GMDSS modernisation and e-navigation: spectrum needs

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Outline of presentation

- General Introduction to the work of the ITU
- Current Global Maritime Distress and Safety System (GMDSS)
  - Maritime terrestrial systems
  - Maritime satellite systems
- Modernization of GMDSS
  - Future maritime terrestrial and satellite systems
- WRC-19/WRC-23 Agenda Items on GMDSS
General introduction to the work of the ITU

- The ITU is the United Nations specialized agency for information and communication technologies

- The ITU coordinates the shared global use of the radio spectrum and satellite orbits

- The ITU develops technical standards that ensure telecommunication networks/technologies interconnect and interoperability

- The ITU assists in improving telecommunication infrastructure in the developing countries

- The ITU comprises 193 Member States, 869 Sector Members, 135 Associates and Academia. ITU secretariat: 750 staff of 71 nationalities
General introduction to the work of the ITU

The ITU has three main areas of activity organized in ‘Sectors’ which work through conferences and meetings:

- The Radiocommunication Sector (ITU-R) - Radio issues
- The Standardization Sector (ITU-T) - Standards for wired networks
- The Development Sector (ITU-D) - assistance to countries

The ITU's work, in the area of Radiocommunication, is performed in the ITU-R Sector, which:

- Establishes and updates international regulations on spectrum/orbit use and applies them
- Produces global standards, associated material (recommendations, reports and handbooks) and best practices on spectrum and orbit use
- Disseminates information on these regulations, standards and best practice
• The WRC is held every three to four years, it reviews and revises the Radio Regulations, the international treaty governing the use of the radio frequency spectrum and satellite orbits.

• The WRC’s satisfy spectrum requirements for new radio technologies while protecting incumbent radio services and improving the international radio spectrum regulatory framework.

• About 25% of the content of the Radio Regulation (RR) Articles are devoted to maritime radio.

• A close relationship exists between the Radio Regulations and various International Maritime Organization (IMO) conventions such as the Safety Of Life At Sea (SOLAS).

• The main purpose of the RR is to ensure interference free operation of all radio services.
ITU Radiocommunication Sector (ITU-R) Study Groups

- ITU-R study groups develop the technical, operational, regulatory and procedural bases for decisions taken by WRCs

- They develop international standards (recommendations), reports, opinions and handbooks on Radiocommunication matters

- They usually meet twice a year. More than 5000 participating specialists. The Groups dealing with maritime issues:
  - ITU-R Study Group 5 deals with: Maritime Mobile Service including the Global Maritime Distress and Safety System (GMDSS); the Aeronautical Mobile Service and the radiodetermination service
  - Working Party 5B (WP5B) develops Recommendations, Reports and Handbooks on maritime, aeronautical and radiodetermination services, including GMDSS and the Global Aeronautical Distress and Safety System (GADSS)
  - Working Party 4C (WP4C) deals with the mobile satellite service, including its maritime component
Global Maritime Distress and Safety System (GMDSS)

- The Current GMDSS was developed in the 1980s and finalized in 1990s
- GMDSS uses HF, MF and VHF terrestrial radio communications systems
- Search and rescue radar and AIS transponders (SARTs)
- Satellite communications and SAR systems which include distress alerting provided by Inmarsat and Cospas-Sarsat
- 100,000 large commercial merchant ships and millions of other vessels use the GMDSS
- New IMO mandatory systems (that may be associated with GMDSS equipment installed on a ship) have come online over the past 10 years
  - AIS Automatic Identification Systems, AIS uses VHF frequencies
  - LRIT Long Range Identification and Tracking is a ship tracking and monitoring system
  - SSAS Ship Security Alerting System, a mandatory commercial ship anti-piracy alerting facility
Provisions of the Radio Regulations related to GMDSS

CHAPTER VII – Distress and safety communications

ARTICLE 30 General provisions

ARTICLE 31 Frequencies for GMDSS

ARTICLE 32 Operational procedures for distress communications in GMDSS

ARTICLE 33 Operational procedures for urgency and safety communications in GMDSS

ARTICLE 34 Alerting signals in GMDSS

Appendix 15 Frequencies for distress and safety communications for GMDSS
Maritime Mobile Service (terrestrial) communications in current GMDSS

