



*International Civil Aviation Organization*

**Third Meeting of the Asia/Pacific Regional Search and Rescue Task Force  
(APSAR/TF/3)**

Maldives, 25 – 29 January 2015

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**Agenda Item 4: Asia/Pacific and inter-regional SAR planning, coordination and cooperation**

**ICAO BRIEF ON THE SAR RESPONSE TO MH370**

(Presented by the Secretariat)

**SUMMARY**

This paper presents a brief on the events noted by the ICAO Regional Office at the time of the MH370 event, which may reveal some areas of improvement for consideration by the APSAR/TF for inclusion in the Asia/Pacific SAR Plan, global SAR documents and action by States concerned.

**1. INTRODUCTION**

1.1 Malaysia Airlines Flight 370 (MH370) disappeared on Saturday, 8 March 2014, while flying from Kuala Lumpur, Malaysia to Beijing, China with 239 people on board (227 passengers and 12 crew). After ten months the whereabouts of the B777-200ER aircraft remained a mystery, with current search efforts focused on the Southern Indian Ocean.

**2. DISCUSSION**

Purpose of Brief

2.1 The purpose of this brief is to provide feedback from the ICAO Regional Office on aspects of events, coordination, advice, challenges noted and possible improvement suggestions as a result of the MH370 tragedy that could be incorporated into the Asia/Pacific Plan.

2.2 The purpose is not to assign blame, but for all States to examine their own systems in terms of the lessons learnt from this tragedy.

### Timeline

2.3 The following is a summary of key events that the Asia/Pacific Regional Office's Air Traffic Management (ATM) Section was aware of, or became involved in.

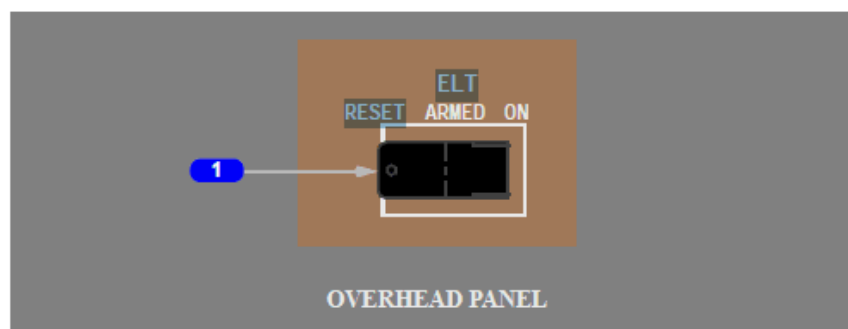
*Saturday 08 March 2014*

- a) MH370 last made voice contact with Kuala Lumpur Air Traffic Control (ATC) at 17:19 UTC, 07 March (01:19 Malaysian time, 08 March) less than an hour after takeoff.
- b) MH370 disappeared from Malaysian ATC Secondary Surveillance Radar (SSR) screens at 17:21 UTC.
- c) MH370's estimated time at the transfer of control point boundary between the Kuala Lumpur Area Control Centre (ACC) and the Ho Chi Minh ACC at position IGARI was 17:22.
- d) Based on radar data records, Ho Chi Minh ACC received radar symbol (Secondary Surveillance response) of MAS 370 on ATS route R208 (South of IGARI) and this symbol disappeared when aircraft approached near IGARI.
- e) At 17:38:54 UTC (IGARI plus **16:54 minutes**), after a number of attempts to communicate on main and emergency frequencies directly and through indirect contacts (via other aircraft) with MH370, Ho Chi Minh ACC informed Kuala Lumpur that they had no radio and no radar contact with the aircraft.
- f) At 18:00 UTC (IGARI plus **38 minutes**), Ho Chi Minh ACC informed the Ho Chi Minh Rescue Coordination Centre (RCC) and the Aviation RCC (Ha Noi) of an INCERFA SAR Phase, as well as informing the Phnom Penh ACC. The Aviation RCC reported to the National SAR Agency Committee and Maritime RCC and other relevant units (note: excerpts from Annex 11 and Doc 4444 regarding alerting Standards and Recommended Practices are in **Appendix 1**).
- g) Malaysian military (Primary Surveillance Radar (PSR) continued to track an unknown aircraft now presumed to be MH370 as it deviated from its planned flight path and crossed over the Malay Peninsula via Malaysia and the southern provinces of Thailand. It was reported that Thai PSR also tracked MH370 as it flew west, then northwest over the Andaman Sea. The last target was seen on Malaysian military radar at 18:15 UTC approximately 200 nautical miles (370 km) west of Penang, 54 minutes after the aircraft had disappeared from civilian SSR screens.
- h) Within 60 minutes of the disappearance of MH370, Ho Chi Minh ACC also informed Sanya and Hanoi ACCs.
- i) At 00:43 UTC (IGARI plus **7 hours 21 minutes**) Ho Chi Minh ACC issued an ALERFA/DETRESFA message.
- j) The Regional Office (RO) wrote to the Civil Aviation Authority of Viet Nam and the Kuala Lumpur RCC, offering assistance should it be required. Meanwhile, the RO engaged in informal coordination and information sharing of on-going events with ICAO HQ, the Chair of the ICAO-IMO Joint Working Group (JWG), IMO and the Chair of the Asia/Pacific SAR Task Force (APSAR/TF).

