MT2000/TG2/0305.doc **Agenda Items 3.2 and 4.6**

USE OF EMAIL AS SUPPORT COMMUNICATION SYSTEM FOR REDUCTION IN COMMUNICATION LOAD ON PRIME COSPAS-SARSAT NETWORK

1. ACTION REQUIRED

The Task Group is invited to consider to adopt email as support communication system to reduce load on prime Cospas-Sarsat communication network without compromising system requirements.

2. BACKGROUND

As we have seen from Australian paper "Cospas-Sarsat Ground Segment Communications" (JC-13/6/22), no communication system is free from problems. Every system has plus and minus points. No single system can meet present Cospas-Sarsat communication requirements, hence it is necessary that we exploit the benefits/merits of individual systems and combine them optimally in such a way that negative aspects one system are taken care by another. This way we can achieve a highly reliable, efficient, cost effective, simple, trouble free and sustainable system.

Moreover, there is a lot of redundancy in distribution of SIT messages i.e. a single beacon when activated gets picked-up by all Cospas-Sarsat satellites and in turn gets processed by entire Cospas-Sarsat System (LUTs & MCCs). Each MCC transacts at least two SIT messages for a single beacon event. The multiple redundancy of message communication on the prime communication system can be minimised by use of support communication system through a single email message **broadcast** to all the Cospas-Sarsat MCCs.

A very simple approach using email has been proposed that would be able to handle most of the message traffic of Cospas-Sarsat MCCs without compromising system requirements.

3. COMMENTS

Methodology

As study shows that 77% of the email messages are received within 10 minutes, 7% within 30 minutes, 14% took more than 30 minutes, and 2% of the messages are lost (Indian Paper: JC-13/6/21), which is a very good response by a simple most system by providing error free data transmission. Email system is expected to perform even better as continuous improvement in the services has been observed. The major difficulties posed by email system are delays (14% takes more than 30 minutes) and loss of messages to the extent of 2% that would be eliminated by prime communications systems in use at Cospas-Sarsat MCCs.

Email is proposed to be used by all MCCs as first level mode of data communication, to broadcast alerts to entire Cospas-Sarsat system. This would be an additional interface to Cospas-Sarsat MCCs that would indirectly help in reducing existing load on the Cospas-Sarsat communication network by providing efficient and reliable message distribution and handling as much as 80-90% message traffic, apart from certain additional benefits. **This approach does not call for any change in MCC processing policy except for introduction of separate email interface**. It makes maximum use of email system, and wherever there is a delay or loss of message because of email, prime communication system automatically takes over to support the system. This approach is presently proposed for 406 MHz alerts only, and will work as follows:

First alert: As soon as first alert is detected by an MCC in its service area, it would broadcast this alert to all the Cospas-Sarsat MCCs in SIT 125 format, notifying that the specific incident is received by the MCC concerned, and there is no further need for this data. The broadcast would be made only by an MCC that has 'A' location in its service area. If 'B' location happens to be outside MCC service area, it would be distributed to MCC concerned through prime communication system apart from email. In case 'B' location also happens to be within the MCC service, no SIT 125 will be transmitted to external MCCs on prime communication network. However MCC would make a broadcast in SIT 125 format through email. **It should be noted that no other MCC would broadcast the first alert detected outside its service area, for such alerts it would follow the normal Cospas-Sarsat procedure.**

Most of the MCCs would pick-up this message even before they get it directly from the satellite through global dump mode. This way all the MCCs sooner or later will receive the alert, either through satellite global dump mode or through SIT message transmitted by email. As 84% email messages are received within 30 minutes, at least 80-90% of global MCCs would be able to get the first alert data before receiving it through satellite dump.

Even in cases where satellite dump mode is not available, still MCCs would be able to get the alerts picked-up in local mode only, through this approach, **thus realising global concept for those satellites not supporting this mode through onboard memory (like S3 & S6).**

Here there will be two situations when an alert is subsequently picked-up by other MCCs in the Cospas-Sarsat network:

1. If alert is received first through email and later through satellite global dump, the MCC would not transmit a message to nodal MCC, thus reducing load on the prime communication systems. The existing MCC logic will work as follows:

   ⇒ The MCCs are configured as per Figure III/A.8 of the DDP; so when an alert is received by the MCC as SIT 125/127 through email before satellite detection, having both the locations in different MCC service area, it will process the alert and just store it. No alert will be sent to external MCCs. This is a general processing philosophy of any Cospas-Sarsat MCC as per DDP.

⇒ When the Same Beacon Event (SBE) is picked-up through satellite detection, MCC will treat this as redundant data (see para 3.2.3 of the DDP and note filtering out of SBE). That is, if the new detection is deemed REDUNDANT (same satellite, close TCAs, close locations), no message to external MCC would be generated.

