NATSAR Manual Amendment Schedule – Agreed at NATSAR 46

Date received	Current manual reference (page number)	Reason for amendment	Previous Wording	New Wording *For images or tables that cannot fit within this document are to be attached to email to Secretariat.	Name/agency
1/06/22	Acronyms and abbreviations	Missing information	NIL	SLDMB – Self Locating Datum Marker Buoy	Glenn Columbine AMSA
1/06/22	Glossary	More explanation to differentiate from SLDMB Current definition is insufficient to cover changes in technology in respect to Sar datum Buoys. New SAR Datums Buoys are self-locating (GPS located) and do not require assets to reacquire to update local water drift.	Droppable floating beacon used to determine actual sea current, or to serve as a location reference.	Droppable floating beacon that is not self-locating requiring the beacon to be relocated by homing the frequency. Once relocated used to determine actual sea current, or to serve as a location reference.	Glenn Columbine AMSA
1/06/22	Glossary	Missing term	Self-Locating Datum Marker Buoy	A droppable floating beacon that is self-locating. Used to determine actual sea current, sea surface temperature or to serve as a location reference.	Glenn Columbine AMSA
	P 62	New wording proposed by the NATSARMC	Volume 1 2.1.25 The SMC is responsible for ensuring that the following duties are carried out depending on the SAR incident and local circumstances: a) Obtaining and evaluating all information pertaining to the incident, including emergency equipment carried by the aircraft/vessel/vehicle/person in distress; b) Classifying the SAR incident into the appropriate emergency phase (Uncertainty, Alert/Urgency, or Distress); c) Alerting appropriate SAR assets and SAR organisations that may be of assistance during the incident; d) In consultation with other SAR Authorities, confirming which Authority will exercise overall coordination in accordance with Appendix B; e) Conducting a risk assessment and/or Search Urgency Assessment; f) Promptly initiate a response to the situation, including dispatching SRA's immediately, if situation warrants; g) Conducting initial communications checks. If unsuccessful, making an extended communications search to obtain additional information on the incident, personnel involved and equipment carried by the vessel, aircraft or party in distress; h) Calculating the search area. Preparing optimum plans and promulgating attainable plans; i) Obtaining past/present/forecast weather, drift information and oceanographic conditions if applicable; j) Providing for SAR crew briefing, dispatching of appropriate SRA's, or other assets; k) Organising logistical support for all SAR assets including fuel, food and accommodation, through to the completion of the incident; l) Making arrangements for appropriate communications; m) Maintaining a continuous, chronological plot showing, for example sighting and hearing reports, DF bearings, air plot, RADAR plot, fixes, reports of debris, areas searched or not searched and other intelligence; n) Maintaining a continuous, chronological record or log of the search effort, including actions taken in relation to intelligence, SRA's employed, sorties, hours flown/underway, sightings, leads, results obtained, message traffic, briefing notes, telephone calls, daily evaluation of progress and probability of detection; o) Initiating maritime distress broadcasts or maritime information broadcasts and initiating the alerting of enroute aircraft. Consideration should be given to arranging for announcements to be made over radio and TV networks; p) Arranging communication schedules when and if needed; q) Requesting additional SAR assets, as required; r) Exercising overall coordination of SAR assets; s) Determining the Time Frame for Survival (TFFS) in consultation with a medical practitioner if required. t) Maintaining liaison with the next of kin, owner, agent or management of the missing craft or persons;		NATSARMC

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<table>
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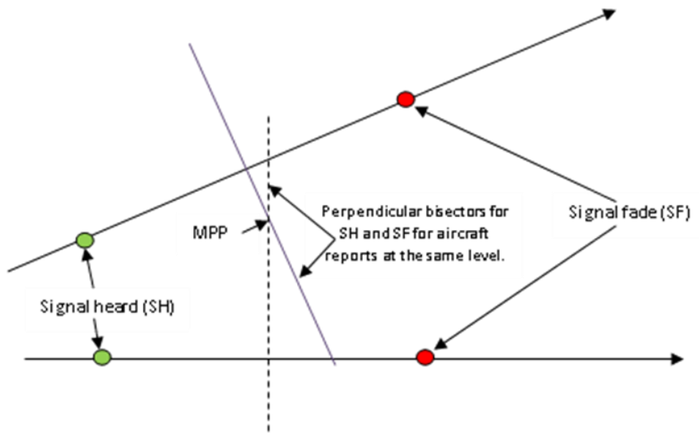
<tr><td></td><td></td><td></td><td colspan="2">u) Keeping all authorities involved fully advised of SAR incident progress with timely and regular situation reports (SITREPs). SITREPs should be sent in a numbered sequence;
v) Making recommendations in relation to the continuation or suspension of searches;
w) Issuing news media releases on the progress of incidents in accordance with the local SAR organisational procedures and policies;
x) Providing debriefs of SRA's, cancel alerts, release SAR assets and organisations involved, and issuing the final SITREP to all concerned; and
y) Acting as required to cope with unique, unusual or changing circumstances of the emergency.</td><td></td></tr>
<tr><td></td><td>Volume 2, page 246: Figure 4-16 Signal Heard and Signal Fade Plotting</td><td>Corrected diagram as original is missing wording</td><td></td><td> 
</td><td>NATSARMC</td></tr>
<tr><td></td><td>Page 246, section 4.7.36.</td><td>Correction for clarity</td><td></td><td>4.7.36 To check individual craft as the source of a signal, a domestic FM/AM radio tuned to FM 99.5MHz is likely to receive the signal if placed within a few metres of the source. Also, the aerial may be removed from an Aviation VHF radio, if the signal is still received the source is very close.</td><td>NATSARMC</td></tr>
<tr><td></td><td>Section 7.16.9</td><td>Table to be incorporated</td><td></td><td>7.16.9 Danger considerations when conducting search operations in hot and humid conditions. The areas identified in RED and BLACK are considered extremely dangerous for searchers.

See updated table in Attachment 1 below.</td><td>NATSARMC</td></tr>
<tr><td></td><td>Appendix E-8:3</td><td>Updated table to replace existing table</td><td colspan="2">
<table>
<tr><th colspan="22">Cumulative POD Table (Land SAR)</th></tr>
<tr><th colspan="22">POD for current search</th></tr>
<tr><th rowspan="2">POD for previous search</th><th>%</th><th>5</th><th>10</th><th>15</th><th>20</th><th>25</th><th>30</th><th>35</th><th>40</th><th>45</th><th>50</th><th>55</th><th>60</th><th>65</th><th>70</th><th>75</th><th>80</th><th>85</th><th>90</th><th>95</th></tr>
<tr><td>5</td><td>10</td><td>15</td><td>19</td><td>24</td><td>29</td><td>34</td><td>38</td><td>43</td><td>48</td><td>53</td><td>57</td><td>62</td><td>67</td><td>72</td><td>76</td><td>81</td><td>86</td><td>91</td><td>95</td></tr>
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<tr><td>15</td><td>19</td><td>24</td><td>28</td><td>32</td><td>36</td><td>41</td><td>45</td><td>49</td><td>53</td><td>58</td><td>62</td><td>66</td><td>70</td><td>75</td><td>79</td><td>83</td><td>87</td><td>92</td><td>96</td></tr>
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</table>
</td><td></td></tr>
<tr><td></td><td>Appendix E-1 Search Urgency Assessment Form</td><td>Updated form to replace existing form in manual</td><td>
Search Urgency Assessment
<table>
<tr><td colspan="2">Name of Incident:</td><td colspan="2">No:</td></tr>
<tr><td>Date Completed:</td><td>Time completed:</td><td>Initials:</td><td>Incident date:</td></tr>
</table>
<table>
<tr><th colspan="3">Number of subjects</th></tr>
<tr><td>1 person
2 people or 3 or more –separated
3 people or more – together</td><td>1
2
3</td><td></td></tr>
<tr><th colspan="3">Age</th></tr>
<tr><td>Very young
Other
Very Old</td><td>1
2-4
1</td><td></td></tr>
<tr><th colspan="3">Medical Condition</th></tr>
<tr><td>Known illness or requires medication
Suspected illness or injury
Healthy
Known frailty
Potential vision impairment</td><td>1
1
3
1
1</td><td></td></tr>
<tr><th colspan="3">Intent</th></tr>
<tr><td>Suicidal
No known intent
Absconder from facility</td><td>1
3
4</td><td></td></tr>
<tr><th colspan="3">Cognitive Capacity</th></tr>
<tr><td>Dementia / Alzheimer’s /Parkinson’s
Capacity of 16-year-old or less
Diagnosed mental illness, depression or anxiety
No known capacity issues</td><td>1
1
2
3</td><td></td></tr>
<tr><th colspan="3">Experience profile</th></tr>
<tr><td>Not experienced, not familiar with area
Not experienced – familiar with area
Experienced – not familiar with area
Experienced – familiar with area</td><td>1
2
3
4</td><td></td></tr>
<tr><th colspan="3">Physical Condition</th></tr>
<tr><td>Unfit
Fit
Very fit</td><td>1
2
3</td><td></td></tr>
<tr><th colspan="3">Clothing profile</th></tr>
<tr><td>Inadequate/insufficient
Adequate
Very good</td><td>1
2
3</td><td></td></tr>
</table>
</td><td></td><td>NATSARMC</td></tr>
</table>

