NATSAR Manual Amendment Schedule – NATSAR 41

WP: 7.4

Date received	NATSAR Manual reference	Reason for amendment	Previous Wording	New Wording	Approval Status	Responsible
11/9/2017	Chapter 1	NSW POL Review		1.1.18 NSW Marine rescue monitor VHF16	APPROVED	NSW Police - Darren Wood
				27.88 has been overtaken in popularity by VHF16 by the general public	APPROVED	NSW Police - Darren Wood
	Chapter 2			1.2.3 g) the surface vessel or craft is overdue or unreported (and initial evaluation has failed to resolve the incident) see 1.5.10	APPROVED	NSW Police - Darren Wood
				2.11.14 e) replace boats with the word vessels	APPROVED	
	App B-5			Inclusion of stand-up paddleboards due to increased popularity	APPROVED	NSW Police - Darren Wood
12/9/2017	App B-8 (merger)	VIC POL Review Feedback	Appendix B talks about PPE for aircraft incidents but doesn't include those in the marine environment – is there a template of PPE and response available. We found out aircraft do at times splash into the ocean and the PPE discussed certainly isn't available or useable in the environment, but certain risks are also not present. We did have issues around air craft manufacturing materials and handling of such. Not sure if we need more on this or just leave it.	To be determined	No change is required.	VIC Police - Alistair Nisbet
	App B-10 (merger)		Suggest to change the term 'Splash Point' which currently is our title of LKP. It immediately insinuates that the vessel has splashed/sunk etc. when this may not be the case.	To be determined	This is consistent terminology. No change required.	VIC Police - Alistair Nisbet
	App C-1 (merger)		In regards to the Search Urgency Assessment Forms and other forms – Need to confirm the currency of forms in line with forms used within the National SAR Managers course.	To be determined	No change required.	VIC Police - Alistair Nisbet
	App C-11 (merger)		FSH Layout and all the other SAR boards to state 'examples'.	To be determined	APPROVED	VIC Police - Alistair Nisbet
22/9/2017	App B (Vol 1 merger)	QLD POL Review Feedback	Footnote iv to be moved:	Persons and vehicles on land (iv); and Persons and vessels on inland waterways and in waters within the limits of the ports of the relevant State or Territory.	APPROVED	VIC Police - Alistair Nisbet
17/10/2017	Appendix P	Clarity to the meaning of 'position known'	The term 'position known' means that the position accuracy is nominally within 150 meters. An appropriately trained response team should be able to localise the final beacon position on scene in line with respective procedures.	The term 'position known' means that the position accuracy is nominally within 5km, and for GPS encoded positions is within 150 meters. An appropriately trained response team should be able to localise the final beacon position on scene in line with respective procedures.	APPROVED	AMSA - Alan Lloyd