- Traditionally terrestrial maritime communications have used **HF, MF and VHF frequencies**, for morse-code telegraphy (Rec. ITU-R 1170), then radio telephony (Rec. ITU-R 1171)
  - operational procedures for distress communications described in RR Article 32
- **Radio telex** was introduced (late 1960’s), then radio-facsimile and **NAVTEX**, this work was supported by ITU recommendations such as, Rec. ITU-R M.1467
- **Digital Selective Calling (DSC)** for automated watch-keeping and alerting on **HF, MF and VHF** frequencies, supported by Recs. ITU-R M.493 and M.541
- **Search and rescue radar transponders (SARTs)**, supported by Rec. ITU-R M.628
- ITU studies and reports have supported all the work in these areas
Maritime Mobile Satellite Service communications in current GMDSS

- **Communications of information** (long range radiocommunication)
  - Regulated by SOLAS chapter IV under GMDSS; currently carried by the only IMO recognized GMDSS satellite service provider – **Inmarsat**

- **Locating ships and persons in distress by beacon (Cospas-Sarsat)**
  - The only type of beacon designated for use within the GMDSS is a Cospas-Sarsat Emergency Position Indicating Radio Beacon (EPIRB) / operates on 406MHz.
  - Some of the related ITU standards are: Rec. **ITU-R M.1478** and **ITU-R M.633**
Maritime Mobile Satellite Service communications outside the scope of current GMDSS (not capable of GMDSS alerting)

- **Positioning/locating for navigation purposes** (Global Navigation Satellite System – GNSS)
  - ✓ IMO recognized GNSS (so far): GPS, GLONASS, BeiDou and Galileo

- **Receiving/relaying AIS & LRIT information** (for maritime situational awareness purposes)
  - ✓ Primary purpose: AIS - collision avoidance, LRIT - Security
Modernization of GMDSS in progress

- Call for modernization given technological advances
  - GMDSS technologies used (DSC), have not reached their full potential
  - GMDSS functions could be performed by more modern technologies
- IMO (MSC) agreed to revise GMDSS aspects of SOLAS chapter IV on radiocommunications to accommodate new technologies
  - non-SOLAS ships also should be considered
- Early this year, MSC-98 has approved the Modernization Plan
GMDSS Modernization - components

1. Overarching considerations;
2. Functional requirements: alignments with the Radio Regulations and other ITU-R documents;
3. GMDSS satellite services and redefinition of Sea Area3;
4. VHF Data Exchange System (VDES);
5. NAVDAT (digital Navigational Data system);
6. Routing of distress alerts and related information;
7. Search and Rescue technologies;
8. HF Communications;
9. GMDSS carriage requirements;
10. False alerts;
11. Training;
12. Obsolete provisions; and
13. Clarifications
**Electronic navigation (eNAV) definition and scope**

“E-navigation is the harmonized **collection, integration, exchange, presentation and analysis** of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.”

- The concept based on the **interconnection of ships and shore facilities** by communication links, including **high speed broadband data links**, to ensure **safe navigation** particularly in coastal and high traffic areas.
- To provide the mariner on board the ship and the Coastal state with **high speed data** to update information, such as updating of computerized bridge displays in real time.
- The system will allow vessels to be always on, connected to maritime electronic highways, particularly during passages through more sensitive high traffic coastal passages and vessel traffic schemes (VTS).
Electronic navigation (eNAV)

- **eNAV** is under development at the IMO and ITU is supporting and co-operating in this work.
- **The Strategy Implementation Plan (SIP)** at the IMO
  - SIP supports a coordinated approach, lead by IMO, to achieve a harmonized global implementation of e-navigation solutions.
  - **ITU-R M.2092** Technical characteristics for a VHF data exchange system in the VHF maritime mobile band.
  - **ITU-R M.2122** EMC assessment of shore-based electronic navigation (eNAV) infrastructure and new draft Standards for data exchange in the VHF maritime mobile band (156-174 MHz).
Future VHF Data Exchange System VDES, with terrestrial and satellite components

- A radio communication development in support of modern electronic navigation concepts (eNAV), is the **VHF Data Exchange System (VDES)**

- It has the potential to provide many forms of data to ships, such as **Maritime Safety Information (MSI)**, hydrographic and environmental data, piracy and security reporting, updating and monitoring of **onboard systems** (i.e. engine and cargo monitoring systems)