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			Equipment Profile Inadequate for activity/environment 1 Questionable 2 Adequate 3 Very Well equipped 4 **Weather profile** Existing Hazardous weather 1 Hazardous forecast (8 hours or less) 2 Hazardous forecast (more than 8 hours) 3 No hazardous weather forecast 4 **Terrain and Hazards profile** Known hazards 1 Difficult terrain 2 Few hazards 3 Easy terrain, no known hazards 4 11-17 Emergency Response 18-27 Measured response 28-40 Evaluate & Investigate Note: If **any individual category** above is rated as **ONE (1**), regardless of its total – the search could require an emergency response **Remember**: the lower the number the more urgent the response!!!		
	Appendix E-5	The old version has corrupted formatting. New version has been updated with new data.		**Appendix E-5 Lost Person Behaviour** **Lost Person Behaviour** Lost Person Behaviour (LPB) has been derived from many studies and statistics gathering from search and rescue groups in many countries of the world. It has been found that certain categories of missing persons tend to have similar characteristics with respect to being lost. These categories have been broken down into the following groups: a) Children 1-3 years of age b) Children 4-6 years of age c) Children 7-12 years of age d) Youths 13-15 years of age e) Despondent or Suicide f) Psychological Illness g) Developmental Problems h) Alzheimer's and Dementia i) Hikers and Walkers j) Climbers k) Hunters l) Prospectors m) ADD, ADHD, Autism and Asperger's **Lost Person Behaviour Definitions:** **Children 1-3yrs:** All children aged 1-3 years of age.	NATSARMC

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				Children 4-6yrs: Al children aged 4-6 years of age **Children 7-12yrs:** All children aged 7-12 years of age. **Youths 13-15yrs:** All teens aged 13-15 years of age. **Despondent:** A person feeling or showing signs of profound hopelessness, dejection, discouragement and/or gloom. This includes depression and people who have expressed the intent to commit suicide. Not all despondent people are suicidal and similarly not all suicidal persons are despondent but they have similar characteristics and are therefore combined for SAR purposes. **Psychological Illness:** This category covers persons suffering from a wide range of mental disorders that medically would not be used together. They include persons suffering from schizophrenia, paranoia, psychotic disorders and bipolar disorders. These disorders can be naturally occurring or artificially induced such as by substance abuse. This category does not include dementia. **Developmental Problems:** Also called Mental Retardation or Intellectual disability is a combination of below average intellectual functioning, impairments in daily life (communication, self-care, social skills, work, safety, health) and was onset prior to the age of 18 years. This category also applies to persons suffering brain injuries after 18 years that exhibit the same symptoms. **Dementia:** Dementia is the loss of memory, reason, judgement and language to such extent that it interferes with daily living. Dementia includes AIDS and Alcohol related dementia, Alzheimer 's disease, Down Syndrome, Early or Younger Onset Dementia, Fronto Temporal Lobar Degeneration, Vascular Dementia and Dementia with Lewy bodies. Dementia often results in severe disturbances in how a person perceives and interprets events, sights, and sounds around them. **Hikers and Walkers**: This category includes day walkers, members of bush walking clubs, hill/fell walkers, multi-day hikers, trekkers, orienteers and other persons who purposefully enter the bush for recreational walking purposes. Mountaineers are included in the climbing category. **Climbers:** This category includes day climbers (single day outings, bouldering, rock and cliff climbers, traditional climbers and sport climbers) and mountaineers (those who attempt prominent peaks or alpine travel). **Hunters:** This category includes all forms of hunting (pigs, water buffalo, brumbies, game fowl, kangaroos, cattle) on land. There is insufficient data for a further breakdown. **Prospectors:** This category includes those persons undertaking any prospecting activities, such as gold prospecting, opal hunting and all other activities of this nature. **ADD, ADHD, Autism and Asperger's**: This category includes all children who have been clinically diagnosed with one of those conditions. While all subtly different in their effects the behaviour of suffering children is often comparable. These are the most common groups of missing persons likely to be the subject of a search in Australia. The distances contained with each category include 25%, 50%, 75%, 80% and 95%. The 25%, 50% and 75% are utilised within the PolSAR Land Search Program and may also be useful outside that context. The 80% is what is most often used to determine the initial search area. Statistically, above 80% there is often a sharp increase in distances, therefore the 80% distance represents the end of the normally expected range. There have been numerous studies on missing person behaviour with the most recent being Robert Koester's (ISRID) International Search and Rescue Incident database www.dbs-sar.com. This study collates thousands of incidents, statistics and previous studies for an international database. This information is continually being analysed and updated with Koester, currently dividing missing person statistics to eco regions around the world that will enable more defined distances of travel for particular areas. For instance Victoria, a temperate terrain, as opposed to Northern Territory a hot dry terrain. The only Australian specific project on missing person behaviour was the SARBAYES project which was completed by Charles Twardy: http://sarbayes.org/natsar.pdf. The current Australian data base for the entry of LPB details is: http://goo.gl/OLZmW Overseas studies also look at other categories such as hunters, skiers and miscellaneous adults. The three main LPB studies used for this manual have been taken from the UK, USA and Canada. Although Australia has many links with the UK and the majority of our citizens have a British background, we are a more mobile and active society more closely resembling Canada in our lost person behaviour. These tables have been prepared as a guide only and are a compilation of studies in the above countries. They represent the statistical properties and characteristics of missing persons and what could be expected of them when they are lost, but ultimately these are only probabilities, not certainties. This information can be used as the basis of search planning when no other information is available. Obtaining a good profile of the target person will assist the SMC in determining whether that person/group fits into the known behavioural patterns of the various categories studied. If so, then further planning can be carried out on the information contained within this section. The SMC must always be aware that not everyone will adhere	

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			to these profiles. As can be seen in the distances travelled, 80% are within a relatively small area while the last 20% of persons in each category tend to travel much greater distances. The studies show what the majority will do, there will always be someone outside the box who will do the opposite of what is expected.		
	Appendix E-5	Incorporates new data	Refer to Attachment 2 for updated LPB profiles		NATSARMC

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Endorsed amendments specific to Aircraft Night Search Guidance

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	Acronyms and Abbreviations	New addition		EO/IR - Electro-Optic/Infrared	Scott Constable, AMSA
	Acronyms and Abbreviations	New addition		IR – Infrared	Scott Constable, AMSA
	Acronyms and Abbreviations	New addition		NVIS - Night Vision Imaging System	Scott Constable, AMSA
	Glossary	New addition		**Term** - Electro-Optic/Infrared (EO/IR) **Definition** - Electronic imaging systems which include both visible and infrared sensors that can be used day and night and in low light conditions with the ability to view objects at long distance.	Scott Constable, AMSA
	Glossary	New addition		**Term -** Night Vision Imaging System **Definition** - A self-contained binocular night vision enhancement device, usually including goggles, that: 1. is helmet mounted or otherwise worn by a person; and 2. can detect and amplify light in both the visual and near infrared bands of the electromagnetic spectrum. NVIS is a term used to incorporate all of the aspects associated with night vision, including Night Vision Devices and Night Vision Goggles.	Scott Constable, AMSA
	Volume 2, 1.4.6 Page 83 Heading	Revised terminology	[HEADING] Night-Vision Devices (NVDs) for aviation searching	[HEADING] Night Vision Imaging Systems (NVIS) for aviation searching	Scott Constable, AMSA
	Volume 2, 1.4.6 Page 83	New paragraph explaining NVIS terminology and reference to new Appendix on Aircraft Electronic Night Search Guidance.	Nil	[*Insert before existing 1.4.6*] NVIS incorporates all aspects associated with night vision including Night Vision Goggles (NVGs) and Night Vision Devices (NVDs).	Scott Constable, AMSA

