29TH WORLD RADIOCOMMUNICATION SEMINAR

30 November – 11 December 2020

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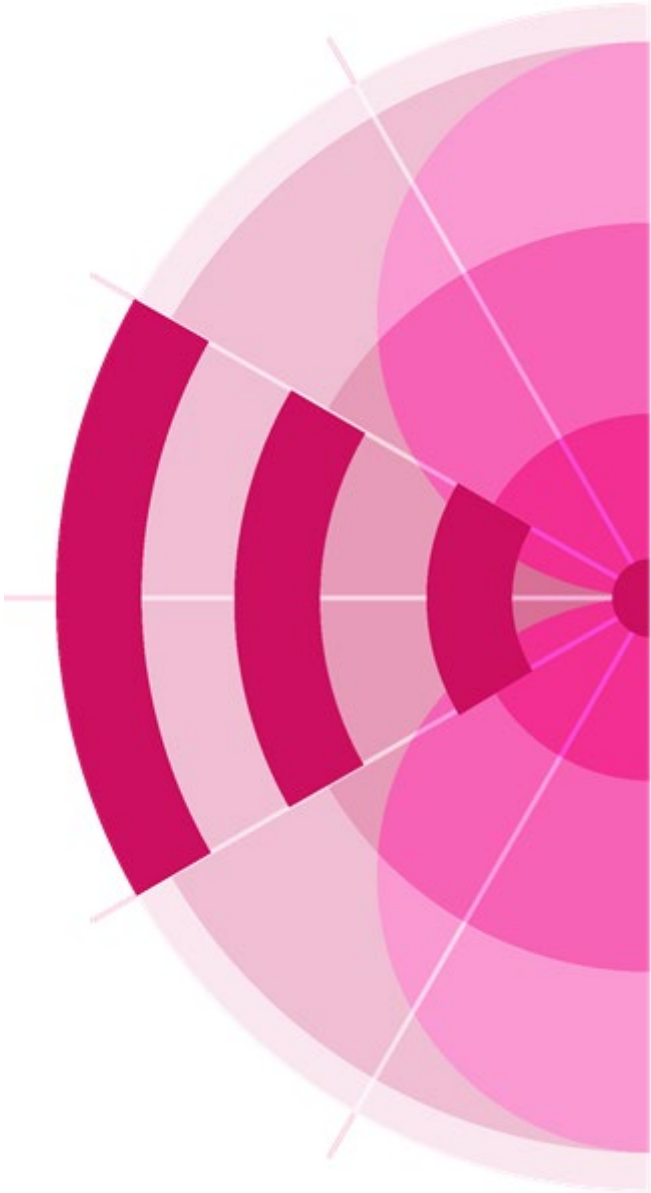
Modern maritime communications



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Presentation:

- Safety and security communications;
- General communications;
- Trends in maritime communications;
- World Radiocommunication Conference 2019 (WRC-19) outcomes;
- World Radiocommunication Conference 2023 (WRC-23) expectations.

Safety and security communications

Global maritime distress and safety system (GMDSS)

The Global Maritime Distress and Safety System (GMDSS) is an internationally agreed set of safety procedures, frequencies, types of equipment, and communication protocols, developed through cooperation between International Maritime Organisation (IMO) and International Telecommunication Union (ITU) since the mid-1970s.

It operates using terrestrial and satellite radio technologies onboard ships and onshore, making it easier to rescue persons and ships in distress.

The system alerts coast radio stations or Rescue Coordination Centres (RCC) in cases of distress at sea.

Safety and security communications

Global maritime distress and safety system (GMDSS)

- GMDSS concept includes:

- Terrestrial communications in VHF, MF and HF maritime frequency bands, including digital selective calling (DSC) capability, radiotelephony (RT) and MF/HF narrow-band direct printing (NBDP);
- Satellite communication systems using geostationary and non- geostationary satellites;
- Satellite service for search and rescue on 406 MHz (Cospas-Sarsat 406 MHz emergency position-indicating radio beacons (EPIRBs));
- Maritime safety information (MSI) via NAVTEX system (518 kHz international, 490 kHz and 4 209.5 kHz national), MF/HF NBDP, satcom enhance group call service (EGC);
- Locating (radar search and rescue transponder (9 200-9 500 MHz SART), VHF automatic identification system transmitter (AIS-SART)).

Safety and security communications

Global maritime distress and safety system (GMDSS)

Digital selective calling (DSC)

One of the GMDSS notable innovations was the implementation of **Digital selective calling (DSC**) technology for automated watch-keeping and alerting in VHF, MF and HF maritime frequency bands.

DSC is a technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations, complying with the corresponding Recommendations of the ITU Radiocommunication Sector (ITU-R).