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1/06/2017	Chapter 2.5	Update manual to incorporate MEOSAR satellite constellation	2.5.2 The Cospas-Sarsat System provides distress alert and location data to RCCs for 406 MHz beacons activated anywhere in the world. In the Australia/New Zealand region, the Australian Mission Control Centre (AUMCC) is located in JRCC Australia and controls the three LUTs located at Albany, Western Australia, Bundaberg, Queensland and Wellington, New Zealand.	2.5.2 The Cospas-Sarsat System provides distress alert and location data to RCCs for 406 MHz beacons activated anywhere in the world. In the Australia/New Zealand region, the Australian Mission Control Centre (AUMCC) is located in the JRCC Australia and processes data collected by satellite tracking stations in Australia and New Zealand.	APPROVED	AMSA - John Ophel
			2.5.4 The worldwide system comprises: a) Low orbiting satellites in near polar orbits; b) Satellites in geostationary orbit; c) Local User Terminals (LUTs), which are ground stations that receive and initially process the raw distress signal data relayed by a satellite; d) Mission Control Centres (MCCs) which are responsible for the final processing and appropriate distribution of beacon detections; and e) Frequency stable 406 MHz beacons, each with a unique identification code and capable of transmitting for 24 or 48 hours depending on their use.	2.5.4 The worldwide system comprises: a) Low-altitude Earth orbiting satellites in near polar orbits known as LEOSAR satellites; b) Satellites in geostationary orbit known as GEOSAR satellites; c) Satellites in medium-altitude Earth orbit known as MEOSAR satellites; c) Local User Terminals (LUTs) are ground stations that receive and initially process the raw distress signal data relayed by a satellite; d) Mission Control Centres (MCCs) which are responsible for the final processing and appropriate distribution of beacon detections; and e) Frequency stable 406 MHz beacons, each with a unique identification code and capable of transmitting for 24 or 48 hours depending on their use.	APPROVED	AMSA - John Ophel
			Satellites 2.5.5 The satellite constellation is made up of search and rescue satellites in low earth orbit (LEOSAR) and geostationary orbit (GEOSAR). 2.5.6 Each LEOSAR satellite makes a complete orbit of the earth around the poles in about 100 – 105 minutes. The satellite views a "swath" of the earth of approximately 4000 km wide as it circles the globe, giving an instantaneous "field of view" about the size of a continent. When viewed from the earth, the satellite crosses the sky in about 15 minutes, depending on the maximum elevation angle of the particular pass. 2.5.7 Satellites are not equally spaced and hence do not pass over a particular place at regular intervals. In view of this, pass schedules are computed for each LUT every day. On average a satellite will pass over continental Australia every 90 minutes but, because of the irregularity of passes, there could be up to five (5) hours between passes. 2.5.8 The current GEOSAR constellation is composed of five satellites provided by the USA, GOES 11 and GOES 12, and satellites provided by India (INSAT-3A) and Europe (MSG 1 and MSG 2.). These satellites provide continuous global coverage for 406 MHz beacons with the exception of the	**Satellites** 2.5.5 The Cospas-Sarsat system uses three search and rescue satellite constellations: LEOSAR, GEOSAR and MEOSAR. 2.5.6 Each LEOSAR satellite makes a complete orbit of the earth around the poles in about 100 – 105 minutes. The satellite views a "swath" of the earth of approximately 4000 km wide as it circles the globe, giving an instantaneous "field of view" about the size of a continent. When viewed from the earth, the satellite crosses the sky in about 15 minutes, depending on the maximum elevation angle of the particular pass. 2.5.7 LEOSAR satellites are not equally spaced and hence do not pass over a particular place at regular intervals. In view of this, pass schedules are computed for each LUT every day. On average a satellite will pass over continental Australia every 90 minutes but, because of the irregularity of passes, there could be up to five (5) hours between passes. 2.5.8 The current GEOSAR constellation is composed of satellites provided by the USA, India, Russia and Europe. These satellites provide continuous global coverage for 406 MHz beacons with the exception of the Polar Regions. 2.5.9 As the GEOSAR satellites appear stationary from Earth, if the direct line of sight from the beacon to the GEOSAR satellite is	APPROVED	AMSA - John Ophel

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			Polar Regions. To take full advantage of the real-time alerting capability the beacon must be designed to transmit, in its distress message, position data derived from a satellite navigation system such as GPS. 2.5.9 GOES-11 covers Australia's area of interest in the Pacific while INSAT-3A provides coverage over the Indian Ocean region as far as the east coast of Australia. Continental Australia is on the edge of coverage for the GOES-11 satellite and detection of 406 MHz beacons on land depends very much on the terrain and how the beacon is positioned.	blocked (for example, by terrain such as a mountain), the beacon will not be detected by the GEOSAR satellite. 2.5.10 The MEOSAR satellites consists of satellites provided by the United States, the Russian Federation and the European Union. The full MEOSAR constellation will have about 72 satellites. These MEOSAR satellites orbit the Earth at altitudes between 19,000 and 24,000 km, a range considered as a medium-altitude Earth orbit. The footprint of a MEOSAR satellite is between 12000 and 13000 km and the satellites provide continuous global coverage of the Earth.		
1/06/2017	Chapter 2.5	Update manual to incorporate MEOSAR satellite constellation	**Beacon Detection** 2.5.10 With the exception of the GEOSAR, the position of a distress beacon is calculated by using Doppler shift, which is caused by the relative movement between a satellite and a beacon. As a satellite approaches a beacon there is an apparent rise in the beacon frequency and as the satellite moves away the frequency appears to fall. When a satellite is at its closest point to a beacon the received frequency is the same as the transmitted frequency (the point of inflection) and provides the "Time of Closest Approach" (TCA). 2.5.11 This method of calculation produces two possible positions for each beacon (labelled A and B), either side of the satellite's ground track; one is the true position and the other is its mirror image. The ambiguity is due to the equipment only being able to determine the distance between a satellite and a beacon and not the direction. Position ambiguity is subsequently resolved by using: a) Data obtained by the same LUT from the next satellite pass which "sees" the beacon; or b) Data from another satellite pass observed by a different LUT.	**Beacon Detection** 2.5.10 A LUT tracking LEOSAR satellites is known as a LEOLUT. A LEOLUT generates the position of a distress beacon using Doppler shift, which is caused by the relative movement between a satellite and a beacon. As a satellite approaches a beacon there is an apparent rise in the beacon frequency and as the satellite moves away the frequency appears to fall. When a satellite is at its closest point to a beacon the received frequency is the same as the transmitted frequency (the point of inflection) and provides the "Time of Closest Approach" (TCA). 2.5.11 This method of calculation produces two possible positions for each beacon (labelled A and B), either side of the satellite's ground track; one is the true position and the other is its mirror image. The ambiguity is due to the equipment only being able to determine the distance between a satellite and a beacon and not the direction. Position ambiguity is subsequently resolved by using other independent location data (for example; an encoded location or data from another LEOSAR satellite pass). 2.5.12 A LUT tracking MEOSAR satellites is known as a MEOLUT. A MEOLUT generates the position of a distress beacon using DOA (Difference Of Arrival) processing. Upon receiving a transmission (a beacon burst) from a 406 MHz distress beacon via a MEOSAR satellite, a MEOLUT will generally measure two key values: the Time of Arrival (TOA) and the Frequency of Arrival (FOA). Assuming reception of a beacon transmission through at least three distinct MEOSAR satellites, MEOLUT processing can provide a two-dimensional (longitude and latitude) beacon location using a combination of time difference of arrival (TDOA) and frequency difference of arrival (FDOA) computations. The location computed by a MEOLUT is known as a difference of arrival (DOA) location. Three-dimensional locations (i.e., with the addition of a computed altitude) are possible when the beacon burst is relayed to a MEOLUT via four or more MEOSAR satellites.	APPROVED	AMSA - John Ophel