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Endorsed amendments specific to Aircraft Night Search Guidance

Date received	Current manual reference	Reason for amendment	Previous Wording	New Wording *For images or tables that cannot fit within this document are to be attached to email to Secretariat.	Name/agency
	Volume 2, 1.4.10 Page 83	Revised terminology	With the use of Night Vision Goggles (NVG) objects emitting small amounts of light such as mobile telephone screens are able to be seen from great distances. There is no need for a telephone signal, it is the lit screen that is being detected. Larger light sources such as fires, torches, and strobe lights can be viewed from considerably farther. E-Flares and some LED strobe lights have been identified as being invisible on NVG due to the frequencies used. Searchers must be aware of this.	With the use of NVIS, objects emitting small amounts of light such as mobile telephone screens are able to be seen from great distances. There is no need for a telephone signal, it is the lit screen that is being detected. Larger light sources such as fires, torches, and strobe lights can be viewed from considerably farther. E-Flares and some LED strobe lights have been identified as being invisible on NVIS due to the frequencies used. Searchers must be aware of this. Appendix F Aircraft Electronic Night Search Guidance contains more details on using NVIS for searching by aircraft.	Scott Constable, AMSA
	Volume 2, 3.4.16 Page 135	• Editorial amendments. • Removal of the assumption that a night search will follow a beacon search. • Removal of the assumption all maritime incidents have distress flares. • Expanding the possibility of other illumination aids that survivors may have, over land or maritime. • Removal of the “ditching” reference which appears to be a random reference out of context. • Amending the rigid track spacing reference to allow for other night search patterns appropriate to the conditions as guided by the search asset crew’s expertise and capability.	After a beacon search, and given that it is known that the survivors from a maritime incident have distress flares, the next most effective detection aids are luminous types used at night. The SMC therefore plans to use a search assets on a night track line search during the first darkness period following the ditching. This pattern is also expanded laterally, but at a track spacing of 20 miles.	Given that survivors may have illumination aids that assist detection at night by visual or Night Vision Imaging Systems, such as distress flares, lights and fire, a night search can be very effective. The SMC therefore plans to conduct a night search during the first darkness period. The search pattern used should be guided by the search asset crew’s expertise in best use of their capability appropriate to the conditions.	Scott Constable, AMSA
	Volume 2, 3.13.62, Page 176	Editorials to remove some duplication and better describe helicopter capability and availability generically, including night search capability. Specifics are provided in the following paragraphs.	Rotary Wing Aircraft: Rotary wing aircraft, due to their ability to hover and fly slowly are a very valuable land SAR asset. Helicopters are also the most common form of rescue platform. Most helicopters used in land SAR are equipped with a winch, Nite-Sun for illumination and FLIR. They also have telephones, a variety of radio communications, GPS and can normally land near the search area. Each state has SOP’s regarding the use of helicopters in searches.	Rotary Wing Aircraft: due to their ability to hover and fly slowly helicopters are a very valuable land SAR assets and are also a common form of rescue platform. Specialised SAR helicopters are usually equipped with a winch and night search capability. They normally also have mobile telephones and a variety of radio communications, GPS and can often land near the search area. Each state has SOP’s regarding the use of helicopters in searches.	Scott Constable, AMSA

NATSAR Manual Amendment Schedule – Agreed at NATSAR 46

Endorsed amendments specific to Aircraft Night Search Guidance

Date received	Current manual reference	Reason for amendment	Previous Wording	New Wording *For images or tables that cannot fit within this document are to be attached to email to Secretariat.	Name/agency
	Volume 2, 3.13.63, Page 176, 177	Expanded night search references.	Helicopters, advantages: Some of the advantages of using a helicopter are: … i) Night search can be aided by the Nite Sun.	Helicopters, advantages: Some of the advantages of using a helicopter are: … i) If equipped, night search can be aided by a Nite Sun (searchlight), NVIS and EO/IR.	Scott Constable, AMSA
	Volume 2, 4.5.55, Page 238	Expanded night search capability reference.	At night, an aircraft fitted with FLIR would be an advantage.	At night, an aircraft fitted with NVIS and/or EO/IR would be an advantage.	Scott Constable, AMSA
	Volume 2, 4.7.45 Page 248	Expanded description of what IR devices can detect.	Therefore, IR devices may detect survivors by their body heat.	Therefore, IR devices may detect survivors by their body heat, or other search target heat sources.	Scott Constable, AMSA
	Volume 2, 4.7.46, Page 249	Remove specific advice on search considerations and make more generic as this advice has changed in line with the guidance in the proposed new Appendix. Emphasise planning to be guided by aircrew's expertise and conducted safely. Add reference to the new Appendix *[number to be decided]* on Aircraft Electronic Night Search Guidance.	IR devices are normally preferred for night use. Search height should normally be 200 to 500 ft. for small targets such as persons in the water, and up to a maximum of approximately 1,500 ft. for larger targets or those having a larger heat signature. The track spacing can be based on consultation with the operating crew and taking into consideration the effective detection range as provided by the manufacturer.	IR devices are normally preferred for night use. Search heights, patterns and track spacings should be guided by search target size, search conditions and consultation with the search asset crew taking into consideration the capability of their equipment. Given the range of variables for IR searches, search planners and coordinators should be guided by the aircrew's expertise and plan the search accordingly with safety of the operation the priority. Appendix F contains more details on using IR for searching by aircraft.	Scott Constable, AMSA
	Volume 2, 4.7.47 Page 249	Updated heading and terminology.	Night Vision Goggles Use of night vision goggles (NVGs) can be effective in search carried out by various types of search assets.	Night Vision Imaging Systems Use of night vision imaging systems (NVIS) can be effective in search carried out by various types of search assets.	Scott Constable, AMSA
	Volume 2, 4.7.48 Page 249	Updates in line with new guidance in proposed Appendix.	The following factors may influence the effectiveness of NVGs for searching: a) NVG quality; … g) Surface conditions (like snow), and sea state;	There are a range of factors which may influence the effectiveness of NVIS for searching, such as: a) NVIS type and quality; … g) Surface conditions (like snow), sea state, type of terrain and vegetation;	Scott Constable, AMSA
	Volume 2, 4.7.49 Page 249	Updates in line with new guidance in proposed Appendix.	Glare should be minimised as much as possible within the facility where the NVG users are stationed.	Glare and non-essential lighting should be minimised as much as possible within the facility where the NVIS users are stationed.	Scott Constable, AMSA

NATSAR Manual Amendment Schedule – Agreed at NATSAR 46

Endorsed amendments specific to Aircraft Night Search Guidance

Date received	Current manual reference	Reason for amendment	Previous Wording	New Wording *For images or tables that cannot fit within this document are to be attached to email to Secretariat.	Name/agency
	Volume 2, 4.7.50 Page 249	Updates in line with new guidance in proposed Appendix. Expansion of guidance on LED lights.	Visible moonlight can significantly improve detection of unlighted search objects when using NVGs. Search object light sources, like strobe or similar lights, mobile telephone screens or even cigarettes, can greatly improve detection even in poor visibility conditions. Recent studies have found that certain LED lights, because of the frequencies they emit on, are invisible to NVG.	Visible moonlight can significantly improve detection of unlit search objects when using NVIS. Search object light sources, like strobe or similar lights, mobile telephone screens or even cigarettes, can greatly improve detection even in poor visibility conditions. Some Light Emitting Diode (LED) lighting systems, clearly visible to the naked eye, fall outside the combined visible and near-infrared spectrum of NVIS and therefore will not be visible to aircrew using NVIS. This may present a hazard where LED lighting is used for surface obstacles. Emergency or other equipment fitted with LED lighting used by survivors may also impact detectability using NVIS.	Scott Constable, AMSA
	Volume 2, 4.7.51 Page 249	Updates in line with new guidance in proposed Appendix, including not only sweep width considerations in planning, priority for safety, use of surface units and addition of reference to the proposed new Appendix.	RCC staff should be aware that sweep width needs to be discussed with the crew conducting the mission and modified according to the conditions encountered in the search area.	Given the range of variables for NVIS searches, search planners and coordinators should be guided by the aircrew's expertise and plan the search accordingly with safety of the operation the priority. NVIS searches by air can be enhanced by the support of surface ground units (land or marine). Appendix F Aircraft Electronic Night Search Guidance contains more details on using NVIS for searching by aircraft.	Scott Constable, AMSA
	Appendices	New Appendix		Per Attachment 3, Proposed NATSAR Manual Amendments, titled "**Aircraft Electronic Night Search Guidance – General Information**".	Scott Constable, AMSA

