NVG operations and these may be available on the helicopter. If you need light in the back of the helicopter, ask the crew for a NVG torch.

Departing from the landing site or winching situation

When the helicopter is ready to depart, the pilot will gradually switch off the aircraft lights to gain the maximum benefit from the NVGs. You should again reduce the amount of white light used until the helicopter is well clear of the area.

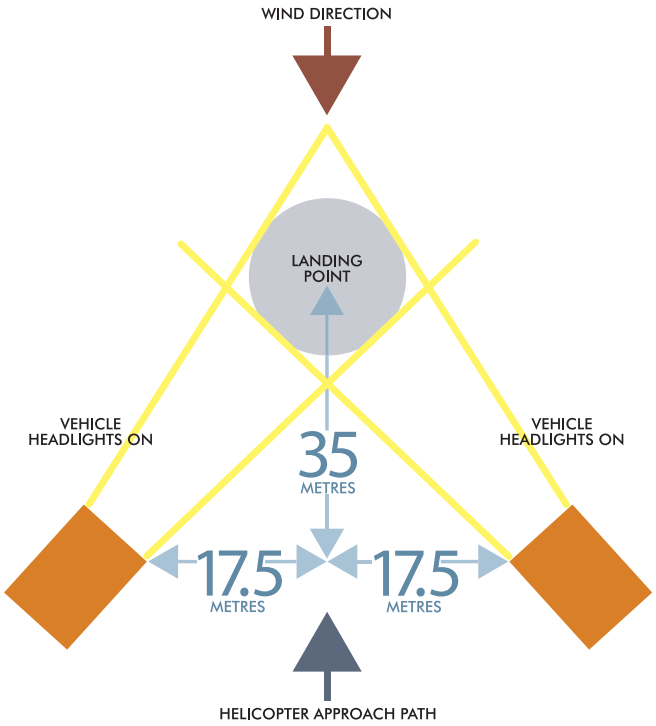
NVGs are not a cure-all for night flying. However, they do enhance the safety of operations if used correctly. Although an NVG equipped helicopter is able to see far more than before, it does not mean it can operate the same as in daylight and it is necessary to strictly control the amount of artificial light if the goggles are to work to their maximum effect. By following these guidelines you will greatly assist the safe operations of helicopters at night.

12. Crossed headlights

One method of marking or illuminating a landing site is the use of crossed vehicle headlights, as shown in the diagram above.

One member of the team should stand in the centre of the landing point with his back to the wind, to indicate the approach line of the aircraft. From this position two vehicles are then positioned approximately 35 metres/paces downwind and 17.5 metres/paces either side of the centre line, as shown. The headlights of the vehicles should point at the position where the man is standing.

When the helicopter is in sight, activate the blue lights to attract the attention and assist the crew with the location of the LS. Be prepared to switch off the blue lights if requested by the crew. See the diagram for the correct layout.



13. Safety precautions

When the helicopter moves in to winch or land there are a few points that must be remembered:

- Down-draughting can be quite severe from any helicopter, more so from modern ones such as the S92 and the AW 139. This is due to the modern blade technology which produces a concentrated cylindrical blade diameter

down-draught, whereas the older helicopters tend to produce a cylindrical pyramid defused down-draught.

Therefore, with any helicopter it is important to protect the casualty and secure all loose equipment including that of the rescuers. A loose polythene survival bag sucked into the blades could lead to damage, or worst still cause the helicopter to crash.

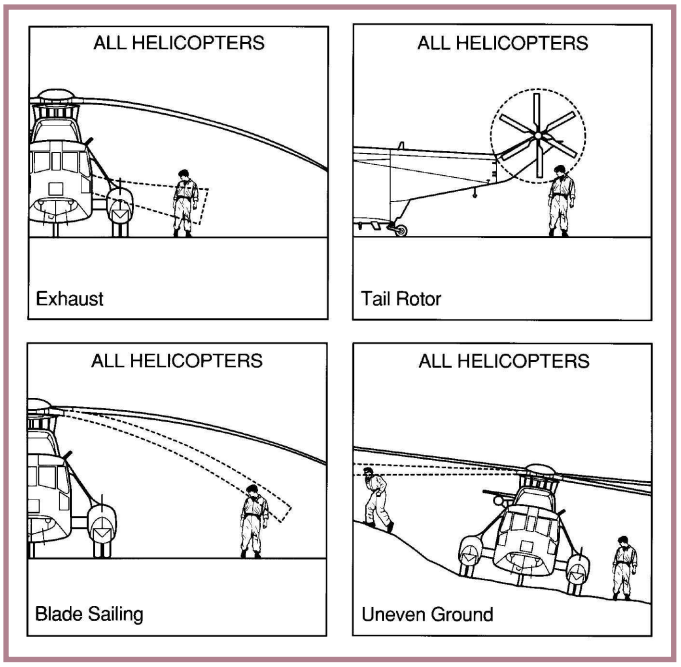
- Clear all non-essential personnel well away from the winching/landing site and restrict all movement to a minimum.

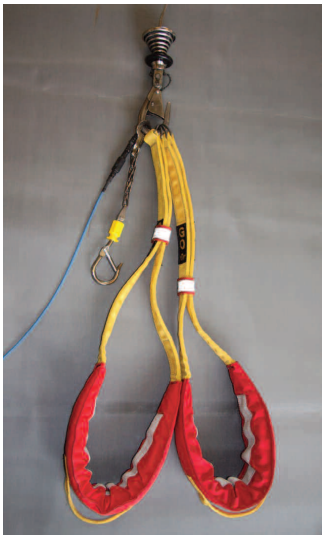
Entering/leaving the helicopter

The following general rules apply to entering, leaving, and flying in the helicopter:

- Never approach a helicopter during start up or shut down.
- Only approach or leave the helicopter when cleared to do so by a member of the crew giving a 'thumbs up' signal or at night a flash of the lights.
- Approach and leave only in the direction indicated by the crew. This is generally the safe sector between the 10 o'clock and 3 o'clock.
- Never approach or leave near the tail, or out of sight of the crew.
- Ensure there is no loose equipment. Keep your rucksack/equipment in your hands and make sure no damage is caused to the aircraft by ice axes, crampons, ski poles etc. These, if possible, should be placed in rucksacks or handed to the crews.
- Once in the helicopter, strap into your assigned seat and do not move until instructed to do so by the crew.
- When working on sloping ground, the rotor blades/ground clearance can be reduced on the upslope side. In these circumstances it is vital, when being picked up, to adopt a kneeling position and stay still until signalled to approach by the crew. If in doubt about what to do, stay put and the crew will escort/direct you. An alternative method, after leaving the helicopter on sloping ground, is to stay put in the kneeling position by the door and let the helicopter move up and away from you. In this case, ensure that all kit is secure and you protect your eyes and face from the rotor wash as the helicopter lifts.
- Flash photography is permitted inside and out however, and especially at night, please ask the crew first.