For DSC calling, Maritime Mobile Service Identities (MMSIs) are used.
MMSI is programmed into VHF/MF/HF DSC equipment and used for identification.

(References: Recommendations ITU-R M.493, ITU-R M.541 and ITU-R M.585)

Safety and security communications

Systems other than GMDSS

Automatic identification system (AIS) enhances the safety of navigation by providing identification, tracking and other information about the ship to other ships and to coastal destinations automatically. It is regarded as a complementary mean to marine radars to exchange navigational data in VHF frequency band for collision avoidance.

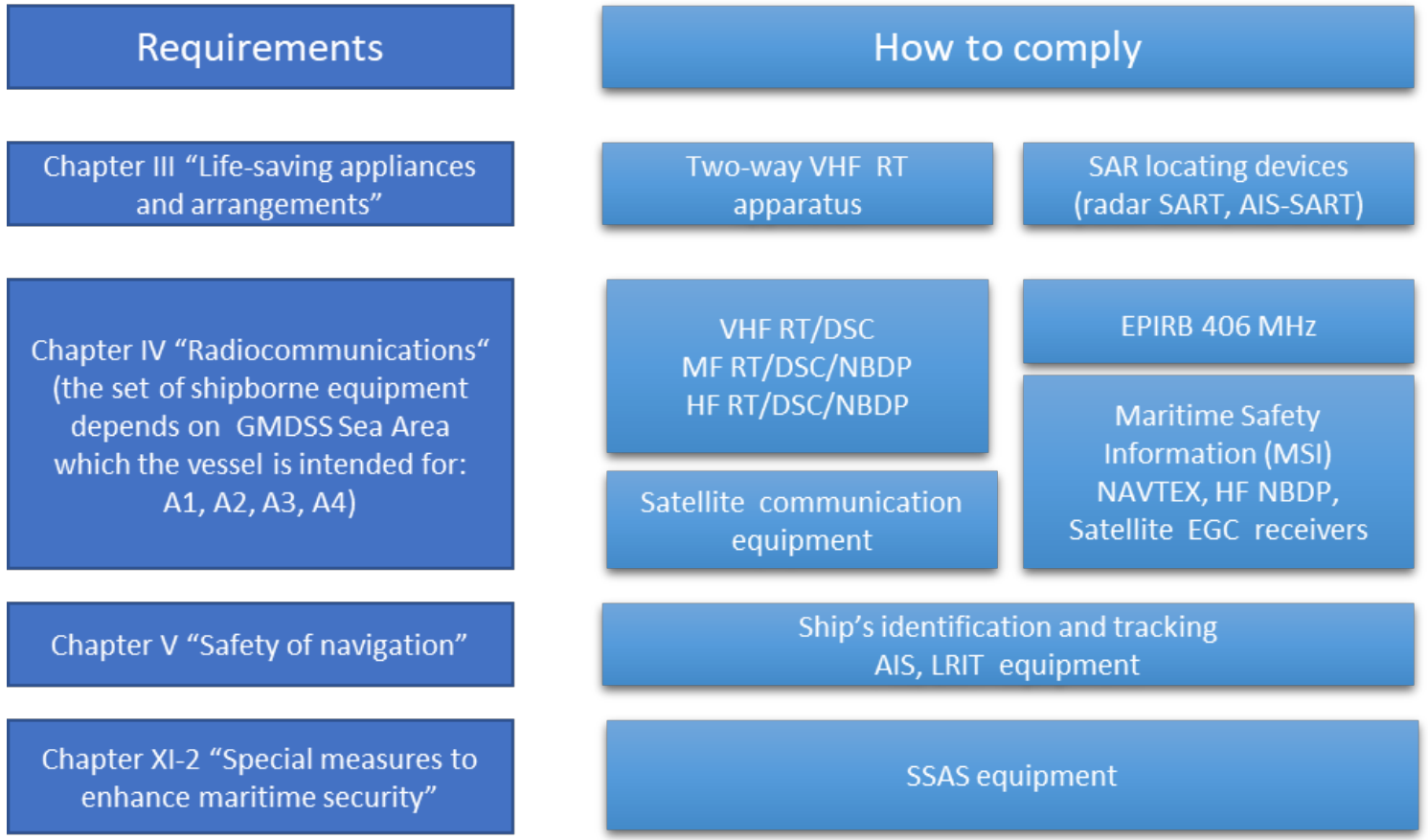
Various AIS technology applications continue to be developed very actively, e.g. AIS-Search and Rescue Transmitters (AIS-SARTs), satellite distress beacons EPIRB-AIS (emergency position-indicating radio beacon with an Automatic Identification System transmitter), AIS aids to navigation (AIS-AtoN), “man overboard” (MOB-AIS), autonomous maritime radio devices (AMRD-AIS).