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				2.5.13 A GEOLUT is only able to detect a beacon and cannot generate a location for the beacon unless the beacon transmits an encoded location.		
1/06/2017	Chapter 2.5	Update manual to incorporate MEOSAR satellite constellation	**Beacons** 2.5.12 There are three types of Cospas-Sarsat distress beacons: a) Emergency Locator Transmitters (ELT) used by aviators; b) Emergency Position Indicating Radio Beacons (EPIRB) used by mariners; and c) Personal Locator Beacons (PLB) used on land. 2.5.13 Aviators and mariners often carry PLBs as personal back up devices to ELTs and EPIRBs. 2.5.14 Because 406 MHz beacons transmit an extremely stable frequency, positions calculated by the LUT usually fall within a radius of 5km from the actual beacon position. All 406 MHz beacons sold in the Australian region are required to transmit on 121.5 MHz to facilitate homing. 2.5.15 406 MHz beacons use digital technology that allows an identifier to be sent when the beacon is activated. This identifier correlates to a registration database held at the MCC and allows additional information to be gained about the target. 406 MHz beacons should be coded with a country code and registered in the country that maintains the database for that country code. It is therefore important that all Australian 406 MHz beacons are registered with JRCC Australia. 2.5.16 If an Australian beacon is detected overseas, the overseas SAR authority may contact JRCC Australia for appropriate details. Similarly, if a foreign-registered 406 MHz beacon is detected in the Australian SAR area, the Australian RCC contacts the appropriate overseas registration authority to obtain further relevant SAR data. 2.5.17 Satellite processing of 121.5 MHz alerts ceased on 1 February 2009, from 1 February 2010, it became illegal to operate the older analogue distress beacon transmitting on 121.5 MHz or 243MHz.	**Beacons** 3.5.12 There are three types of Cospas-Sarsat distress beacons: a) Emergency Locator Transmitters (ELT) used by aviators; b) Emergency Position Indicating Radio Beacons (EPIRB) used by mariners; and c) Personal Locator Beacons (PLB) used on land. 3.5.13 A distress beacon with GNSS (Global Navigation Satellite System) capability is able to transmit an encoded location as part of its beacon message. There are two mechanisms used to derive the GNSS location: either the distress beacon has an internal GNSS receiver or the distress beacon receives the GNSS data from an external device that connects to the beacon. Due to the popularity of the GPS system, the encoded location is often known as the GPS location of the beacon. 3.5.14 Aviators and mariners often carry PLBs as personal back up devices to ELTs and EPIRBs. 3.5.15 Because 406 MHz beacons transmit an extremely stable frequency, positions calculated by the LUT usually fall within a radius of 5km from the actual beacon position. All 406 MHz beacons sold in the Australian region are required to transmit on 121.5 MHz to facilitate homing. 3.5.16 406 MHz beacons use digital technology that allows an identifier to be sent when the beacon is activated. This identifier correlates to a registration database held at the MCC and allows additional information to be gained about the target. 406 MHz beacons should be coded with a country code and registered in the country that maintains the database for that country code. It is therefore important that all Australian 406 MHz beacons are registered with JRCC Australia. 3.5.17 If an Australian beacon is detected overseas, the overseas SAR authority may contact JRCC Australia for appropriate details. Similarly, if a foreign-registered 406 MHz beacon is detected in the Australian SAR area, the Australian RCC contacts the appropriate overseas registration authority to obtain further relevant SAR data. 3.5.18 Satellites processing of 121.5 MHz alerts ceased on 1 February 2009, from 1 February 2010, old analogue EPIRBs and PLBs operating on the 121.5 MHz frequency are no longer licensed for use.	APPROVED	AMSA - John Ophel