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Attachment 1:

Wet Bulb Globe Temperature (WBGT) from Temperature and Relative Humidity																
Temperature in Degrees Celsius																
		20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50
Relative Humidity (%)	0	14.8	16.1	18	18.6	19.8	21.2	22.3	23.5	24.7	25.8	27	28.1	29.3	30	31.4	32.5
	5	15.3	16.7	18.7	19.4	20.7	22	23.3	24.6	25.9	27.2	28.4	29.6	30.9	32.3	33.4	34.6
	10	16	17.4	19.4	20.2	21.6	23	24.3	25.7	27.1	28.4	29.7	31.1	32.4	33.8	35.1	36.4
	15	16.5	18	20.1	20.9	22.4	23.8	25.2	26.7	28.1	29.6	31	32.4	33.8	35.2	36.7	38.1
	20	17.1	18.7	20.8	21.6	23.1	24.6	26.2	27.7	29.2	30.6	32.1	33.6	35.1	36.6	38.2	39.7
	25	17.6	19.3	21.4	22.3	24	25.5	27	28.6	30.1	31.7	33.2	34.8	36.3	37.9	39.5	
	30	18.2	19.8	22	23	24.6	26.2	27.8	29.4	31	32.7	34.2	35.9	37.4	39.1		
	35	18.7	20.3	22.6	23.6	25.3	26.9	28.6	30.2	31.9	33.5	35.2	36.8	38.5			
	40	19.3	20.9	23.2	24.3	26	27.6	29.4	31	32.7	34.4	36.1	37.8	39.5			
	45	19.7	21.5	23.8	24.9	26.6	28.3	30.1	31.8	33.5	35.2	37	38.7				
	50	20.2	22	24.3	25.5	27.3	29	30.8	32.5	34.3	36.1	37.9	39.6				
	55	20.7	22.4	24.8	26	27.8	29.6	31.4	33.3	35	36.8	38.6					
	60	21.1	22.9	25.4	26.6	28.4	30.2	32.1	34	35.7	37.5	39.4					
	65	21.6	23.2	25.9	27.1	29	30.9	32.5	34.4	36.3	38.2						
	70	22.1	23.9	26.4	27.6	29.4	31.4	33.3	35.1	37	38.9						
	75	22.5	24.4	26.9	28.2	30.1	32	33.8	35.8	37.7	39.5						
	80	22.9	24.8	27.4	28.7	30.6	32.5	34.4	36.3	38.2							
	85	23.3	25.2	27.8	29.2	31.1	33	35	36.9	38.9							
	90	23.7	25.7	28.3	29.6	31.6	33.5	35.5	37.5	39.5							
	95	24.2	26.1	28.7	30.1	32	34	36	38	40							
	100	24.5	26.5	29.1	30.5	32.5	34.5	36.5	38.5								

Note: This chart is calculated using temperature and humidity, assuming a very clear sky (Maximum solar load), and atmospheric pressure of 1 ATA (760 mmHg) This chart was developed by Professor Yoram Epstein. It was to be used with Areil's Checklist for hikers in Israel but has relevance to Australian Arid environments.

CAUTION	EXTREME CAUTION	DANGER	EXTREME DANGER
Fatigue possible	Muscle cramps, Heat exhaustion, Heat stroke possible	Heat exhaustion, Heat stroke likely	Heat stroke, collapse, death possible

Figure 7-9 Search condition hazards based on Temperature and Humidity.

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Attachment 2:

Lost Person Behaviour Children 1-3

Characteristics: 1–3-year-old

a. Have no concept of being lost.
b. Navigational skills are non-existent
c. Will wander aimlessly
d. Will not often respond to commands or whistles.
e. Will tend to find shelter, which increases their survivability.

Tendencies:

a. Will often seek out a place of shelter. Thick bushes, tables, old vehicles or appliances, caves.
b. Difficult to detect.
c. Will rarely self-help or walk out.

Strategies:

a. Urgent response
b. Confinement is a low priority.
c. Passive techniques are not often successful.
d. Dogs may be helpful if used quickly.
e. Checks of places of highest probability to be made initially.
f. Teams to run main tracks and trails.
g. May require getting down onto hands and knees to identify other less obvious tracks.

Where located statistically:

a. Habitation 25%
b. Building/shelter 25%
c. Open ground 25%
d. Fence line, hedge, wall 12%
e. Water, water's edge 12%

% of category	25	50	75	80	95%
Distance from LKP (KM)	0.27	0.6	1.79	2.10	4.45

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Lost Person Behaviour Children 4-6 years

Characteristics: 4–6-year-old

a. Have an idea of being lost and will endeavour to return to home or to a familiar place.
b. Will panic, which may cause them to become further lost.
c. Explorations are usually one way, as a result of not comprehending to need to make a return journey.
d. Will tend to remain on tracks or what they perceive as tracks. Not always visible to taller adults.
e. Are considerably more mobile than smaller children.
f. May have been following an adult or animal prior to getting lost.
g. Most Australian children of this age have at least minimal swimming ability.

Tendencies:

a. Will often seek out a place of shelter. Thick bushes, tables, old vehicles or appliances, caves.
b. Difficult to detect.
c. Will rarely self-help or walk out.

Strategies:

a. Urgent response
b. Confinement is a low priority.
c. Passive techniques are not often successful (Consider nicknames).
d. Dogs may be helpful if used quickly.
e. Checks of places of highest probability to be made initially.
f. Teams to run main tracks and trails.
g. May require getting down onto hands and knees to identify other less obvious tracks.

Where located statistically:

a. Habitation 28%
b. Building/shelter 27%
c. Road, linear 19%
d. Bush, scrub 11%
e. Open ground 8%
f. Water, water's edge 7%

% of category	25	50	75	80	95
Distance from LKP (KM)	0.33	0.95	2.12	2.57	5.47

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Lost Person Behaviour Children 7-12 years

Characteristics:

a. Have developing navigational skills.
b. Are developing mental pictures of their environments, which are often inaccurate and highly distorted.
c. Often become lost while attempting a short cut.
d. Often become lost while 'role playing' or adventuring.
e. Often become upset upon being lost and will act irrationally.
f. May attempt to track run which can take them further from their LKP.
g. Will act more rationally if with a friend or sibling.
h. Will often attempt to self-help, not always successfully.

Tendencies:

a. Will mostly stay on tracks or trails.
b. May seek out favourite places, hideouts etc, check with friends
c. May seek out known landmarks, lookouts, high points, places they have been to in the past, lakes, ponds, areas where vegetation changes such as forest edges.

Strategies:

a. Urgent response
b. Confinement is a high priority
c. FAST and Reconnaissance teams to highest probability areas.
d. Use dogs if available
e. Passive techniques are not often successful.