PHOTO INDICATES THE IDEAL POSITION





PHOTOS: JAMES LYNE AND DUNCAN TRIPP

TOP LEFT: HAND USED TO PREVENT 'ROLLOVER'

ABOVE: MRT MEMBER IN STROP WITH KIT

TOP: STATIC DISCHARGER, GRABBIT AND TWO STROPS

ABOVE: THE GRABBIT HOOK

14. Winching

Deployment

For reasons of speed and fuel economy, the pilot may prefer to land to drop off or pick up team members. However, due to the terrain or lack of suitable landing sites the crew may decide to use the helicopter winch for this purpose. Either a single or a double rescue strop may be used for winching. When winching the following points should be noted:

- Obey the crew's signals/instructions at all times.
- Wear your helmet at all times when working with helicopters and if possible ear protection – there is ear protection available from the crew.
- The crew will help you into the strop, making sure you are secure. Ensure you have all your equipment with you – rucksack, ice axe, crampons, walking poles etc. When signalled to do so, remove your seat strap and shuffle on your bottom towards the door of the helicopter. Rucksacks should be placed on the Grabbit hook, which in turn is attached to the main winch hook.

The Grabbit hooks are spring-gated hooks on a 30 cm chain normally used to transfer equipment. They have a safe working load of 100kg and, where possible, the gate must be guarded as there is no lock and as such kit can fall off due to 'roll-over'.

Caution:

When using the Grabbit hook it is advisable, once your kit is on the hook, to guard the gate with your hand to prevent 'rollover' and losing your kit. When deploying and recovering Search and Rescue Dogs (SARDA) attaching them to the Grabbit is the preferred method and, in this instance, it is vitally important to guard the gate!

The winch operator will now winch in the cable a little and, in doing so, draw you out of the aircraft and into a position hanging just outside the door. At this point, depending on the wind strength and direction, you may feel a blast of heat from the engine exhaust.

The winch operator will then proceed to winch out lowering you to the ground. During lowering, the arms should be kept by the sides – avoid the temptation to grasp the cable or strops as doing this could result in you slipping out of the strop. Once you are about 10' from the helicopter you may feel a slight jolt and an increase in the rate of descent. Don't worry, this is quite normal and is the hoist system automatically entering the fast range – the reverse will be felt on recovery.

Once on the ground, make sure you have a secure footing before removing the strop. If there are two people, ensure that one takes a firm hold of the hook as it will swing around, and the other person guards the gate on the Grabbit.

DO NOT BELAY YOURSELF TO ANYTHING WHILE STILL IN THE STROPS.

Remove the strop and then your rucksack from the Grabbit. Ensure the strops and the Grabbit hook are free from any entanglements or snagging hazards such as terrain or equipment and then, if you wish, give a 'thumbs up' indication to the winch operator, who will be watching from the doorway of the helicopter. At this signal, or as soon as he sees that you are safely removed from the strop, he will winch in the cable ready for the next lower.

You are now free to belay if necessary, or to await the arrival of the remainder of the party.

Recovery

Winch recovery to the helicopter is basically the reversal of the above. Additional points to note are:

- As before, wear your helmet and, if possible, ear protection. Allow the earthing strap on the winch cable to make contact with the ground before taking hold of the strop; this avoids any danger of static shock from the helicopter. Do not move around, unless instructed/indicated to by the crew. The winch operator will guide the helicopter and the strop(s) to you rather than you moving to the strop.
- Remove rucksack and place them on the Grabbit hook, remembering to guard the gate. As late as possible, remove any belay you may have before attempting to get into the strop. Crampons may be left on until safely inside the aircraft, if required, and if a crampon mat is fitted.
- Place the strop over your head and under each arm, pull the toggle firmly down and then pick up any equipment you wish to take, hold ice axes, ski poles etc in your hand, these can be passed to the crew at the door. When ready, give a 'thumbs up' sign and then stand still, do not move around in an attempt to get to what you believe is a better winching position. As you are winched in do not attempt to correct any swing.
- When you approach the cabin door do not make any attempt to grab the helicopter (or winch operator!!), or attempt your own entry into the cabin. Allow the

PHOTO: JAMES LYNE AND DUNCAN TRIPP

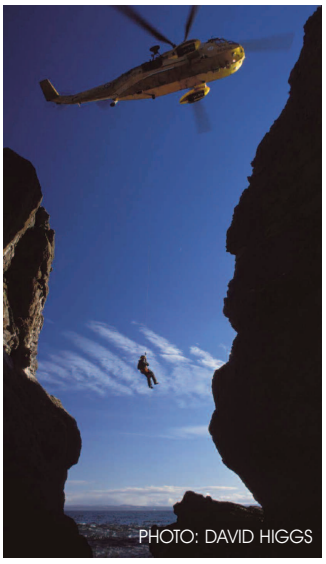


PHOTO: DAVID HIGGS

TOP: DEPLOYING/RECOVERING – NOTE HAND ON GRABBIT

ABOVE: WINCHING INTO GULLY, TRONACH HEAD, PORTNOCKIE

winch operator to do all this for you. He will control your entry into the cabin. You will be pulled into the cabin with your back to the aircraft, facing outwards. Once inside, do as indicated by the winch operator and strap in.

Winching in winter conditions

A protective floor cover within RAF Sea Kings, called a crampon mat, allows MRT members to put their crampons on before deploying and, conversely, keep them on whilst being recovered. The crampon mat is made of canvas with aluminium strips inside. It will be obvious if the crampon mat has been laid. If the situation dictates that you require to retain or put your crampons on, it is worth reminding the crew. Ensure that crampons are removed/fitted only within the bounds of the mat – you are standing on the fuel tanks!