⇒ If there is a conflict in position for the two SBE alerts and the second one is of better quality, then the MCC will transmit the alert to the MCC concerned (see para III/B.4 for SBE position conflict alerts). In other words, if the new detection is not deemed redundant (because of far locations in spite of the fact that it has the same satellite and TCA information i.e. SBE with a far location), then MCC would only generate a message to the MCC concerned if it decides that later detection is of better quality (as per C/S specification), otherwise it would not.

2. In other case where email message happens to be second (first from satellite dump and later through email) or not received at all (lost), normal Cospas-Sarsat communication will take place.

Resolved alert: Whichever MCC first receives resolved location from the satellite, there will be two situations:

(a) Resolved location within MCC service area: If the alert gets resolved within the MCC service area that picks-up the alert first, and if image happens to be in another MCC service area, a SIT 127 message will be sent for the image location through nodal MCC on the prime communication network. In case if image location and resolved location both fall within the MCC service area, no SIT 127 would be transmitted on prime network. In any case MCC would make a broadcast in SIT 127 format to all the MCCs by email.

(b) Resolved location outside MCC service area: If resolved location happens to be outside MCC service area that picks-up the resolved location first, only SIT 127 would be transmitted to MCC concerned through nodal MCC on prime network, and no email broadcast would be made. The MCC in whose service area the alert is resolved, on receiving the SIT 127 would make a broadcast in SIT 127 format to all other MCCs by email.

Unlocated Alerts: This approach can also be applied to GEO and LEO unlocated alerts. Whichever MCC first detects it would transmit the unlocated alert on prime communication channel as per DDP, and then would make a broadcast to all the MCCs using email. The alerts detected after email broadcast through satellite dump mode would not be further transacted in Cospas-Sarsat network. Here also broadcast would be made by an appropriate MCC that serves the country of beacon registration. If the beacon is first detected by an MCC that does not serve the country of beacon registration, it would transmit the alert on prime MCC network as per DDP. Once the MCC concerned receives the beacon, it would make an

email broadcast. If the country of beacon registration is served by the MCC itself, then the MCC would make only an email broadcast.

In all the cases, same filtering criteria would be applied by the MCC for redundant messages/SBE as described above for "first alert".

SIT 124, 126, 133: For the present, no broadcast scheme is proposed for SIT 124 and SIT 126 as they are not frequently used in Cospas-Sarsat System, and would continue to be exchanged among MCCs as per Cospas-Sarsat procedures on prime communication network. SIT 133 would also be transmitted on prime communication network as it is required only by the MCC concerned and not by other MCCs. However SIT 125 would anyway be broadcast simultaneously by the system. If the results are found to be encouraging with SIT 125, SIT 127 and SIT 122, it can be further extended to other SITs if needed.

Operational benefits

i. Several problems as posed by the present communication systems would be minimised, as 80-90 % of messages traffic would be handled by the support email system in the background, indirectly bringing down load on the prime communication system.

ii. The limitation of not having global dump mode on every Cospas-Sarsat satellite would be overcome i.e. every Cospas-Sarsat MCC will be able to receive 406 MHz alerts detected by the satellite either in global or local mode through this approach at the earliest. MCCs will not have to wait longer to get first and resolved alerts through normal satellite dump until next visibility after the beacon is picked-up. This would enable all the MCCs to have first and resolved detections for an alerts and would be very useful in analysing the incident independently.

iii. The requirements proposed by USA in a paper "Issues With Cospas-Sarsat Data Distribution Plan, C/S A.001" (JC-13/6/24) would be met.

iv. There would be no frequent requirements of changing data formats and routing procedures as all the alerts will be made available to all the MCCs soon after detection.

v. This would also serves as backup to nodal MCCs through entirely different route.

vi. The alerts received first through email would be used for distribution to RCCs and SPOCs through prime communication modes if received first.

vii. MCCs will not be a loser in anyway even if alerts transmitted by email are lost in transit or delayed, as existing prime communication network is already supporting the system as per normal Cospas-Sarsat procedures.

viii. Email is the simplest mode of data communication having capability to deliver single message to any number of MCCs by simple implementation, it will only require to change destination code in the SIT message when same message is transmitted to multiple MCCs.

ix. It also provides a provision to have non critical MCC terminals (i.e. not directly involved in SAR operations) for monitoring of Cospas-Sarsat alerts, by having one way alert data flow by email.

x. Direct routing of unlocated GEOSAR and LEOSAR alerts to the MCC concerned may be implemented easily as this approach takes care of minimising redundant alerts.