- A potentially new broadband communications system with up to 300kbps data transfer. **VHF Data Exchange System (VDES)**, which is based on the already very successful **Automatic Identification System (AIS)**, has the potential to provide mariners worldwide with an effective low cost digital communications system
Future VHF Data Exchange System VDES, with terrestrial and satellite components

WRC-15 results

- Enabling application-specific messages in AP\textsuperscript{18} chan. 2027, 2028; protection AIS by prohibiting chan. 2078, 2079, 2020 for ships
- Identification of bands for terrestrial VDES:
  - 157.200–157.325 MHz/161.800–161.925 MHz in Regions 1 and 3 and
  - 157.200–157.275 MHz/161.800–161.875 MHz in some Region 2 countries
- Secondary allocation to uplink maritime mobile-satellite service in
  - 161.9375–161.9625 MHz/161.9875–162.0125 MHz for satellite component of VDES; downlink will be considered at WRC-19
- VDES regional solution: identification of AP\textsuperscript{18} channels 80, 21, 81, 22, 82, 23 and 83 for digital systems in Regions 1 and 3
Navigational Data for broadcasting maritime safety and security related information (NAVDAT)

- **Broadcast of digital files** from coasts to ships
- **Sequential transmission**: like NAVTEX (Also possible on Single Frequency Network SFN)
- **Broadcast modes**:
  - General for all ships
  - Selective: By geographical area, By group of ships, For a specific ship
- **Possibility of encryption for confidential information**
- **WRC-12** exclusively allocated 495-505 kHz band
- **Possible additional frequencies for NAVDAT HF**:
  - 4 MHz band 4 226 kHz / 4 221 - 4 231 kHz
  - 6 MHz band 6 337.5 kHz / 6 332.5 - 6 342.5 kHz
  - 8 MHz band 8 443 kHz / 8 438 - 8 448 kHz
  - 12 MHz band 12 663.5 kHz / 12 658.5 - 12 668.5 kHz
  - 16 MHz band 16 909.5 kHz / 16 904.5 - 16 914.5 kHz
  - 22 MHz band 22450.5 kHz / 22445.5 – 22455.5 kHz
Future potential maritime satellite systems in GMDSS

- **New possible recognitions are considered in IMO**
  - Iridium/HIBLEO 2 - in the process of applying to become a GMDSS alerting provider
  - Inmarsat FleetBroadband - an evaluation report from IMSO to be considered at NCSR
  - Thuraya - indicated that it may be interested (as a regional provider)

- **Next generation Cospas-Sarsat system**
  - Cospas-Sarsat is in the process of upgrading to next generation satellite system
  - This component of Cospas-Sarsat is known as the Medium-altitude Earth Orbit Search and Rescue system (MEOSAR)
Future maritime communications trends that may support GMDSS and eNAV

- The technical standards of ITU and IMO represent the state of the current technologies in maritime radio communications and radio navigation and support GMDSS and eNAV.

- Existing systems are being improved and new technologies continue to emerge, these developments are in parallel with efforts to improve safety at sea, protect the maritime environment and move cargo efficiently.

- Examples of these developments are:
  - New satellite systems
  - The transition to digital technologies
  - GMDSS modernization
  - Developments in NAVDAT, eNAV and VDES
  - Monitoring onboard systems e.g. Machine 2 Machine (M2M) technologies via satellite
  - Increasing use of mobile phone systems in coastal areas.
Maritime issues
WRC-19 agenda items 1.8 & 1.9.2 / WRC-23

► Res. 359 (Rev.WRC-15)
- Studies to consider possible regulatory actions to support GMDSS (Global Maritime Distress Safety Systems) modernization and the introduction of additional satellite systems into the GMDSS

► Res. 360 (Rev.WRC-15)
- Studies to consider RR MODs, including new MMSS (E-s & s-E) allocations, preferably within 156.0125-157.4375 MHz & 160.6125-162.0375 MHz of RR App. 18, to enable a new VDES (VHF data exchange system) satellite downlink component

► WRC-23 Preliminary Agenda / Res. 810 (WRC-15)
- Spectrum for GMDSS modernization & implementation of e-navigation
Summary

- ITU provides spectrum resources for all maritime terrestrial and satellite systems
- It ensures interference-free operation of maritime radio equipment and its compatibility with non-maritime systems (through compatible allocations, channeling arrangements, technical limitations)
- It standardizes maritime radio equipment ensuring its interoperability
Thank you!

Questions?

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