PHOTO: JACK KASSAPIAN

PHOTO: DAVID HIGGS

Rigging of stretchers for winching by SAR helicopters

Most stretchers used by the MRS and the emergency services such as the Aerohawk, Bell, MacInnes, Neil-Robertson, Stokes Litter, Ferno, Tyromont or Alphin types are suitable for winching. The stretchers should be presented to the winchman already rigged. This can be in the form of four or six slings, integral wire, adjustable slings or, in the case of the RAF MRS, a single 10m piece of 8mm rope brought together from each corner in an over-hand knot.

If for any reason the stretcher does not have any of the above, or if the winchman is unhappy with the type or condition of the stretcher slings, he will resort to using four 120cm slings, a triangular Mallion and four karabiners, which are all carried in the helicopter.

For the majority of stretchers, one sling is secured to each corner of the stretcher using spring

ABOVE: RAF MRS WINCHING BRIDLE USING 10M OF 8MM ROPE WITH OVERHAND KNOT AND KARABINER

LEFT TOP: THREE CLIENTS AND CASUALTY, 850M UP CENTRE POST, CREAG MEAGAIDH

LEFT BOTTOM: TWO CASUALTIES ON EASTERN TRAVERSE, TOWER RIDGE, BEN NEVIS

lock or screw gate karabiners.

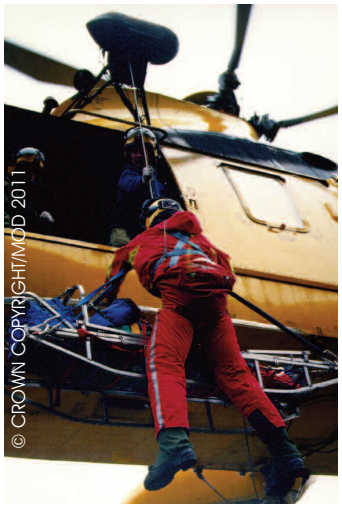
The winchman will not proceed with the winching until he is happy with the security of the slings and stretcher or the position of the stretcher.

He has the ultimate responsibility and authority when winching.

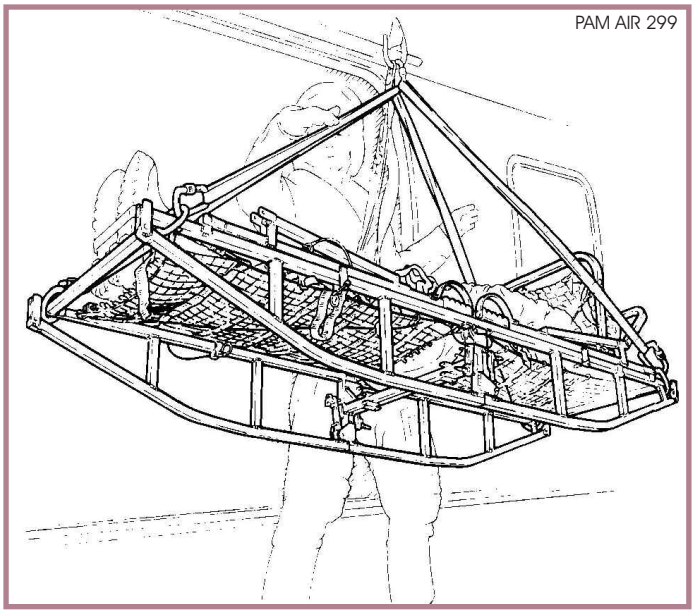
The casualty should be secured in the stretcher as for a vertical/horizontal lower. Just prior to winching the sling assembly, the integrity of the stretcher and any karabiners should be checked for security. If the stretcher is of the collapsible type, double-check the locking mechanism.

When the helicopter moves into the winching position, at least two people should stay with the stretcher to:

- Prevent it from being blown.
- Protect the casualty from downdraught and debris.
- Assist the winchman.
- 'Operate' the hi-line for the winchman.



BELL STRETCHER BEING WINCHED


PAM AIR 299

Notes:

1. Any stretcher handles, extended during lowering or carrying, should be placed in the stowed position before winching.

2. Rigging of stretchers for winching into MCA aircraft is identical to the RAF/RN helicopters.

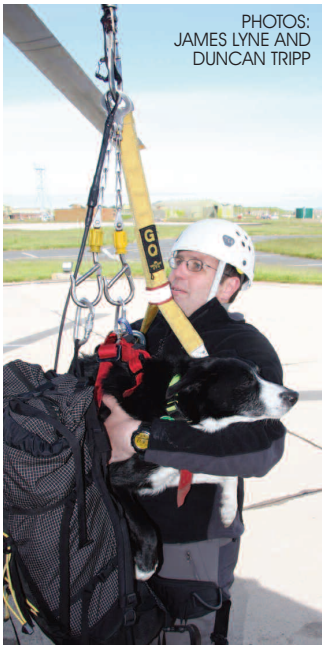
15. Helicopters and dogs

The array of resources available to the search manager is varied and in most cases plentiful. However, SAR dogs are a finite resource but, when coupled with a helicopter, become an immediate and efficient search asset able to be placed in difficult terrain and then cover large areas. One of the most important tasks dogs undertake is their rapid deployment post-avalanche when they can be placed near to the debris and ahead of other searchers who may well contaminate or mask the scent for the dogs. This is where the combined use of dogs and their rapid deployment by helicopter can pay dividends in a time critical search.

The training process

Like humans, dogs need to be trained and exposed to a variety of experiences and situations. MRT members typically undergo mandatory safety training, winching and helicopter crash drill briefings. This is generally straightforward and carried out using video footage, lectures, practical drills and exercises.

These techniques allow team members to become familiar and operate in a safe and confident manner without compromise to


PHOTOS: JAMES LYNE AND DUNCAN TRIPP

TOP: THE AUTHOR WITH AONACH

LEFT TOP: SEARCH AND RESCUE DOG WITH HANDLER IN THE IDEAL CONFIGURATION

the helicopter, the crew or themselves. A major function of training is to help alleviate fears and anxieties that are experienced by some people. The same training must also be carried out by and with dogs. Some of the problems in this process are that dogs don't tend to be as attentive or have the same ability to sit through videos or lectures as their human counterparts! The process that is used is one of gentle progress, which allows the dogs to become familiar and de-sensitised to the unusual smells and sounds of the helicopter.