Long-Range Identification and Tracking (LRIT) system provides information for the global identification and tracking of ships up to 1000 nautical miles from coast. Ships report to LRIT Data Centre every six hours as a minimum. Satcom technologies are mainly used to support LRIT.

Ship Security Alert System (SSAS) is one of the measures to strengthen ship’s security against acts of terrorism and piracy. It provides covert alert «ship-to-shore» which indicates to competent authorities ashore that security of the ship was jeopardized. Satcom technologies are mainly used to support SSAS.

Safety and security communications

SOLAS Convention requirements and general ships' compliance



Appendix 15 to the Radio Regulations (RR) contains the list of frequencies for distress and safety communications for GMDSS.

IMO is in the process of GMDSS modernization. Supporting this activity, ITU is carrying on studies and developing Recommendations and Reports.

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General communications

The range of possibilities is very diverse

Terrestrial

- VHF/MF/HF radiotelephony, data and e-mail;
- Public mobile communication technologies like IMT-Advanced (4G) are being widely and actively used by ships during coastal navigation where cellular networks are available. To date, this usage mostly limited to commercial purposes and personal communications. IMT-2020 (5G) and cloud technologies may provide additional advantages primarily in ports and inland waters.

Possible use of public broadband communication and technical standardization for public mobile networks for the future maritime needs are being considered within IMO.

Satellite

Satellite communications: systems operating via geostationary or non-geostationary satellites are being increasingly used on board ships for general and safety/security related communications;

- Hybrid solutions, e.g. onboard passenger ships: very small aperture terminal (VSAT) combined with onboard cellular dedicated networks;
- Global monitoring and tracking functions of ships, containers, control devises and other floating objects are widely offered on the market of the various satellite service providers using different technologies and applications.

General communications

On-board communications

On-board communications are intended for use by the crew onboard ships for operational purposes, e.g. in ship's maneuvers, berthing, cargo operations, etc.

Provision No. 5.287 of the RR allows the use of the frequency bands 457.5125- 457.5875 MHz and 467.5125-467.5875 MHz by the maritime-mobile service being limited to on-board communications. It could be implemented in both analogue and digital modulation on 25 kHz, 12.5 kHz or 6.25 kHz channel bandwidth (see Recommendation ITU-R M.1174).

The use of the frequency bands for on-board communications in territorial waters is subject to the national regulations of the concerned administration.

Trends in maritime communications

New developments in supporting of e-navigation concept

E-navigation is defined by IMO as *"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."*
It is expected to provide digital information and infrastructure and based on the interconnection of ships and shore facilities by communication links, including high speed broad band data, to update information on computerized bridge displays in real time.

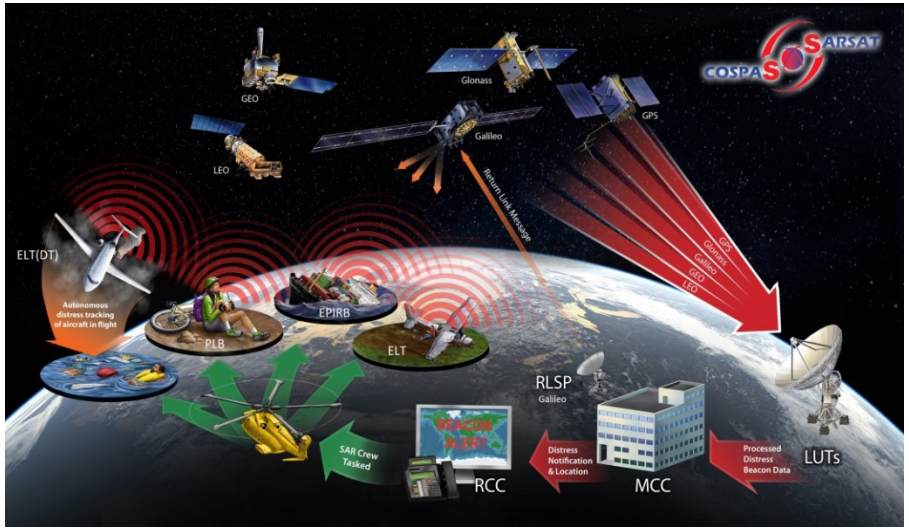
VHF data Exchange System (VDES) integrates the functions of VHF data exchange (VDE), application specific messages (ASM) and AIS in the VHF maritime band (156.025-162.025 MHz). VDES comprises both terrestrial and satellite components.

NAVDAT (Navigational Data) is a digital system operating in MF/HF maritime bands for broadcasting of maritime safety and security information. NAVDAT system may complement or possibly replace in future, current NAVTEX (Navigational Telex) system.