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26/4/2017	Appendix P	Change of POC for transfer of land SAR incidents	NSW Sydney Police COM Centre Duty Operations Inspector (DOI)	NSW Sydney Police COM Centre Rescue Coordinator (RCO)	APPROVED	NSW Police - Patrick Stafford
11/5/2017	Appendix M		Replace all reference of the Dornier to Challenger	Replace all reference of the Dornier to Challenger	APPROVED	AMSA - Mike Wytcherley
11/5/2017	Appendix M *Opportunity Base SAR Services*		The MUL is an ongoing procurement process open to 2014.	The MUL is closing in 2017.	APPROVED	AMSA - Mike Wytcherley
29/3/2017	Appendix M		Update Figure M.1 Base Locations of AMSA Dedicated Tier 1 Aircraft SRUs	Updated Figure M.1 Base Locations of AMSA Dedicated Tier 1 Aircraft SRUs to remove reference to Darwin and Brisbane	APPROVED	AMSA - Mike Wytcherley
29/3/2017	Appendix M		**Customs Aircraft** AMSA and Customs have implemented a “first response” SAR capability for Customs DASH8 aircraft to enable them to drop limited stores when operating from Christmas Island. The stores are limited due to weight considerations and comprise SAR datum marker buoys and rescue platforms.	Delete section	APPROVED	AMSA - Mike Wytcherley
1/2/2017	Appendix M	Contractual changes for AMSA Aviation Capability (Dornier to Challenger)	Tier 1 SRUs AMSA contracts five dedicated Dornier 328 turboprop aircraft for SAR at bases in Darwin, Perth, Cairns, Melbourne and Brisbane. These aircraft are fitted with a range of communications (UHF, VHF, HF and satellite telephones) and sensor systems (search RADAR, FLIR, NVG, DF, AIS, UV/IR line-scan). These Dornier 328s are able to drop a range of life-support equipment on land and sea, by day and night including life rafts, SAR datum marker buoys and de-watering pumps. Communications equipment (radios and satellite phones) can also be dropped which, using the multi-mode communications relay capability of the aircraft, enable communications to be established between the surface and JRCC Australia or another command/control or response facility. The aircraft are available to other government agencies, such as the police, fire and emergency services, on a whole of government basis, for assistance with response to emergency operations.	Tier 1 SRUs AMSA contracts four dedicated Bombardier Challenger 604 jet aircraft for SAR at bases in Perth, Cairns and Melbourne with the fourth aircraft am operational spare. These aircraft have been modified to have a large visual observation window on each side and are fitted with a range of communications (UHF, VHF, HF and satellite telephones) and sensor systems (search RADAR, high definition EO/IR turret, NVDs, DF, AIS, video anomaly detection). The Challenger 604s are able to drop a range of life-support equipment on land and sea, by day and night including life rafts, SAR datum marker buoys and de-watering pumps. Communications equipment (radios and satellite phones) can also be dropped which, using the multi-mode communications relay capability of the aircraft, enable communications to be established between the surface and JRCC Australia or another command/control or response facility. The aircraft are available to other government agencies, such as the police, fire and emergency services, on a whole of government basis, for assistance with response to emergency operations.	APPROVED	AMSA - Mike Wytcherley

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1/2/2017	Appendix M		Updated picture from Dornier Photo: AMSA Dornier 328  	Updated picture to Challenger Photo: AMSA Challenger 604 	APPROVED	AMSA - Mike Wytcherley
29/3/2017	Chapter 5 5.7.8		AMSA Dornier aircraft and several civil SAR aircraft can home and decode 406 signals.	AMSA Challenger CL604 aircraft and several civil SAR aircraft can home and decode 406 signals.	APPROVED	AMSA - Scott Constable
29/3/2017	Chapter 6 6.7.5		AMSA staff are familiar with the type and disposition of Civil and ADF SAR equipment and its usage and can be contacted for advice. Detailed procedures and instructions relating to the operation and delivery of the equipment are incorporated in: a) AeroRescue Operations Manuals, and b) Search and Rescue Standards and Procedures Manual for Tier 2/3 Rotary Wing SAR Units. **Note**: These publications can be obtained from the SAR Resources and Training section of AMSA.	AMSA staff are familiar with the type and disposition of Civil and ADF SAR equipment and its usage and can be contacted for advice.	APPROVED	AMSA - Scott Constable