To do this the following process is generally followed:

- Handlers are firstly given the standard brief for mountain rescue personnel on helicopter operations.
- Handlers and dogs are then presented to the crew (in case of any aggression the co-pilot is 'volunteered' to be presented first!).
- With the helicopter shut down the handlers and dogs are given the freedom to wander around and in the helicopter.
- An engine is then started and, once more, the handlers and dogs are free to wander around and in the helicopter.
- The other engine and rotor head are then started with the handlers and dogs at a safe distance.
- They then approach the helicopter and again the handlers and dogs are free to wander around and in the helicopter.
- The handlers and dogs are next secured in the helicopter that then takes them for a short familiarisation flight.
- Next, the helicopter lands and deploys the handlers and dogs before getting airborne to the hover. With the winchman on the ground, the winch is deployed with a static lead, two Grabbit hooks and a strop. One at a time, the handlers are called forward with their dog, where they're winched into the helicopter (described in more detail below).
- All of these steps are completed as many times as required to the satisfaction of all concerned.

Boarding and exiting protocols

For most dogs, once they have completed training, it's relatively easy to get them onto the aircraft. Often, enthusiastic dogs and handlers run to the helicopter then attempt to jump into it. Many fail – especially the handlers! With that in mind, it is far easier for handlers, once cleared, to enter the rotor disc, approach the door, hand the lead to the crew and lift the dog in. They then climb onboard, strap themselves in and take the lead back from the crew member. This process ensures there is positive control of the dogs at all times and the handler is not distracted trying to get him/herself in. Exiting is the reverse.

Flying

Flying dogs is relatively unique to SAR helicopters and, as such, there is a number of additional considerations handlers need to be aware of on top of the general requirements. Dogs can be unpredictable and their natural survival instinct when put in an unfamiliar environment can be expressed as fear and aggression. More so when forced into a noisy, smelly helicopter! With this in mind the laid-down rules for the carriage of any dog is that they are to be muzzled. However, given that all dogs on SAR operations must have completed mandatory helicopter training, crews generally take a pragmatic approach and do not enforce this rule. But if, during training, dogs have shown any signs of aggression then handlers are to ensure that they are muzzled.

Generally, dogs – like their handlers – are so focused on the task that crews have little or no problems with either. It has been known for some dogs to use the

PHOTO: BOB SHARP

PHOTO: JAMES LYNE AND DUNCAN TRIPP

TOP: SAR DOG AND HANDLER

LEFT TOP: STATIC DISCHARGER, TWO GRABBITS AND STROP

PHOTO: JAMES LYNE AND DUNCAN TRIPP

HAND USED TO PREVENT 'ROLLOVER'

under seating area as a refuge and have to be 'encouraged' out. Most settle and 'enjoy' the ride, some a little too much. On one occasion a dog had to be dragged from the co-pilot's lap whilst flying! On another occasion, a dog refused to take a biscuit and the handler unconsciously threw it out of the door. Happily, the dog was caught mid flight halfway out the door! Feeding dogs, and co-pilots, whilst in flight is to be discouraged.

Winching to the helicopter

Dogs are not designed, nor do they generally have the desire, to be winched. Therefore, there is a need for any harness to be formally recognised and cleared by the organisation for which they belong. Not only does the harness act as a winching medium, it also needs to provide the dog with a degree of security, comfort and restraint. Ideally, when dog and handler are to be winched, they will be presented with the winch hook (contents may vary) but will generally have a static discharger, two Grabbit hooks and a strop.

The ideal procedure is for the dog to be attached first to a Grabbit, the handler's bag to the second Grabbit and the handler then gets himself into the strop. Once in the strop, the handler should lift the hook up into the winching position, which will ensure that dog and bags are still attached. With one hand holding the hook, the other hand must 'protect' the gate on the Grabbit with the dog. This will ensure that the dog's harness attachment has not and cannot 'roll over' the Grabbit gate, which could lead to the dog falling off. Once the winch takes the weight, the handler removes his hand from the hook and the Grabbit, and turns his attention to supporting and reassuring the dog. At the door of the aircraft, the handler again guards the Grabbit gate until they are safely inside the helicopter.

Winching from the helicopter

As with the winch in, dog, bag and handler are attached. Again, it is important to guard the Grabbit that the dog is attached to. Once at the door, the handler checks the strop has not slipped while moving to the door and managing the dog's movement. When on the ground the handler slips the strop, removes their bag and then the dog.

Generally a dog's survival instinct is much stronger than a human's and, as such, they are normally reluctant to be winched, especially from the helicopter. It has been known for dogs to dig their claws into the floor seam. Prizing their claws out ends up like a scene from Tom and Jerry with claws pinging out from the seam one by one as they are winched out and 'scrape' down the side of the helicopter!

Once on the ground, they are normally glad to be alive. So much so that on one occasion, the handler removed himself and bag but the dog felt he'd had enough and ran off with the hook and helicopter attached. At this point the dog discovered that pulling ten tons of helicopter was futile and although the hoist looked like 245 feet of retractable lead, when fed with 3000 psi of hydraulic pressure no amount of canine adrenaline was going to overcome it!

16. Hi-line

The hi-line is a length of rope that can be used in a number of versatile ways. When working with boats the hi-line can be lowered to the deck with the aid of a weight. This can then be pulled in by the boat crew, stabilising and controlling the winchman as he is winched out into a confined area or onto a lively deck.

In another method the winchman can be lowered, taking the hi-line with him, and when he arrives on the boat or ground, with the hi-line attached to the winch hook, he can then deploy the hi-line as the winch cable is winched in and the helicopter backs off out of the

PHOTOS: JAMES LYNE AND DUNCAN TRIPP

PHOTO: DUNCAN TRIPP

TOP: PACKED HI-LINE

CENTRE: UNWRAPPED HI-LINE

ABOVE: HI-LINE USED TO STABILISE COASTGUARD PUMP ONTO FISHING BOAT

overhead. This reduces noise, downdraught and the helicopter crew's work load compared to being in the hover. It also means the winchman can remain in 'contact' and have the hook, with or without equipment, returned to him whilst the helicopter remains out of the overhead.

During the recovery the winchman will brief the ship's crew or emergency services to deploy the hi-line as he is winched in. They should allow the hi-line to pay out maintaining firm pressure; this will stop the winchman and stretcher from swinging and spinning, recovering from a confined area or lively boat in a controlled manner. If there are multiple winching evolutions then ideally two people should 'operate' the hi-line; one to deploy and heave to and the other to control/manage the 'dead' hi-line to prevent entanglements. Once the winchman has reached the door, he will release the hi-line allowing it to drop away, so be aware.