Where located statistically:

a. Habitation 28%
b. Building/shelter 27%
c. Road, Linear 19%
d. Forest/woods 11%
e. Open ground 8%
f. Water, water's edge 7%

% of category	25	50	75	80	95
Distance from LKP (KM)	0.65	1.98	4.57	5.15	10.2

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Lost Person Behaviour Youth 13-15

Characteristics:

a. Moderately developed navigational skills
b. Often want to be alone.
c. Often become lost as part of a group engaged in exploring.
d. Don't often travel far.
e. Often respond to attractant techniques.
f. Often seek familiar locations by direction sampling.
g. Will act more responsibly as part of a group.
h. Will often attempt to self-help.
i. May panic if alone
j. Will not often enter water

Tendencies:

a. Will mostly stay on tracks or trails.
b. May seek out favourite places, hideouts etc, check with friends
c. May seek out known landmarks, lookouts, high points, places they have been to in the past, lakes, ponds, areas where vegetation changes such as forest edges

Strategies:

a. Urgent response
b. Confinement is a low priority unless MP is alone
c. FAST and Reconnaissance teams to highest probability areas.
d. Use dogs if available
e. Passive techniques are not often successful.

Where located statistically:

a. Habitation 24%
b. Stream/waterway 22%
c. Building/shelter 21%
d. Forest/ woods 11%
e. Road, Track 11%
f. Forest edge or clearing 11%

% of category	25	50	75	80	95
Distance from LKP (KM)	1.25	2.2	4.0	4.37	14.43

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Lost Person Behaviour Despondent

Characteristics:

a. Don't often travel far, but intent to be alone
b. Often located a border of two types of terrain and/or vegetation boundary
c. May head for a scenic location or well-known beauty spot.
d. Locations are often well known to MP, check with family
e. Rarely located in dense underbrush or trees.
f. Rarely respond to call and whistles and may hide.
g. Very high fatality rate
h. Drugs and/or alcohol often involved.

Tendencies:

a. Go to high points or scenic locations.
b. Well known or favourite places.
c. Terrain interfaces
d. Group 1- merely seeking to get out of sight.
e. Group 2-will seek out a specific location, significant to their life.
f. May travel further.

Strategies:

a. Investigation important
b. Obtain a good subject profile from family and friends.
c. Urgent response
d. Thorough search of a small area
e. Confinement is a low priority
f. Passive techniques not successful

Where located statistically:

a. Habitation 26%
b. Water/water's edge 24%
c. Forest/woods 16%
d. No trace 13%
e. Road 11%
f. Forest edge/clearing 9%

% of category	25	50	75	80	95
Distance from LKP (KM)	0.41	1.18	2.15	2.46	18.14

An increasing percentage of all persons who go missing do so with the intent of committing suicide. The reasons for this are beyond the scope of this document but are wide and varied. The SMC should consider whether the MP is genuinely at risk of taking their own lives and what strategy should be used. Studies have shown that there is a strong link between depression and suicide, although not all depressed

persons consider suicide as an option. The three strongest indicators that a depressed person may contemplate suicide are:

a) They have left a suicide note indicating their intentions of taking their own lives.

b) They have recently talked about taking their own lives.

c) They have acted uncharacteristically, such as tidying up their affairs, leaving their wallet, telephone and other documents behind.

The SMC needs to obtain a detailed profile of the target person. There is often something in their background that is either the cause or trigger for them to contemplate suicide. Problems to look for are:

- Relationships
- Finances
- Sexual
- Employment
- Education
- Medical
- Mental health
- Addictions

If someone who is suffering depression has indicated an intention to take their own life, and has one or more of the above triggers present, there is a high probability that the person poses a high risk of taking their own life. The risk is normally low pre-teens and increases during puberty and adolescence, reaching a peak in the mid-twenties and remaining relatively constant until old age.

Religious conviction may be an indicator of suicide intent. Strongly Christian believers are less likely to commit suicide. Those with no religious believes have a high tendency towards suicide. In some religions, such as Judaism, Islamic, Hindu, Shinto, suicide is a valid way to depart earth.

If there is a suicide note, the contents may provide important information regarding where and how the person intends to suicide. It may provide specific information about a favourite or known location. It may also indicate that they will not be found which may point out that they will be in a secluded or difficult to reach location. The presence of a note does not automatically mean that the target has committed suicide as some people sue these notes for shock tactics to get attention or they change their minds and not follow through.

Gender is very important in determining whether suicide is a possibility. Men are three times more likely to take their own lives than women (ABS 2021). Men, 18-45, are the greatest at risk. Within the men group Aboriginal and Islander males are at a higher risk than average. Hanging is the most popular method (51%), with poisoning by drugs (15%) and poisoning by other methods such as car exhaust (16%) following. Jumping from high buildings, drowning, firearms, etc. account for the remainder. Married men are less likely to commit suicide.

Once a person has reached the decision to commit suicide, they generally want to carry it out as soon as possible for the least amount of effort. Access to the means to do so should be investigated by the SMC as this may determine how and where it may take place.

There are many recorded instances where an adult has gone missing with their children. The killing of the children prior to suicide is not uncommon.

With the increased mobility of today's young people, it is often difficult to obtain sufficient details of a missing person because they have not established a close circle of friends. Computer sites such as 'You tube', Facebook' and 'Myspace' may provide details about a missing person and any intentions that they may have.

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Lost Person Behaviour Psychological Illness

Characteristics:

a. May be evasive and run or hide
b. Often not respond to their name
c. Rarely travel purposely to a target
d. Medication or lack of it may be a problem.
e. May be frightened of authority and of being found
f. Can be aggressive
g. Not actually lost in the normal sense.
h. Difficult to predict behaviour

Tendencies:

a. Do not often penetrate forest or thick undergrowth
b. Will seek shelter and seclusion
c. May walk out when ready

Strategies:

a. Check all buildings and places of shelter/seclusion
b. Check drains, streams and tracks.
c. Obtain profile by talking to family, friends and medical experts.
d. Dogs may be of use.
e. Containment a priority
f. Re-search areas and tracks
g. On-going search of buildings as target may return to areas already searched.

Where located statistically:

a. Road, Linear 29%
b. Habitation 19%
c. Building/shelter 14%
d. Stream 14%
e. No trace 9%
f. Open ground 9%

% of category	25	50	75	80	95
Distance from LKP (KM)	0.55	1.23	4.05	4.7	11.73

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Lost Person Behaviour Developmental Problems

Characteristics:

a. lack the concept of being lost
b. Cross between young children and Alzheimer's.
c. Generally good survivability
d. Do not often respond to names or other signals.
e. May also have a physical impairment.
f. Rarely travel to a specific target but will seek shelter
g. Will often penetrate thick forest and undergrowth
h. Will often run away and avoid searchers.

Tendencies:

a. Not route orientated.

Strategies:

a. High urgency
b. Obtain profile from family
c. Dogs may assist
d. Detailed ground search
e. Check streams and drains
f. Re searching areas is important.
g. Check buildings etc ongoing.

Where located statistically:

a. Building/shelter 40%
b. Road, Linear 30%
c. Forest 20%
d. No trace 6%
e. Open ground 4%

% of category	25	50	75	80	95
Distance from LKP (KM)	0.63	1.85	4.46	5.02	23.9

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Lost Person Behaviour Alzheimer's/Dementia

Characteristics:

a. Poor short-term memory but may remember things that happened many years ago, such as address while a child.
b. Impaired ability to rationalise surroundings.
c. Often last seen in their home or a nursing home.
d. May have a previous history of wandering
e. Other physical problems may exist (Limited mobility, poor sight or hearing)
f. May be seeking a secluded location
g. Will not attract attention or respond to calls.
h. Possible not concept of being lost
i. Will not often leave any clues apart from paradoxical undressing.
j. Often succumbs to the environment (Hypothermia etc)
k. 25% fatality rate if not located within first 24hrs
l. Two types, walkers and non-walkers

Tendencies:

a. Often located a short distance from a road or path.
b. Will often attempt to travel to a place previously known to them.
c. Will be stopped by fences, hedges etc.
d. Will tend to walk on the path of least resistance, downhill, and not often uphill. (Be aware: more physically capable, MP's may walk uphill or in a direct line regardless of terrain).
e. Can be found in drains or streams due to the low levels.
f. May remove items of clothing

Strategies:

a. High urgency
b. Early containment is essential
c. Use dogs or trackers
d. Check all drains and low-lying areas.
e. Check all fences, hedges and private yards in vicinity
f. Thorough search of the house, nursing home, and repeat every few hours.
g. Search heavy bush
h. Search previous home locations.

