International Civil Aviation Organization

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Agenda Item 4: Asia/Pacific and Inter-regional SAR Planning, Coordination and Cooperation

ENHANCED 406 MHZ DIRECTION FINDING TRAINING FOR SEARCH AND RESCUE UNITS

(Presented by Australia)

SUMMARY

This paper presents information about the use of 406 MHz test protocol coded beacons by Australia's search and rescue (SAR) authority to enable enhanced direction finding (DF) and homing techniques training to Australian SAR units (SRUs) and the benefits of this enhanced training. The paper also invites States to share information about their own SRU DF training programs.

1. INTRODUCTION

1.1 For SRUs fitted with 406 MHz DF equipment, it is critical that those SRU crews are well trained and competent in the use of the 406 MHz DF equipment to be able to successfully carry out SAR missions in response to 406 MHz distress beacon activations.

1.2 Due to the 406.0 - 406.1 MHz and 121.5/243.0 MHz distress frequencies being reserved for use only during a genuine safety of life or distress situation, challenges exist to enable SRU crews to conduct beacon homing training exercises using those frequencies.

2. DISCUSSION

2.1 The Australia Maritime Safety Authority (AMSA) is responsible for providing Australia's aeronautical and maritime SAR service per the relevant international SAR conventions, and as part of those obligations, is responsible for the provision of SRUs within the Australian SAR Region (SRR).

2.2 For the purposes of SRU training and practice in distress beacon homing techniques, AMSA has for many years relied on the use of training beacons transmitting a 121.4 MHz homing signal to simulate a real 121.5 MHz distress beacon homing signal. These training beacons have been used by AMSA for the training and audit of aircraft SRU crews, marine SRU crews and ground unit personnel and to provide the opportunity for crews to demonstrate and practice their homing skills.

2.3 AMSA recently identified an opportunity to improve the training, knowledge and proficiency of aviation SRU crews equipped with 406 MHz DF equipment by making use of 406 MHz test protocol beacons. These beacons provide an opportunity for those crews to practice their skills in the use of the 406 MHz features of their homing equipment to supplement their 121.5 MHz homing skills. Without the availability of these 406 MHz test beacons, the only opportunity the crews of those aircraft have had to experience interrogation of 406 MHz distress beacon transmissions has been when they were tasked for a real SAR mission in response to a 406 MHz distress beacon activation. Therefore,

the first time that these SRU crewmembers get practical experience with using their DF equipment to interrogate a 406 MHz beacon signal is when they are first tasked on a SAR mission to locate a 406 MHz distress beacon.

2.4 These beacons are programmed in test mode, are manually activated and transmit a test protocol HEX ID on 406.040 MHz, a GNSS-encoded position and a homing signal on 121.4 MHz. All are registered in AMSA's distress beacon register. When activated these beacons will transmit a test protocol message which Cospas-Sarsat Mission Control Centres (MCCs) recognize as a test beacon and will not generate a distress alert to Rescue Coordination Centres (RCCs) or SAR Points of Contact (SPOCs). These test transmissions appear as a test protocol beacon on the JRCC Australia monitor which displays current Cospas-Sarsat distress beacon system information, including active distress beacons and satellite locations.

2.5 AMSA has acquired several customised and hand-built 406 MHz test protocol beacons for use with SRUs. Additional test beacons have also been supplied to AMSA's dedicated SAR aircraft (Challenger 604) operator for their crew training and currency.

2.6 The new 406 MHz test beacons were introduced into the AMSA SRU training program in early 2025 and have so far been used to facilitate demonstrations, discussions and information sessions with Australian helicopter SRUs equipped with 406 MHz DF equipment. These sessions have proven of high value by helping to address SRU crew knowledge gaps regarding 406 MHz distress beacon properties and to improve knowledge of how to maximize use of their various 406 MHz DF equipment capabilities. Some of the areas covered by these sessions include:

a) comparison between the transmission of the 406 MHz data burst every 50 seconds and the continuous 121.5 MHz swept-tone;

b) use of the DF equipment to access and display the decode of the beacon HEX ID to identify the beacon, which is useful also for situations where more than one 406 MHz beacon is active in the search area;

c) for GNSS-enabled beacons, use of the DF equipment to access and display the beacon's encoded GNSS position;

d) differences in the propagation characteristics of the 406 MHz and 121.5 MHz transmissions due to beacon antenna design being a compromise for both frequencies, differences in the transmission power output of both frequencies, and the variations that can be expected in detection ranges of the two frequencies as a result;

e) selection of the appropriate 406 MHz beacon channel, noting there are multiple channels available; and

f) situations where it may be appropriate to set the DF unit to scan for all 406 MHz channels, such as when a 121.5 MHz homing signal is detected by the DF unit but no 406 MHz signal is yet received. This can be helpful in situations such as when the 406 MHz beacon channel is not known or is not available.

2.7 During the information sessions, demonstrations have been conducted by activating the test beacons on the ground in the vicinity of parked SRU helicopters with their 406 MHz DF equipment switched on using ground power. Feedback from SRU crews has shown that these demonstrations have been particularly valuable for highlighting features of their DF equipment not often practiced, such as navigating DF unit menus to display and interpret decoded 406 MHz transmission data including the beacon HEX ID and its encoded GNSS position, as well as the behavior of the DF display when it receives the 406 MHz data burst every 50 seconds. These demonstration sessions have also proven useful to confirm that aircraft DF equipment is functioning correctly. This was highlighted recently when a test beacon was activated and the 406 MHz signal could not be decoded due to a fault in a helicopter's DF equipment, which could not be ground tested without a live 406 MHz signal.

2.8 SRU crews have enthusiastically welcomed the opportunity to learn more about 406 MHz beacons and to practice using their DF equipment on 406 MHz beacon transmissions. The crews have universally stated that they would now be more confident in applying their beacon homing procedures during future SAR taskings to distress beacons.

2.9 There is a limit to the number of 406 MHz test protocol beacons that can be switched on simultaneously in the world due to Cospas-Sarsat satellite system capacity constraints and guidelines. For this reason, AMSA currently limits the number of activations of these new test beacons to three simultaneously. Each time it is planned that one of the test beacons is to be activated, the user seeks the approval of the Australian MCC and notifies JRCC Australia.

2.10 Australia is not aware of any other States using 406 MHz test protocol beacons for SRU training, however, noting that there may be other States doing so, or that may also wish to acquire such test beacons for SRU training, it may be important to implement some method of global coordination for the activation of test beacons to avoid exceeding the Cospas-Sarsat system capacity constraints. Australia intends to share the information in this paper with the next meeting of the ICAO/IMO Joint Workgroup on Harmonization of Aeronautical and Maritime SAR, 3-7 November 2025, for its consideration and to potentially recommend to ICAO, IMO and Cospas-Sarsat that there may be the need for the development of a coordinated global approach due to possible growth in the use of 406 MHz test protocol beacons for SRU training, and other test reasons, by global States.

2.11 Australia also welcomes the opportunity to learn about 406 MHz test protocol beacons that are being used by other States for SRU distress beacon DF training. Meeting participants are invited to share this information with the Workgroup.

3. ACTION BY THE MEETING

3.1 The meeting is invited to:

a) note the information contained in this paper;

b) advise the Workgroup whether other States are known to be using, or are planning to acquire and use, 406 MHz test protocol beacons;

c) share information about SRU distress beacon DF training programs in their States, including 406 MHz DF training; and

d) discuss any relevant matters, as appropriate.

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