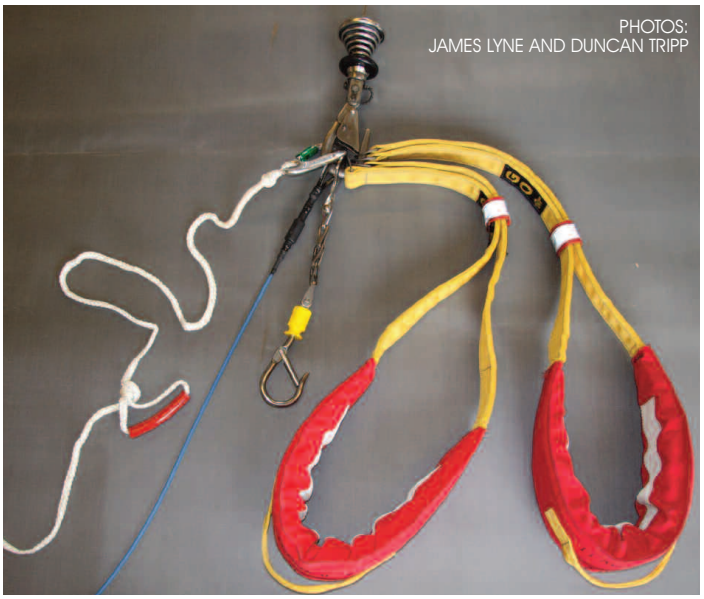
HI-LINE HANDLE

If you are being deployed/recovered by the winchman using a hi-line, you will be given the red handle to hold. By doing this the weak link, circled below, is effectively bypassed as it can break easily under shock load – your arm/ strength now acts as the weak link. Do not overstrain yourself, moderate strength is enough – anymore then you should release the handle and allow the weak link to take over. Never feed your wrist through the loop!

HI-LINE WEAK LINK

For the RAF, the hi-line is 150 feet of nylon rope rigged in a pouch. For the RN and MCA, the length and presentation is different but the principle remains the same. At each end there is a karabiner with one end attached to the karabiner by a weak link, which has a breaking strain of 150-180 lbs. Hi-lines can be joined together for extended cable recoveries. The weak link end, which is the same as the red handle end, is attached either to the hook, stretcher, or the winchman may elect to hold it.

NEVER ATTACH THE 'DEAD END' OF THE HI-LINE TO A BELAY OR FIXED STRUCTURE.



PHOTOS:
JAMES LYNE AND DUNCAN TRIPP

HI-LINE, STATIC DISCHARGER, GRABBIT AND TWO STROPS

17. Stretcher back belay technique – 'Helicopter Double Italian Hitch Stretcher Belay System'

Background

On occasions, the crew may arrive on scene to find the casualty already 'packaged' in a stretcher. This situation often occurs when the rescue involves MRTs – both civil and military, and during cliff rescues involving the MCA.

During these incidents, there may be a need to load the casualty into the stretcher in far from ideal conditions, on some precarious or steep terrain. This will result in the need for the stretcher to be secured to some sort of belay prior to the helicopter's arrival. However, when it comes to recovering the casualty in the stretcher by helicopter, having it secured to both a belay and the winch at the same time can traditionally have distinct disadvantages.

The general rule, during recovery, is that the stretcher cannot be secured to both the belay and the helicopter winch at the same time. This is mainly due to concerns that, if the helicopter needs to fly away, there is potential to compromise the casualty, winchman or, more importantly, the aircraft.

It is generally incumbent on the winchman and emergency services to ensure that the transfer from belay to helicopter winch is both quick and more importantly safe. This, however, leaves the casualty in a compromised situation where, for a finite time, they are insecure.

The Italian Hitch is a very simple and commonly used friction knot which has the advantage that, when tension is released, the knot relaxes. It can be used as an abseil system, when only a rope and karabiner are available, negating the need for equipment or an abseil device such as a figure of eight.

The system

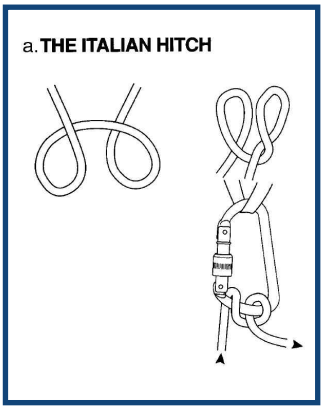
First a secure belay point must be located above the stretcher and, using slings/rope, form a belay brought to a single point and attached to a karabiner. The belay rope is then attached with an Italian Hitch and either locked off or held and controlled by the 'anchor man'. A tail of 2-3m of dead rope is ideal.

The stretcher should be set up with a bridle using either rope or slings to maintain the stretcher in the required attitude and like the belay, brought to a single point and attached to a karabiner. The other end of the belay rope is then attached to the stretcher via the karabiner with an Italian Hitch and again either locked off or held secure by the 'stretcher man', as before a tail of 2-3m of dead rope is ideal.

Just prior to arrival the 'anchor man' and the 'stretcher man' unlock the Italian hitches and take control. When the winchman arrives, the stretcher can be attached to the winch and, on the winchman's command, the 'stretcher man' releases his end of the rope. When the stretcher is winched in, the rope simply pulls through the karabiner. Should, for any reason, this end of the rope become tangled the 'anchor man' simply releases his end and, at worse, the winchman and stretcher will be winched up with a length of rope attached. As a tertiary back up the 'anchor man' should have a J knife/knife at his disposal and, if all else fails, the belay rope can be cut.

WINCHING WITH CASUALTY ON STEEP GROUND

This is a simple system which bridges the gap of having both the aircraft and stretcher attached to the belay at the same time. But most importantly it maintains the integrity and security of the casualty throughout the recovery. It must, however, be emphasised that this system and the use of the Italian Hitch is only for use on steep ground and is not to be used for vertical/horizontal lowers.