Where located statistically:

a. Habitation/ structure 35%
b. Road 35%
c. Water 10%
d. Open ground 6%
e. No trace 5%
f. Forest 4%
g. Clearing 3%

% of category	25	50	75	80	95
Elderly/non-walker Distance from LKP (KM)	0.19	0.75	1.42	1.5	3.9
Younger/walker Distance from LKP (KM)	0.49	1.28	2.76	3.2	14.00

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Lost Person Behaviour Hikers/Walkers

Characteristics:

a. Often track orientated but become disoriented if they miss their track junctions or it is overgrown and not easily found.
b. Tend to travel further than other categories.
c. At times poorly prepared or experienced for type of walk.
d. Will often attempt to self-help by track running or seeking a high spot.
e. May follow paths of least resistance, such as streams and forest boundaries.
f. May panic and be irrational
g. May look for shelter in poor weather, at nightfall or if injured.
h. May seek higher ground to attempt a reorientation
i. May seek higher ground to gain mobile telephone reception

Tendencies:

a. Stay on tracks
b. Seek shelter
c. Seek high ground

Strategies:

a. Containment
b. FAST and Reconnaissance teams to high probability areas.
c. Track searches.
d. Obtain profile and route details
e. Being clue aware.
f. Be aware of the potentially large distances the MP could have walked.

Where statistically located:

a.	Road, Linear	48%
b.	Stream	27%
c.	Building/shelter	10%
d.	Fence	4%
e.	Forest edge	3%
f.	Forest	3%
g.	Open ground	1%
h.	Water	1%

% of category	25	50	75	80	95
Distance from LKP (KM)	1.15	2.56	4.95	5.76	15.15

Note: This LPB category is the only one that is NOT a circle around LKP. This distance is either side of their intended track.

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Lost Person Behaviour Hunters

Characteristics:

a. Often game focused, which tends to contribute to their being lost.
b. Will not often acknowledge that they are lost.
c. Following targets often leads them to deadfall areas, boulder fields, underbrush or dense forest.
d. Will go to great lengths to self-help.
e. Will sometimes avoid searchers for fear of embarrassment.
f. Often rely on GPS, radios and mobile phones.
g. Usually mobile and responsive.
h. Tend to travel at night and will follow linear features.
i. Will take easy routes, ridge lines, cross country.
j. Will make shelter and fire where possible.

Tendencies:

a. Will attempt to self help
b. Seek shelter
c. Seek high ground

Strategies:

a. Containment
b. FAST and Reconnaissance teams to high probability areas.
c. Use of attraction techniques.
d. Check historical finds
e. Air searches.
f. Be aware of the potentially large distances the MP could have walked.

Where statistically located:

a.	Road	52%
b.	Forest	10%
c.	Building/shelter	9%
d.	Stream	9%
e.	Water	8%
f.	Ridges	6%
g.	Open ground	3%
h.	Rocks	3%

% of category	25%	50%	75%	95%
Distance from LKP (KM)	0.96	2.09	4.82	17.2

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Lost Person Behaviour Climbers

Characteristics:

a. Will often travel considerable distances to reach climb site.
b. Generally well equipped but beginners may attempt difficult climbs without adequate equipment.
c. Often overdue because of over estimation of climbing ability (39%).
d. May be caught out in bad weather (24%)
e. Being lost is not common (17%).
f. Being stuck because of weather is common.
g. Trauma is often experienced (Rocks falling on them or others).
h. Will often be lost going to and from the climb site.
i. Some climbers are stranded by nightfall (12%) and cannot go up or down.

Tendencies:

a. Will attempt to self help
b. Seek shelter
c. Seek high ground

Strategies:

a. Containment
b. FAST and Reconnaissance teams to high probability areas and tracks.
c. Use of attraction techniques.
d. Snow/Avalanche search if necessary
e. Thorough search of 25% zone
f. Climbing location is the immediate area
g. Check other climbs and routes in area.

Where statistically located:

a. Scrub 40%
b. Water 27%
c. Rocks 27%
d. Road 20%
e. Ridges 18%
f. Open ground 9%
g. Stream 9%
h. Forest 9%

% of category	25%	50%	75%	100%
Distance from LKP (KM) Day climber	0.0	0.3	0.8	1.8
Mountaineer	0.1	1.0	3.0	10.5

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Lost Person Behaviour Prospectors

Characteristics:

a. Often do not tell family and/or friends of exact location
b. Often prospect alone, even if with a group
c. Often become distracted by detection equipment, ore formations on ground
d. Often well prepared for prospecting
e. Not often well prepared for extended survival, limited water/food carried
f. Not often equipped with GPS, compass, map
g. Often rely on memory or maps kept on their person.
h. Not always fit

Tendencies:

a. Are not track orientated
b. Tend to take limited notice of surroundings outside of immediate area of interest
c. Tend to prospect out and back from a central location
d. May travel larger distances following a possible ore seam, ground formation
e. May lose track of time
f. May attempt to self help
g. May seek shade, water where possible

Strategies:

a. Identification of central location, camp or LKP
b. Obtain information on where ore has been located previously in area
c. Check all abandoned/old/current mine shafts
d. Thorough search of a small area around identified central location
e. Confinement is a low priority
f. Passive techniques should be attempted
g. Aerial searching may provide clues and aid in self help

Where located statistically:

a. Open country (Tracks, desert, lightly wooded) 32%
b. Closed country (Thick woodland) 32%
c. Creeks, dry water courses 18%
d. No trace 12%
e. Mine shafts (Abandoned/used) 6%

% of category	25	50	75	95
Distance from LKP (KM)	0.75	1.7	3.5	6.5

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Lost Person Behaviour ADD, ADHD, Asperger's, Autism

Characteristics:

a. Tend to travel alone
b. Not track or trail orientated
c. Have an affinity for water
d. Have difficulty concentrating
e. Have limited social skills
f. Often don't recognise/understand they are lost
g. Limited survival skills but survivability is increased due to rapid response
h. Rarely respond to call and whistles and may hide.

Tendencies:

a. Appear to wander aimlessly but may have a destination or plan in mind.
b. Will often head to water (Pools, creeks, canals, drains, golf course water hazards)
c. Will possibly be avoiding searchers
d. Limited fear of the unknown
e. Often unresponsive to passive search techniques
f. May be attracted to vessels, vehicles, trains or aircraft

Strategies:

a. Investigation of characteristics of MP is important (May think they are playing)
b. Urgent response required
c. Check all water hazards
d. Establish barriers and/or confinement
e. In an urban environment a minute systematic search is required
f. Utilise media
g. Passive techniques not successful

Where located statistically:

a. Habitation (Buildings and yards)	40%
b. Water/water's edge	30%
c. Forest/woods/paddocks/grassed areas	20%
d. Road	10%

% of category	25	50	75	95
Distance from LKP (KM)	0.25	0.6	1.2	6.0

NATSAR Manual Amendment Schedule – Agreed at NATSAR 46

Attachment 3: New Appendices for Aircraft Electronic Night Search Guidance

Appendix F - Aircraft Electronic Night Search Guidance

Term	Definition
EO/IR, or Electro-Optic/Infrared systems	Electronic imaging systems which include both visible and infrared sensors that can be used day and night and in low light conditions with the ability to view objects at long distance.
NVD, or night vision device	Night vision enhancement equipment fitted to, or mounted in or on, an aircraft, vessel or vehicle, or worn by a person, that can: 1. detect and amplify light in both the visual and near infrared bands of the electromagnetic spectrum; or 2. provide an artificial image representing topographical displays.
NVIS, or night vision imaging system	A self-contained binocular night vision enhancement device, usually including goggles, that: 1. is helmet mounted or otherwise worn by a person; and 2. can detect and amplify light in both the visual and near infrared bands of the electromagnetic spectrum. NVIS is a term used to incorporate all aspects associated with night vision, including NVD.

General Considerations

1. This information provides general guidance for search planners when considering night searches by aircraft using Electro-Optic/Infrared (EO/IR) equipment and/or Night Vision Imaging Systems (NVIS).

   Note 1 - day searches using visual observation plus EO may be beneficial, but this guidance focuses on night search only.

   Note 2 – NVIS is used in this guidance as a collective term incorporating all aspects associated with night vision such as Night Vision Devices (NVDs) and Night Vision Goggles (NVGs).