Wednesday 12 March 2014

- k) In response to enquiries from the RO, the International Air Transport Association (IATA) advised that ‘All onboard surveillance and surveillance sources e.g. ADS-B/X/PDR/FMS can be turn off inflight by switches or via circuit breakers. The aircraft Emergency Locator Transmitter that is installed on all B777 (a recent mandate) failed to provide a signal. Apparently this can also be deactivated if the switch is left in ‘reset’ position by the crew. It is normally set to ARM during the crew pre-flight checks’ (Figure 1).

#### Fuselage Mounted Emergency Locator Transmitter



#### 1 Emergency Locator Transmitter (ELT) Switch

RESET (spring-loaded) – ends transmission of emergency locator signal.

ARMED (guarded position) – transmits emergency locator signal if activated by high deceleration forces.

ON – transmits emergency locator signal.

Figure 1: ELT switch

Thursday 13 March 2014

- l) The RO noted that ICAO HQ Chief Accident Investigation Section (AIG) had confirmed by letter to Malaysia that Malaysia as the State of Registry was responsible for instituting an investigation when the location of accident or the serious incident cannot be definitely established.

Friday 14 March 2014

- m) The RO received communication from Phoenix International Holdings, Inc., regarding their expertise in the field of aircraft search and recovery, which was checked and passed onto Malaysia for their information (Phoenix systems were subsequently employed in the search).

Saturday 15 March 2014

- n) The RO had communication with the RCCs in Kuala Lumpur and Canberra, which expressed concern about the management of aircraft within the Australian Search and Rescue Region (SRR). The search aircraft appeared to be under the direction of high Malaysian officials, and not the RCCs. It was not clear that the States involved were actively searching within their airspace under the provisions of Annex 12 paragraph 5.3.1 i). Moreover, the RCCs were reportedly receiving information only from journalists or via ‘diplomatic channels’.

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*Sunday 16 March 2014*

- o) The RO sent a message to the Malaysian Director of Civil Aviation Dato' Azharuddin Abdul Rahman extending its sincere sympathy to all those affected in Malaysia by the MH370 disappearance. The correspondence also stressed: *As the SAR activity now involves several States, the expectation from the ICAO APAC Regional Office is that all SAR actors to this unfolding situation comply with the provisions of Annex 12 and the spirit of international cooperation enshrined in the IAMSAR (International Aeronautical and Maritime SAR Manual), setting aside all other priorities to the greatest extent possible in the urgent pursuit of an effective SAR response to MH370's disappearance.*

*Monday, 17 March 2014*

- p) The RO sent an urgent email message to Malaysia and Australia, emphasizing the need for clarity in the SAR response, as it appeared that there was a lack of understanding as to who was responsible for managing the SAR response to MH370's disappearance and deploying SAR assets. The root cause of the problem appeared to be confusion between the provisions of Annex 12 (SAR) and Annex 13 (Air Safety Investigation), and political involvement at the highest levels in the search direction. It was noted that Annex 12 was not 100% clear as there was no mention of the transition process between any Annex 12 and Annex 13 action, apart from a brief reference to the need to 'cooperate' with air safety investigators in 3.2.3 (and a later reference to including investigators in Search and Rescue Units - SRUs).