18. Emergency drills

The Sea King helicopter is a robust, twin-engined aircraft, with a first class safety record. In the unlikely event of an emergency, the following procedures should be adopted:

- Follow the directions of the crew.
- Secure any loose equipment, putting it under seats or feet.
- Ensure your seat belt is tight, the legs are at right angles and the feet are not tucked under the seat rail.
- On hearing the call **'BRACE BRACE'** or being shown the **'BRACE BRACE'** card:
  - **Place the arm nearest an exit across your chest gripping the opposite shoulder. This is called the orientation arm and is important after a crash or ditching in helping you to locate and orientate yourself towards your nearest exit – this will be discussed later in this section.**
  - **Place the other hand under the knees with the hand gripping the clothing on the opposite leg.**
  - **The head and chest are brought down towards the thighs, with the elbow of the arm placed on the far side of the knees.**
  - **The face is pushed into the crook of the arm with the chin tucked into the chest and the body braced for impact.**
  - **Prepare for a series of impacts.**

IDENTIFY EXIT

PHOTOS: DUNCAN TRIPP

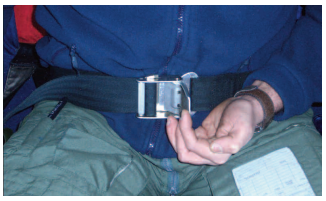
'ORIENTATION' ARM ACROSS BODY

OTHER HAND GRABS SEAT RAIL

FACE INTO CROOK OF ARM

- Remain strapped into your seat until:
  - All motion has stopped **or**,
  - When told to move by the crew **or**,
  - When you can hear your own heartbeat!
- Release your seat belt.

LIFT



RELEASE

Exit through the normal routes. If these are blocked, damaged or a fire is present, the emergency exits will have to be used.

In RAF Sea Kings, all the cabin windows are jettisonable and can be used as emergency escape exits.

Each window has a large **metal ring and a red tag**, normally located at the top.

RING/TAB AT TOP OF WINDOW

By pulling the **ring/tab**, the window seal is removed and the window is easily pushed out.

PULL RING/TAB

Some windows are 'obstructed' by a black and yellow bar this too can easily be removed.

BAR ACROSS WINDOW

Move out quickly and clear the helicopter to at least 50 metres upwind.

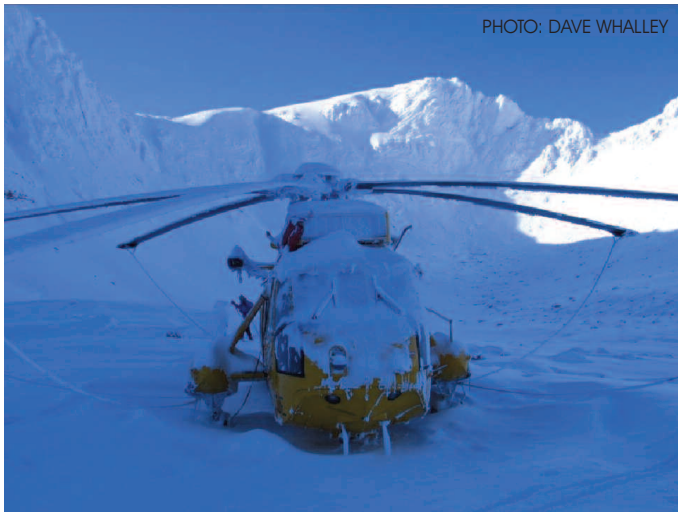
BAR REMOVED

Note:

Emergency handles and window jettison tags are coloured **YELLOW** and **BLACK** or **RED.**

Other helicopters have similar emergency procedures, ensure that you refamiliarise yourself with your escape exits and drills every time you fly.

DO NOT JETTISON ANY WINDOW WHILST AIRCRAFT IS IN FLIGHT



ALL PHOTOS (APART FROM SNOWY SEA KING): DUNCAN TRIPP

OOPS!!

19. Over water

There may be occasions when you will fly over extended expanses of water. In this case, the crew will issue you with passenger lifejackets. These are very similar to the ones you will have seen when flying in any civilian airliner. If these are to be issued, the crew will brief you on their operation.

If, in the extremely unlikely circumstances, you have to ditch or you are disorientated after a crash it is important to use your 'orientation arm' to help locate the nearest exit. In a ditching most helicopters have automatic and manual inflation devices that are designed to keep it afloat.

Over water you should adopt the crash position as previously detailed. However, if the flotation devices are damaged or the helicopter starts to fill with water, or if the helicopter starts to roll over, immediately bring the 'orientation arm' up and locate a solid piece of the helicopter's structure in the direction of your nearest exit. The other hand should locate and hold onto the seat belt buckle – do not release yet.

The helicopter may roll – just before your face enters the water, take a deep breath whilst keeping both hands in position. Wait until all violent motion has stopped and the water has stopped rushing in – count to 10! Then open your eyes, if they are closed, release your seat belt with one hand whilst maintaining hold of the helicopter with your orientation hand.

NEVER INFLATE YOUR LIFEJACKET INSIDE THE HELICOPTER.

Keeping hold of the helicopter structure, work your way along to your chosen exit. Open the exit – remember that if the helicopter is upside down the tabs/handles won't be where you expect, keep hold of the structure at all times or you will become completely disorientated and will not get out.

It is **vital** that you:

- Are all disciplined.
- Maintain your grip with your orientation hand and the other on the buckle – do this or you will become completely disorientated.
- Wait until all violent motion has stopped.
- Wait until water has equalised – if you do not, each window is approximately 0.5m², taking into account flow rate and pressure you will be fighting against approximately 1.5m³/sec ie. 1.5 metric tonnes per second!
- **Always maintain contact with the helicopter structure until you escape**

This whole process will take approximately 20 seconds, although it will feel like a lifetime. However, carrying out these actions will allow you to reorientate, release your seat belt, and locate your exit and effect an escape. Once free, swim clear and inflate your lifejacket if necessary. Hopefully the crew will have deployed or taken the dinghies with them and you can then climb aboard and wait to be rescued by another helicopter!

20. Sea King beam seats

If the beam seats are occupied during a crash the same basic procedures apply.

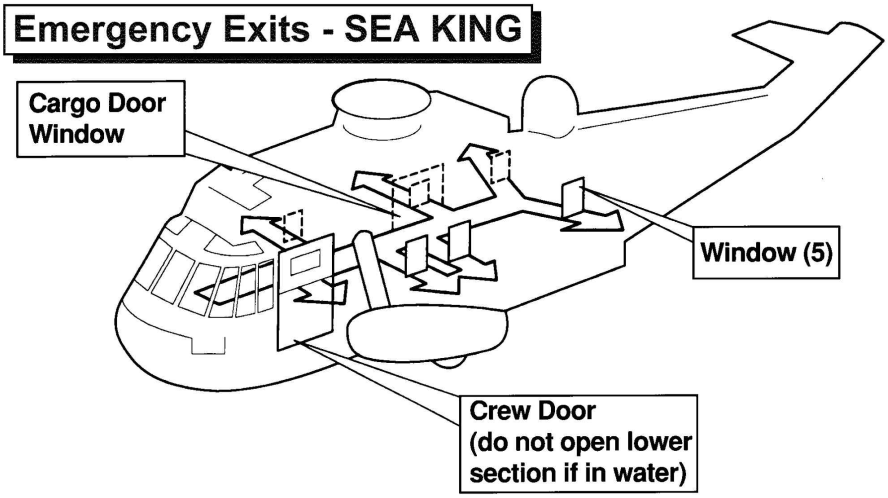
PHOTOS: DUNCAN TRIPP

Additionally, the seat belt inertia system must be locked and the crash position above must be adopted.