2. It is preferable, safer, and normally more effective to search in daylight. Of course, the timing of distress situations is not always optimal for a daylight search. Where suitably capable night search aircraft with aircrew trained and competent in safe night search operations are available, SMCs may consider a night search is necessary where the urgency of the situation may be critical to saving lives.

3. Factors generally common to selection of aircraft and the ability for pilots to safely accept any search task apply such as regulatory requirements, risk factors, aircraft performance and capability, equipment fitted, aircrew training and experience, weather, nature of search area (topography, vegetation, distance offshore, availability of forced landing areas, obstacles, and powerlines, etc), fuel endurance available, transit times, available time on scene, fatigue, etc.

4. Search planners and coordinators should have a good understanding of the capability and limitations of EO/IR and NVIS searching to be able to discuss and brief an effective search plan with the aircrew to establish reasonable expectations of possible outcomes and best use of the asset. Given the range of variables for these types of searches, search planners should be guided by the aircrew's expertise and plan the search accordingly with safety of the operation the priority.

Aircraft and equipment factors

5. Aircraft type and the type of EO/IR and NVIS equipment available on board provide different search options. Aircrew training and experience play a central role in night search effectiveness.

6. Ideally the use of a combination of EO/IR and NVIS is the most effective. NVIS can provide a wide viewing area with any sightings being able to be examined in more detail using IR which has a narrower field of view and greater acuity. EO/IR cameras with the ability to zoom in on sightings provides advantages over EO/IR systems without this capability. Aircraft lighting, both internal and external, needs to be compatible with NVIS.

7. It is possible that an object can be visible in the NVIS but not be visible in the EO/IR, or vice versa depending on the object's characteristics. This may present challenges where search aircraft equipped with only one of these two types of electronic night search capability needs to transfer sighting details to another search aircraft with the other means of detection for investigation.

8. Advanced systems integrated with navigation systems, moving map displays and recording capabilities provide additional benefits to assist operators to provide greater search integrity, efficiency, and effectiveness. For search aircraft suitably fitted, the ability for the RCC to send search patterns and search areas via data files (e.g., KML files) to be uploaded to aircraft mission management systems, GNSS units or aircrew portable electronic devices (if equipped) can provide efficiencies by reducing the need for complex conversations, relay of information and human error. Such aircraft if also fitted with a GNSS flight tracking system may also be able to provide the RCC with a debrief of the actual search tracks flown.

9. Visual and IR lasers are visible using NVIS. SAR coordinators should note that some aircraft operators may have visual or IR laser capability which may be used for the purpose of guiding other aircraft and surface SAR units to a distress location. IR lasers can also be used by crew members on the same aircraft operating with different sensors to help each other acquire a sighting, for example, the crew member operating the EO/IR is having difficulty acquiring a sighting detected on NVIS by another crew member. Depending on the laser type there may be hazards associated with their use. SAR units who intend to use lasers should be appropriately authorised and trained in their use. Other assets involved in a search operation, both aircraft and surface units, should be informed when lasers are being used by search assets so they can take their own precautions with respect to laser safety and prevent confusion as to the reason for the laser.

10. Aircraft fitted with an external public address or loudhailer system may assist with providing verbal directions to a person on the surface and may give comfort to a missing person not yet located that they are being looked for.

11. Safety and capability can be enhanced for aircraft fitted with a terrain warning system, weather, or ground mapping radar and, for helicopters, auto-hover.

12. Some Light Emitting Diode (LED) lighting systems, clearly visible to the naked eye, fall outside the combined visible and near-infrared spectrum of NVIS and therefore will not be visible to aircrew

using NVIS. This may present a hazard where LED lighting is used for surface obstacles. Emergency or other equipment fitted with LED lighting used by survivors may also impact detectability using NVIS.

13. Poor visibility due to contaminants in the air such as dust or smoke may compromise EO/IR and NVIS effectiveness. In maritime areas, strong winds can blow salt spray across camera lenses and windows obscuring the electronic image or view through windows, potentially leading to missed detection. Rain in the area can help clear this residue away.
14. In maritime areas, detectability of unlit targets on the sea surface using NVIS will be degraded, particularly in calm conditions because of the low albedo (reflective properties) and contrast.

Survivor factors

15. Search success can be limited where people being searched for are not actively trying to be located or are not capable of actively aiding search crews, for example due to exposure or injury, or if they are hiding.
16. Ideally persons in distress will have a light source which can be easily seen by NVIS equipped crews, such as a torch, light from a mobile phone or signal fire. Reflective material may also assist. It is also possible that laser pointers may be used by persons in distress.
17. A person in the water without a light or reflective surface in broad scale searches where a specific splash point is not known is very difficult to locate at night. A known splash point with a short time frame between the splash point time and arrival of the search aircraft will increase the probability of locating the target.
18. To assist survivor awareness of the presence of the search aircraft and to elicit a survivor response signal, when the aircraft first arrives in the search area, if possible, the aircraft should be made as conspicuous as it can be by flying through the search area or orbiting at lowest safe altitude with as many external lights visible before commencing the search pattern.
19. A person in distress may see or hear the search aircraft and respond by activating a light or flare. Crews should be alert that it is possible the person in distress may not have had the opportunity to activate their light signal by the time their aircraft passes and where possible adjust their search technique accordingly, for example, by flying both directions along the same search leg or, if capable and practicable, directing their detection equipment to search both forward and behind the aircraft.
20. Survivor morale can be lifted when a search aircraft is sighted or heard during the night, even if the search aircraft does not find the survivor.

Search planning factors

21. The timeliness and accuracy of intelligence information for search area determination has a bearing on search effectiveness.
22. Search coordinators should also consider that a NVIS capable aircraft may not necessarily be capable of conducting a NVIS search. This is because:

    a. NVIS may be used by pilots and aircrew solely for the purposes of safe air navigation and terrain avoidance functions in compliance with aviation regulations and may not have any capacity to conduct dedicated NVIS searching, whereas

b. other aircrew not directly involved in air navigation and terrain avoidance functions may use NVIS solely for the purposes of searching and observation.

23. Search planning should also take into account that search crews, when using EO/IR and NVIS equipment, will need periodic breaks to manage operator fatigue and provide an opportunity to view the search area with unaided electronic vision which may pick up lights that both EO/IR and NVIS cannot.

24. It is important to note that aircraft EO/IR equipment can normally only search one side of a search leg at a time, or only a forward or rear splay area at any time. Using NVIS to detect possible search targets, then using the EO/IR to investigate those sightings is generally the most effective search technique especially for small targets.

25. The target type will influence the type of night search to be conducted. Considerations include whether the primary target is to be a person, aircraft, vessel, or other object, its size, and its potential to provide a light source or light signal, and the amount of heat it may produce. The potential condition of the target should also be considered such as whether a survivor is likely to be capable of signalling or moving, a distressed aircraft has been damaged, or a vessel has capsized or is semi-submerged.

26. Night searches may be more effective in areas with reduced numbers of people to avoid false sightings. Wildlife and livestock can be a distraction.

27. Environmental conditions to consider include:

    a. **Weather conditions** - both for search effectiveness and compliance with flight operations regulations, such as NVIS minima, ability to maintain visual meteorological conditions (VMC), risk of inadvertently entering instrument meteorological conditions (IMC), availability of optimal search altitude due to amount of cloud cover, precipitation, visibility, the action of wind over terrain and impacts of turbulence, freezing level, surface and air temperature, humidity, fog or mist, thunderstorms and sea conditions.

    b. **Ambient light** - amount of moonlight and moon phase, position and elevation, effect of twilight and other ambient light sources. Nights with good ambient light enables more effective searching with NVIS.

    c. **Thermal crossover** - the natural phenomenon that normally occurs twice daily when temperature conditions result in a loss of contrast between two adjacent objects on IR imagery which may have an adverse effect on IR detection.

    d. **Bushfire activity** - EO/IR detection capability will be affected by the heat from the fire(s). NVIS detection capability will be affected by the light from the fire(s) which can cause blooming (distortion or blotting out of the image) and smoke can reduce visibility.

    e. **Thunderstorms** – search aircraft should avoid thunderstorms by a safe distance to avoid the hazardous effects of severe turbulence, lightning, icing, etc. Distances from thunderstorms may be difficult to estimate visually when using NVIS and the fitment of airborne weather radar or other electronic detection devices to the aircraft will assist. The NVIS image may be adversely affected by lightning flashes.

    f. **For searches over land** - the topography including type of terrain, type and degree of vegetation, ground cover such as snow, and shadows from overhanging rocks and cliffs can impact search effectiveness. Different terrain can have positive and negative impacts

on night searches. For EO/IR, a hot night may cause image wash out and a lack of obvious contrast between hot and cold and cause other structures and material to maintain heat for a longer period. Rocky terrain can be difficult to search by EO/IR where objects have the ability to retain heat during the day and provide 'false positives' during a night search. Time spent by ground crews checking these sightings can limit overall search effort.

g. **For searches over water** - sea conditions will determine search effectiveness. Rough water, waves, choppy surfaces, and whitecaps can impede identification of people in the water. Whitecaps splashing over the head of a survivor limits detectability.