The RO noted that normally, an event moved time sequentially from an Annex 12 SAR response to an Annex 13 investigation, but in this case there was a high profile concurrent investigation guiding parts of the SAR response. In the case of MH370, the investigation (whether it was formally declared as such or not) was providing potentially valuable clues for the SAR response, but that did not mean that the investigation took over from the SAR response.

The RO message clarified that until there was little prospect of survival, the provisions of Annex 12 should take precedence so Australia should direct operations within their SRR (however this was not explicitly clear in Annex 12 and 13). This was because the people who have the necessary expertise to act on any information and direct SRUs accurately with the appropriate knowledge of crucial things like ocean currents were the RCCs.

The RO noted that what seemed to be causing confusion was the provision in Annex 13 which dictated that 'should an accident happen over the high seas the State of Registry would be responsible for instituting and conducting the investigation of the occurrence'. However this provision only dictated who was responsible for the investigation, and not the SAR response.

- q) Australia advised that a high level meeting of the Inter-Governmental Coordination Group was meeting, then subsequently the RO was advised that the Australian Prime Minister had accepted a request from Malaysia to take charge of the 'southern vector' of the search, and offered additional surveillance resources.

- r) The RO advised ICAO HQ that the MH370 event had exposed several potential problem areas in Annex 12:
- it was not 100% clear in terms of which RCC should be managing the SAR response, as 5.2.4 b) only gave four choices, whereas the second choice was closest. However this did not take into account the scenario of MH370 with several SRRs being involved not on the original flight path of the aircraft and included the anomalous words ‘was on the line separating two search and rescue regions’; and
  - the potential confusion caused by multiple overlapping SRRs, was not helping a complex search situation with many permutations involving several SRRs. A major root cause of this was noted as being the SRRs being designated by States themselves under the provision of Annex 12. Despite the requirements of the paragraph 2.2.1: *Such regions shall not overlap and neighbouring regions shall be contiguous*’, this was not always followed.

ICAO HQ noted that SRR were currently in regional ANPs and could only be amended by regional air navigation agreement. Moreover, ICAO HQ did not have the resources to consider such a change to ensure the ICAO Council were able to make decisions on SRR boundaries, recommending that regions could try to sort out the inconsistencies but HQ was not recommending this. ICAO HQ noted that there was more critical work to be done and they were only putting limited efforts into SAR.

- s) The RO received the first Situation Report (SITREP) from the Australian RCC. By 02 April, 17 SITREPs had been received.

*Wednesday 19 March 2014*

- t) The ICAO/IMO JWG Chair advised that the JWG planned for September 2014 had been moved from Bangkok to London, which meant the opportunity for JWG to review the outcomes of investigations into MH370’s SAR response could not be conducted with all the Asia/Pacific States concerned.

*Tuesday 25 March 2014*

- u) Australia advised that they were having difficulty obtaining the updated analysis of Inmarsat data announced by the Malaysian Prime Minister which had been stated as confirming the southern route of MH370 inside the Australian SRR. Australia wanted to obtain this as a contributory source of data for the search in their SRR, and asked to obtain this information through RCC Kuala Lumpur without success. They understood that this Inmarsat information went to the ‘Steering Committee’ (DG DCA, MAS, military) who then passed it upwards to the Prime Minister’s office, with the Kuala Lumpur RCC only supplied with the last known position by the Director General DCA Malaysia.

Australia had unsuccessfully approached Inmarsat and had made a written request to their Australian Safety Transport Bureau, which had made contact with the investigators in Kuala Lumpur seeking the information. In addition, Australia noted that they had experienced difficulty obtaining the MH370 cargo manifest which would be useful for identification against debris recovered.

- v) Tuesday 25 March 2014: The RO contacted the Director General DCA Malaysia to urge release of the requested data. The information was duly provided to Australia.