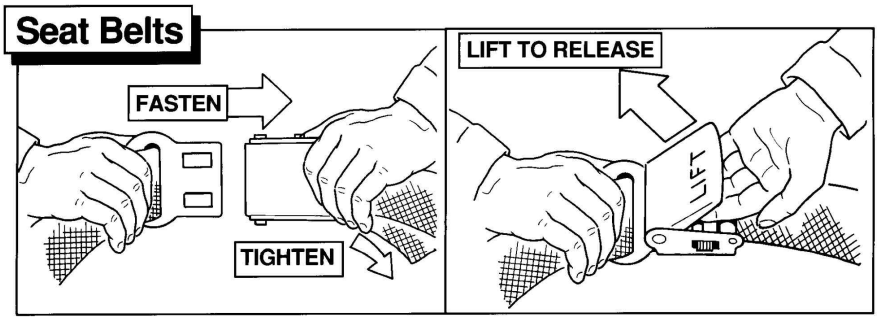
To release the seat belt locate the buckle, depress the silver button and rotate the body either left or right 90°.

TOP: BRACE POSITION IN SEA KING BEAM SEAT
OTHERS: RELEASING FOUR POINT HARNESS

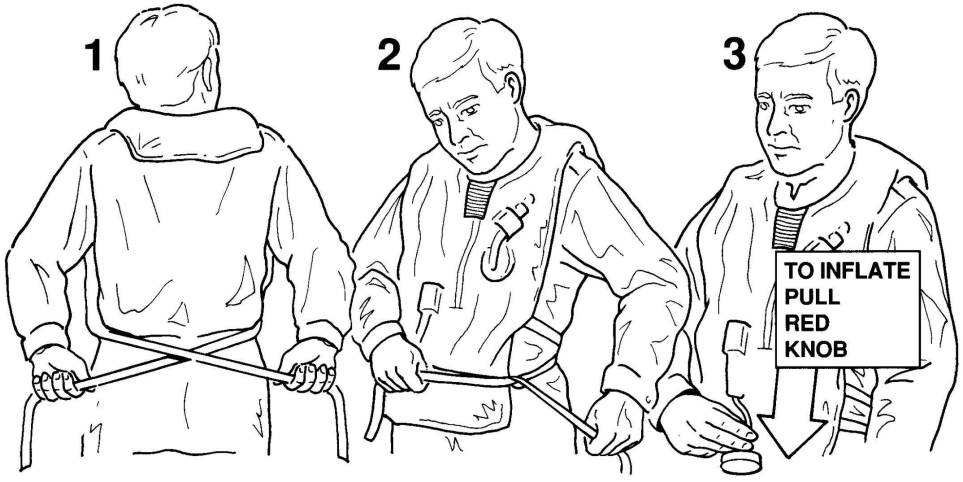
Emergency Exits - SEA KING



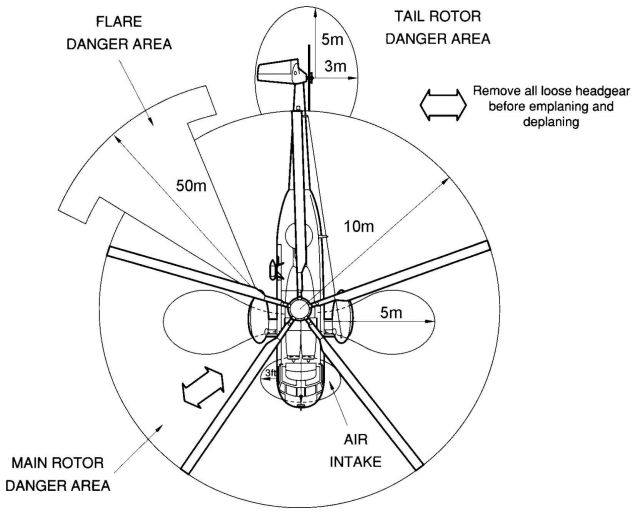
Seat Belts



Life Jackets




Cargo Door Window
PULL LEVER
PUSH WINDOW OUT
Crew Door (do not open lower section if in water)
PUSH LEVER
PUSH UPPER DOOR OUT
Windows
PULL RED TAG REMOVE SEAL
PUSH WINDOW OUT


FLARE DANGER AREA
TAIL ROTOR DANGER AREA
5m
3m
Remove all loose headgear before emplaning and deplaning
50m
10m
5m
AIR INTAKE
MAIN ROTOR DANGER AREA

21. The Sea King Multi Sensor System (MSS) – background information

System description

The Sea King is equipped with the STAR-Q Multi Sensor System (MSS). The MSS comprises of a Thermal Imaging (TI) system and a daytime TV camera, co-located in an external turret mounted under the port stub wing. Both TI and TV can be recorded on a digital video recorder of broadcast quality along with the aircraft intercom system and radios.

Information from the radar, TV and TI is displayed to the operator by means of two screens and the operator has the choice of Radar, TI, TV or video playback (of TI and TV) on his screens.

The system is controlled by the operator by means of a keyboard co-located with the radar keyboard at the radar station, and the TI/TV turret is controlled by using a joystick. The TI side of the system is often referred to as FLIR (Forward Looking Infra Red), which is a bit of a misnomer, as the Sea King system has full 360° coverage in azimuth, and from + 20° to 120° (ie. beyond vertical) in elevation. The TI, in the right conditions, will pick up cows etc, up to 4-5 miles away, and small animals like rabbits at half to one mile – if configured correctly. It will pick up surfers in neoprene wetsuits in excess of two miles, and a head in the water up to 0.6 mile (in favourable sea conditions).