28. Searching over water presents different challenges to searching over land. Helicopter operations may be limited by the ability of the crew to maintain continuous visual contact using NVIS with land or a shoreline, including any illumination levels and potential hover references. Large areas of open water such as oceans can be difficult to comprehensively search. Operations in close proximity to coastline, islands or other obstacles can limit ability to search at optimum search altitude due to minimum safe altitude requirements.

29. A more finite and smaller search area would benefit from a low altitude and slow speed search however a vast expansive search area such as in an open rural environment might require a higher altitude and faster search speed to cover. Higher probability locations may need smaller and repeated sweep widths or multiple orbits depending on field of view and to vary the slant ranges to potentially reveal previously unseen detail. Lower altitudes and low search speeds are most suitable for searching for a person in the water.

30. For best use of available aircraft search time, the best search progression will generally be in order of firstly covering the Last Known Position, then the intended route, likely routes or locations based on local knowledge and intelligence, before a broad area search. For overwater searches, search planners will need to allow for drift of the target.

31. Search pattern and sweep width choice and suitability will be dependent on the various factors described in this guidance and should be guided by aircrew expertise. Search patterns using parallel legs may be best in some cases while flying orbits/circular patterns may be better. Adjustments may be required when the aircraft arrives in the search area due to the conditions encountered and aircrews should be provided with flexibility to adjust their search parameters where possible.

32. Search altitude variations may be applicable depending on the type of search, search aircraft type, its electronic night search capability and aviation regulatory requirements. The lowest safe search altitude at night over land is terrain and weather dependant but generally 1,500 – 2,000 feet above ground level (AGL) would be reasonable. For helicopters with NVIS capability and regulatory approval, lower altitudes may be possible where conditions allow, and it is safe to do so. Higher search altitudes may be optimal such as the those generally flown by AMSA's Challenger CL604 using a circle search technique which would normally be flown between 5,000 – 10,000 feet AGL and typically not above 15,000 feet AGL. As different aircraft operators, both civil and military, may have different capabilities and regulatory authorisations, SAR coordinators should be guided by the operator/aircrew on a case-by-case basis when planning search altitudes.

33. Searching areas of thick vegetation such as forested areas can be difficult. Searching over forested areas can be more effective at a higher altitude to allow for a higher viewing angle through the tree canopy. Circling an area of thick vegetation to provide a view from different angles may also assist.

34. EO/IR and NVIS can fail to detect a person due to the limitations and variables outlined in this guidance, and depending on where and how they are situated, for example under thick vegetation, covered in mud, etc. Search planning decisions made regarding potentially discounting areas searched by EO/IR and NVIS need to be carefully considered and searching those areas again by different search methods are likely to be needed for better search integrity.

35. Sector searches over a datum improve detectability through the cumulative effect of repeatedly covering the datum area. Circular patterns or orbits may also offer the same effect.

36. Most night search operations are likely to occur outside controlled airspace and where more than one aircraft is to be used for searching in the same area, as for day searches, those aircraft should be planned to allow aircrew to maintain deconflicted operations, both laterally and vertically, not only for safety purposes but also to maximise available search time while minimising the need for pilots to organise self-separation with other aircraft. For helicopter NVD operations, Australian civil aviation rules (*CAO 82.6, Appendix 3, 12 Close proximity flights*) require those flights operating in close proximity to another aircraft to be a minimum of 250 metres horizontally and 500 feet vertically apart and to be arranged and discussed between the pilots in command of those aircraft before the close proximity flight begins. For operations within controlled airspace, Air Traffic Services (ATS) requirements will need to be factored into the planning in consultation with the responsible ATS unit.

Surface unit support

37. The success of night searches can be dependent on surface (land or marine) unit support to investigate sightings by search aircraft. The deployment of surface units in the search area in support of the aircraft night search may also assist the aircrew to establish suitable reference parameters for their sensor equipment for the search conditions.

38. Where aircraft and surface resources are to search concurrently, identification of high probability areas suitable for air search while surface resources search more easily accessible areas can provide more efficient search area coverage.

39. Where surface search personnel are likely to be present there should be a method for the aircraft search crew to easily identify them, for example, radio communications, identifying light signals, and IR strobes where aircraft NVIS are used. Surface units may be assisted by search aircraft to locate distress locations or identify a point of interest, for example by use of helicopter search lights to illuminate a search location or use of search aircraft laser systems

    NOTE – see precautions regarding aircraft laser systems in *Aircraft and equipment factors* section above.

40. Helicopter night winching has limitations, especially overwater, where a suitable visual reference is required or an auto-hover capability. NVIS capability may assist to safely permit a night winching within regulatory requirements, however, using surface unit support to investigate sightings or perform a rescue presents a lower risk option.

Circle Search technique - General guidance

41. A circle search is based on the search aircraft having the capability to search using a combination of EO/IR and NVIS operating at a fixed distance around a datum. As the aircraft flies the circular search pattern, the aircraft's NVIS and EO/IR are used as search sensors. Observers are afforded a broad but less detailed view of the search area utilising NVIS while EO/IR may provide both a

wide field of view for target acquisition and a detailed, narrow field of view for target investigation. Due to the nature of this search technique and aircraft bank angle, observers and search equipment only search from the one side of the aircraft, i.e., towards the inside of the circle.

42. The circle search flight profile depends on three key inputs:
    a. A datum to define the centre of the search area;
    b. A search radius, typically 3NM for faster fixed-wing aircraft, to balance search area coverage against the aircraft's NVIS and EO/IR capability, aircraft handling characteristics and search platform stability. The optimum radius will depend on the aircraft performance limitations; and
    c. An altitude, normally between 5,000-10,000ft AGL and typically not above 15,000ft for aircraft capable of higher altitudes.
43. Search planners need to be guided by the aircrew as to the optimum circle search radius, search altitude and speed.
44. The search area should be relatively confined and made up of terrain considered suitable for a circle search.
45. Before the search is initiated, the aircrew sensor operator breaks the search area into several smaller areas defined by human made or geographic boundaries such as roads, rivers, and property lines. Multiple orbits of the search area allow for each sub-area to be observed from multiple angles until the crew is confident the entire area has been searched as effectively as possible within the limits of the aircraft sensor capability and search conditions. For this reason, circle searches are ordinarily confined to land areas and are not normally appropriate for over water searches due to the lack of maritime surface features available. However, if multiple fixed points of reference are available overwater, like islands, reefs, and mud flats, then a circle search may be an option if the search area is geographically constrained to those areas.
46. For broader areas, several circle searches may be combined adjacent to each other to complete that area in stages, for example a search along a track. This is dependent, of course, on aircraft endurance, crew duty time and on-scene search time available.
47. The number of circle searches required will depend on the time taken to clear each individual search area and this will depend on the nature of the terrain, weather, light levels, and aircrew operator skill.
48. The nature of terrain will determine the ideal search altitude. For example, heavily wooded or mountainous terrain are best searched at higher altitudes to improve the look down capability of the EO/IR, but the ideal search height will always be secondary to the Lowest Safe Altitude.
49. Cloud and/or poor visibility may compromise a circle search; however, the EO/IR capability can be utilised to look through cloud breaks where they occur.
50. When search planners are considering tasking suitably capable aircraft for a sector or expanding square search, the use of a circle search should also be considered.

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