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Key SAR Issues

2.4 The following issues are highlighted:

- a) There was a time lapse of more than 16 minutes between the transfer of control point at IGARI and the advisory to the last ATC unit (Kuala Lumpur ACC) that MH370 had disappeared.
- b) There was a time lapse of at least 38 minutes between the disappearance of MH370 before IGARI and the issuance of an INCERFA SAR phase.
- c) There was a time lapse of 7 hours and 21 minutes between the disappearance of MH370 and the issuance of an ALERFA/DETRESFA SAR phase.
- d) Annex 11/12 Alerting Service phases that were designed to meet the needs of a procedural (non-surveillance) environment had been relatively unchanged for decades. Thus the SAR alerting phases do not take into account the logical actions that should be possible within a modern ATS surveillance environment.
- e) PSR information from Malaysian military PSR and the two PSRs in Thailand at Hat Yai (near the Thai-Malaysian border) and Phuket (Bang Duk Hill) that could have observed the westbound track of MH370 were not provided to civilian authorities during the immediate period following the disappearance. The Malaysian military PSR information was not publically released for approximately a week after the disappearance.
- f) Poor and ad hoc coordination post-incident between States was evident, with a lack of flow of information between RCCs and third parties such as political entities being involved in the operational decision-making process, which required several ‘interventions’ and clarifications by the RO.

The weaknesses in Asia/Pacific SAR preparedness, particularly in respect of a lack of SAR Agreements and testing of systems using SAREX, had been identified previously by the APSAR/TF. An APANPIRG Conclusion (24/22) *Search and Rescue Agreements* urging States to make arrangements for senior civil and military decision-makers to facilitate the implementation and maintenance of SAR Agreements as early as possible had not resulted in a noticeable improvement.

- g) Annex 12 and Annex 13 were largely silent on the transition procedures between the two Annexes, particularly concerning who was responsible during concurrent activities (note: the enquiry from Malaysia to ICAO HQ to clarify Annex 13 responsibilities without also referring to Annex 12 may have contributed to the subsequent confusion of responsibilities in the period prior to 17 March 2014).

Annex 12 had no reference in paragraph 5.2.4 as to responsibility when more than two SRRs are involved, especially if the airspace concerned was not part of the original flight plan.

SRR designation by States instead of the Council had led to many areas having a confusing disposition of SAR responsibilities.

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Possible Actions

2.5 The following actions are not presented as recommendations because this Brief had been prepared on the basis of incomplete information. However, due to the need to urgently address the potential issues, the following possible actions are suggested for consideration.

- a) The time lapses of more than 16 minutes between the transfer of control point at IGARI and the advisory to Kuala Lumpur ACC that MH370 had disappeared, 38 minutes for the issuance of an INCERFA SAR phase and 7 hours and 21 minutes for the issuance of an ALERFA/DETRESFA SAR phase by Viet Nam indicates there was probably not enough resources utilized and/or urgency in responding.
- b) It is apparent that a higher degree of Malaysian civil/military coordination may have revealed the possibility of the MH370 course reversal much earlier after the initial alert advice from Viet Nam, and as the hypothesized track also crossed Thailand's PSR coverage, advice to Thailand may have also proved beneficial. In essence, a week or more was lost in the initial search because of poor civil/military cooperation.
- c) Annex 12 SAR phases and actions need to be revised to take into account the expectations and capabilities of an ATS surveillance environment. The SAR actions should include the need for civil/military coordination where appropriate, and advisories to all neighbouring ACCs in the case of uncertainty of the aircraft's track.
- d) Poor SAR preparedness and ad hoc SAR coordination between States, including the intervention by political decision-makers needs to be addressed if an optimal operational response is to be possible. Past APANPIRG Conclusions meant to address SAR coordination weaknesses have been largely ignored. In some cases SAR Agreements are hindered by political barriers whereby States can take many years to progress documents through government ministries. This requires a high level political agreement (above APANPIRG - ASEAN, SAARC, etc.) to change the manner in which SAR agreements and operational coordination is prioritized and managed. In addition, the region needs to conduct properly organized SAREX\* on a regular basis and reported to APANPIRG, instead of this being done on an ad hoc basis between States.
- e) Annex 12 and Annex 13 need to be updated to include SARPs on transition procedures between the two Annexes, particularly regarding who is responsible during concurrent Annex 12 and Annex 13 activities.
- f) Annex 12 had no reference in paragraph 5.2.4 as to responsibility when more than two SRRs are involved, especially if the airspace concerned was not part of the original flight plan.
- g) Aeronautical SRR designation by States instead of the ICAO Council was not optimal, but this would require changes to SARPs and a complete review of the current situation to resolve and optimize the SRRs.
- h) Lack of ICAO HQ SAR resource and oversight, as identified in an APSAR/TF/2 Draft Conclusion that was formulated on 30 January 2014 would need to be addressed urgently if the lessons learnt in the MH370 accident were able to result in the necessary changes to ICAO SARPs.