The TV has a zoom facility, 27 times zoom plus a x2 extender, which is excellent for classifying potential targets identified visually by day without having to descend the aircraft to observe closely, for example in the context of a coastal or mountain search.

PHOTO: JAMES LYNE AND DUNCAN TRIPP

MSS TURRET

It is a mistake to think TI systems like that on the Sea King detect temperature – they actually detect energy. This energy is in the form of radiation, Infrared (IR). All materials above a temperature of absolute zero (–273°C) emit energy in the form of radiation. If the object in question is a living thing (human being, for example), then this IR radiation will be produced mainly (but not exclusively) by the heat of the body.

If it is an inert object (rocks, concrete, land, etc) much of the energy comes from the sun, which emits IR, which is subsequently absorbed by the object in question and re-emitted to atmosphere.

As most IR comes from the sun, if it's a hot sunny day, an object will have more chance to absorb (and subsequently re-emit) radiation than if it's a cold day, or at night. This means that, even though you may think a human body will stand out because it's 'warmer' than the surroundings, if those surroundings are emitting more radiation than the object you're looking for, then it will be hard to detect.

Cliffs, dry sand and concrete are all examples of material, which, will obscure the thermal picture due to the high amount of radiation being re-emitted to atmosphere. Hence a relatively small human will be extremely difficult to pick out against that background. This phenomena of thermal crossover continues for an hour or two after dusk as the background stored energy dissipates, and the reverse occurs at dawn as the background starts to absorb and potentially obscure any target. Therefore the TI is primarily a nighttime sensor.

In order to better manage the thermal radiation available for detection TI searches are normally carried out at 1000–1500 foot as opposed to visual searches, which are carried out at 100–200 foot, hence a TI search is incompatible with a visual search. Another limitation is that TI doesn't work in cloud and becomes degraded in rain due to atmospheric attenuation. However, it will see through smoke and haze much better than the naked eye.

PHOTO:
JAMES LYNE AND DUNCAN TRIPP

Practical Thermal Imaging (TI) operations and search planning considerations

The MSS can help significantly in several main areas, but does have limitations, which need to be considered when planning a search, and working out how effective the search will be. Some of the practical aspects to consider in formulating a TI search plan are:

- **Target Type:** TI is only 'skin deep', which means that whatever the outer presenting layer is, that's what we'll see on the kit. Surfers in neoprene wetsuits show up well in the water, people walking in Gore-Tex also show up pretty well over land, especially at night or against bland thermal backgrounds. However, some materials such as plastics don't give off much energy and don't show up at all well. Survival 'bivvi bags' are an example of something not showing up very well. (So, if there's a chance you will be chased by a helicopter with TI, or don't want to be found – always carry a bivvi bag!!)

- **Time of day** – the sunnier it is, and the more intense the sun, the more radiation is available to be absorbed, hence re-emitted, and/or reflected. Daylight will give a poorer search quality than night, particularly over some land surfaces, and the few hours after sunset can be a bad time to search cliffs as they will still be 'giving back' all the radiation they have absorbed during the day.

  Nighttime should yield better thermal results generally, particularly over land.

- **Time of year:** As above, the sunnier it is, and the more intense the sun, the more radiation is available to be absorbed, hence re-emitted and/or reflected. Consequently, for a particular surface, better results may be obtained in winter than in summer.

- **Surface type:** Some materials emit/reflect too much radiation for crews to see through. Boggy moorland, being wet, and undergrowth may be easier to search at night than rocks, due to their high water content. Large areas of cliff are difficult to search effectively just after sunset.

- **Overwater search areas:** The TI kit is very good at picking up casualties in the water, especially if in wetsuits or fitted with a life jacket, and can pick up a head at up to 1km in calm seas. However, a severely hypothermic/dead casualty is likely to present little thermal contrast for the operator and, in all cases, the probability of detection decreases with increasing sea state (chances of detection decrease significantly in sea state 4 and above), as the head/body becomes 'washed over' with the relatively colder water masking the casualty.

- **Overland search area:** The police and other TI operators won't get airborne on a nebulous '…someone went missing four hours ago. Your TI search area is a box 20km x 20km…' type call. This is seen as a near impossible task, so they'll always get accurate intelligence and tie down the area for search as tight as they can before committing to it. The Sea King crews will do the same, as searching a large overland area will generate literally hundreds of thermal targets to investigate. A more realistic tasking would be '…search the path from point A to point B and 300m either side…' or '…search the coastline from grid ref X to grid ref Y…' or '…search within a 1km radius of the old peoples' home at grid ref Z…'

  This emphasises the importance of an on-scene face-to-face briefing with the Search Manager or POLSA co-coordinating the search, to ascertain exactly what is required and what has already been searched. It is important the operators take time to sort out search parameters and that the crew is briefed on a coherent plan before they get airborne. Local MRTs, MCA, police etc, have an excellent knowledge of where missing people are most likely to be. It is, therefore, highly advantageous for the crew to take one of these personnel on board.

- **Hover height vs. light levels:** For a good thermal picture, higher is better, up to a point, so over water and over land the helicopter needs to be up at 500-1500 foot depending on the target type. In the mountains, cloud base may preclude this and the pilots need to be able to have good VISUAL references to maintain a high hover. In areas with poor cultural lighting, or in times of poor light levels (no moon, full cloud cover etc), the NVG performance may be degraded to such an extent that the pilots will be unable to maintain a high hover – NVG performance gets significantly poorer with height. In this case, the crew may attempt a lower hover and accept the degraded TI performance, or resort to visual search techniques with the TI as a back up.

- **Weather:** TI is severely degraded in rain, mist and fog. At best, you can expect a 20% advantage over a visual search (according to the manufacturers). In practice, the advantage can be small, if any. However, IR radiation penetrates haze extremely well, so is very useful for searching in conditions where visibility is reduced by dense haze/smoke/smog.
- **Type of terrain:** Dense woodland and populated urban areas are a nightmare to search, as are huge swathes of countryside containing numerous walls, rivers, streams, animals etc. Open hillsides can be easier, especially if they are of a bland thermal background and don't have too many animals wandering around. Beaches and coastline are fairly easy to search, but TI is obviously best used by night in these areas.

Summary

The MSS is another tool in the Sea King's search capability. It is not the answer to every search problem and it is not effective in all weathers, terrains or at all times of day. In the right conditions, however, it is an outstanding sensor, which will both speed up searches and increase the probability of locating the target, assuming, of course, the target wants to be found!

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