xi. Multiple redundancy of message transaction among Cospas-Sarsat MCCs through nodal MCCs would be minimised.

xii. Best case: Take a case of 20 MCCs in the Cospas-Sarsat network. For a 406 MHz alert, each MCC will transmit two messages apart from NOCR and GEOSAR messages to external MCCs, thus 40 messages will be transacted through nodal network until alert gets resolved. If the email system is used and if it delivers messages to all MCCs before the first and resolved alerts are picked-up from satellite, only two messages will be handled by the prime communication systems, remaining all will be handled by email. Therefore, 95% of the load on Cospas-Sarsat prime system is reduced. In normal operational environment, it is expected to reduce the load by 80-90 %.

Why email?

Main objective of introducing concept of alert broadcast using email is to reduce load on the prime communication network in the light of various problems posed by these systems. The intend is not to load the prime communication network heavily by creating additional system requirements. The aim is to use a system with least complexity to implement as well as to avoid any major change in the present MCC processing policy. The precious prime communication systems should be used only when they are needed. In any case prime communication systems are in loop to support the system wherever email fails to deliver the message in time. In case if an MCC reports to nodal MCC having problem with email system, then nodal MCC can configure different communication mode to support that MCC for alert broadcast. However, it is open to MCC operators to decide and use a communication mode of their choice for this purpose. Following points support the use of email:

- As universally known email is the most popular, cost effective, easily available and easy to implement system.

- There is no requirement of communicating alert broadcast message immediately to MCCs, as many of the MCCs in different parts of the world would be receiving the alert data through satellite memory dump much later. Most of the email messages would be delivered within 30 minutes (majority in 10 minutes).

- It would work in the background independently without loading the prime MCC systems.

- Alert broadcast is an additional load on system and would incur extra cost to the MCCs for using expensive mode of communication for this purpose.

- Except delay (14% messages taking more than 30 minutes) and message loss (2%), email is free from all those problems that are associated with other modes of communication as stated in Australian paper (JC-13/6/22). The performance of email system is expected to improve. It is required to test the performance of the email system in the operational environment when most of the MCCs are ready with this feature.

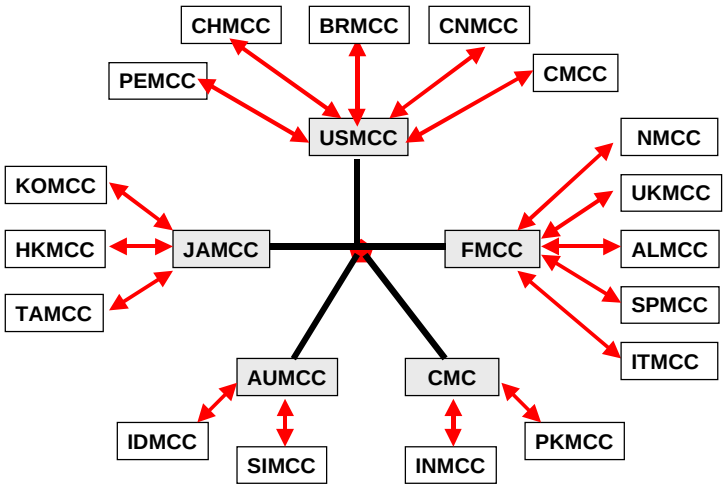
- As alert broadcast requires to transmit SIT messages to all the MCCs simultaneously (single message to 22 different destinations), it would not be so easy to implement this concept with MCCs using other communications systems.

Limitations

- There will be a redundancy of a few SIT messages in the system i.e. some MCCs may get same message by email as well as by prime communication network in cases where email messages are delayed.

- The destination code in SIT messages to be transmitted by email, will have to be changed for each MCC to which message is to be addressed. The email software would be able to handle this. MCCs can also have provision to process the messages irrespective of destination code given in the SIT message (as available with INMCC).

MCC NODAL NETWORK



4. RECOMMENDATIONS

India recommends use of email as support communication system by employing "Broadcast" concept, for distribution of global Cospas-Sarsat alerts within Cospas-Sarsat MCCs. This approach has a potential to resolve multiple operational issues.

Use of existing communication modes (AFTN, X.25, X.400, and FTP) would be minimised, and would be used only to overcome limitations of the email system. Email not only serves as means of communication; it also helps in overcoming some of the operational limitations of Cospas-Sarsat System as a whole (like realising global concept for all satellites with minimum delays). The implementation does not call for any change in the existing MCC processing scheme except for introduction of email interface.

Acknowledgement

The subject matter was discussed with AUMCC and we acknowledge the technical comments and suggestions provided by AUMCC while writing this paper.