\*Note – many SAREX in the Asia/Pacific are in fact airport emergency plan and crash response displays for dignitaries with no actual search element, or real testing of the system because everyone knows prior to the SAREX what will happen.

**3. ACTION BY THE MEETING**

3.1 The meeting is invited to:

- a) note the information contained in this paper;
- b) comment on the Key SAR Issues and Possible Actions; and
- c) discuss any relevant matters as appropriate.

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## Appendix 1: ICAO SARPS

### Annex 11

5.2.1 Without prejudice to any other circumstances that may render such notification advisable, air traffic services units shall, except as prescribed in 5.5.1, notify rescue coordination centres immediately an aircraft is considered to be in a state of emergency in accordance with the following:

a) Uncertainty phase when:

- 1) no communication has been received from an aircraft within a period of thirty minutes after the time a communication should have been received, or from the time an unsuccessful attempt to establish communication with such aircraft was first made, whichever is the earlier, or when
- 2) an aircraft fails to arrive within thirty minutes of the estimated time of arrival last notified to or estimated by air traffic services units, whichever is the later, except when no doubt exists as to the safety of the aircraft and its occupants.

b) Alert phase when:

- 1) following the uncertainty phase, subsequent attempts to establish communication with the aircraft or inquiries to other relevant sources have failed to reveal any news of the aircraft, or when 2) an aircraft has been cleared to land and fails to land within five minutes of the estimated time of landing and communication has not been re-established with the aircraft, or when
- 3) information has been received which indicates that the operating efficiency of the aircraft has been impaired, but not to the extent that a forced landing is likely, except when evidence exists that would allay apprehension as to the safety of the aircraft and its occupants, or when
- 4) an aircraft is known or believed to be the subject of unlawful interference.

c) Distress phase when:

- 1) following the alert phase, further unsuccessful attempts to establish communication with the aircraft and more widespread unsuccessful inquiries point to the probability that the aircraft is in distress, or when
- 2) the fuel on board is considered to be exhausted, or to be insufficient to enable the aircraft to reach safety, or when
- 3) information is received which indicates that the operating efficiency of the aircraft has been impaired to the extent that a forced landing is likely, or when
- 4) information is received or it is reasonably certain that the aircraft is about to make or has made a forced landing, except when there is reasonable certainty that the aircraft and its occupants are not threatened by grave and imminent danger and do not require immediate assistance.

## PANS ATM

9.2.2.2 When alerting service is required in respect of a flight operated through more than one FIR or control area, and when the position of the aircraft is in doubt, responsibility for coordinating such service shall rest with the ATS unit of the FIR or control area:

- a) within which the aircraft was flying at the time of last air-ground radio contact;
- b) that the aircraft was about to enter when last air-ground contact was established at or close to the boundary of two FIRs or control areas;
- c) within which the aircraft's intermediate stop or final destination point is located:
  - 1) if the aircraft was not equipped with suitable two-way radio-communication equipment; or
  - 2) was not under obligation to transmit position reports.

9.2.2.3 The unit responsible for alerting service, in accordance with 9.2.2.2, shall:

- a) notify units providing alerting service in other affected FIRs or control areas of the emergency phase or phases, in addition to notifying the rescue coordination centre associated with it;
- b) request those units to assist in the search for any useful information pertaining to the aircraft presumed to be in an emergency, by all appropriate means and especially those indicated in 5.3 of Annex 11 (Use of communication facilities);
- c) collect the information gathered during each phase of the emergency and, after verifying it as necessary, transmit it to the rescue coordination centre;
- d) announce the termination of the state of emergency as circumstances dictate.

9.2.2.4 In obtaining the necessary information as required under 5.2.2.1 of Annex 11, attention shall particularly be given to informing the relevant rescue coordination centre of the distress frequencies available to survivors, as listed in Item 19 of the flight plan but not normally transmitted.