VHF voice digitalization, currently under studies, is one more expectation.

Trends in maritime communications

Satellite service for search and rescue on 406 MHz (Cospas-Sarsat)



Source: The MEOSAR System Concept (www.cospas-sarsat.int)

Cospas-Sarsat is currently developing second generation beacons (SGBs)

Medium Earth Orbiting Search and Rescue (MEOSAR) is space segment with search and rescue (SAR) repeaters placed on the satellites of the Global Navigation Satellite Systems (GNSS). MEOSAR complements the existing low-altitude Earth orbit (LEOSAR) and geostationary Earth orbit (GEOSAR) systems and will eventually replace the LEOSAR system.

MEOSAR will offer:
- advantages by providing transmission of the distress message and independent location of the beacon with near-real-time global coverage;
- new capability to provide “Return-Link-Service” (RLS) transmission to a distress beacon that will provide the user with a confirmation that the distress message has been received.

WRC-19 outcomes on maritime communications

Agenda item 1.8

*To consider possible regulatory actions to support **Global Maritime Distress and Safety System** (GMDSS) modernization and to support the introduction of additional satellite systems into GMDSS, in accordance with **Resolution 359 (Rev.WRC-15).***

Issue A: ***NAVDAT***

WRC-19 authorized the usage by NAVDAT of the frequency bands 415-495 kHz and 505-526.5 kHz and six HF channels between 4 221 kHz and 22 455.5 kHz (Appendix 17 to the RR) in the maritime-mobile service.

Issue B: ***introduction of additional satellite systems into GMDSS***

WRC-19 recognized the need for a primary allocation for safety of life service and upgraded to primary the allocation to the maritime-mobile satellite service (space-to-Earth) in the frequency band 1 621.35-1 626.5 MHz. This band was also included in Appendix 15 to the RR, containing frequencies for distress and safety communications for GMDSS.

Achievements: Enables NAVDAT and the possibility to introduce additional (non-GSO) satellite systems into GMDSS capable to provide global service including polar areas.

WRC-19 outcomes on maritime communications

Agenda item 1.9.1

*Regulatory actions within the frequency band 156-162.05 MHz for **autonomous maritime radio devices** to protect GMDSS and automatic identification system (AIS), in accordance with Resolution 362 (WRC-15).*

WRC-19 identified frequencies of Appendix 18 to the RR for use by autonomous maritime radio devices (AMRD) as follows:

- 156.525 MHz (channel 70), 161.975 MHz (AIS 1) and 162.025 MHz (AIS 2) may be used by AMRD Group A that enhance the safety of navigation, using DSC and/or AIS technology;
- 160.9 MHz (channel 2006) may be used by AMRD Group B that do not enhance the safety of navigation which deliver signals or information which do not concern the navigation of the vessel or do not complement vessel traffic safety in waterways, using AIS technology. AMRD Group B are limited to a transmitter equivalent isotropically radiated power (e.i.r.p.) of 100 mW and an antenna height not exceeding 1 m above the surface of the sea.

Achievements: AMRDs classification and regulation of their operation on specific frequency channels thus enhancing the safety at sea by protecting the integrity of GMDSS and AIS.

(Reference: Recommendation ITU-R M.2135)

WRC-19 outcomes on maritime communications

Agenda item 1.9.2

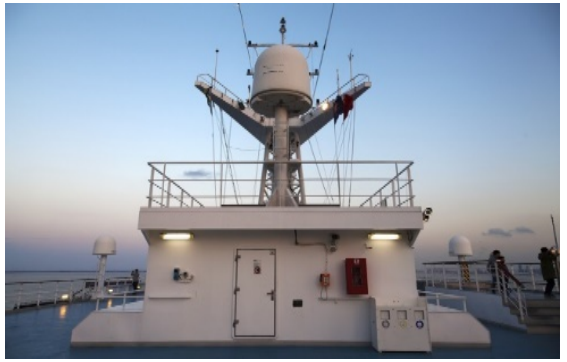
Modifications of the Radio Regulations, including new spectrum allocations to the maritime-mobile-satellite service (Earth-to-space and space-to-Earth), preferably within the frequency bands 156.0125-157.4375 MHz and 160.6125-162.0375 MHz of Appendix 18, to enable a new ***VHF data exchange system (VDES)*** *satellite component.*

WRC-19 made secondary allocations to the maritime-mobile satellite service (uplink and downlink) in the frequency bands 157.1875-157.3375 MHz and 161.7875-161.9375 MHz to enable the satellite component of the VHF data exchange system (VDES). The use of these bands is specified in Appendix 18 to the RR.

Achievements: Enables the satellite component of VDES. This decision extends the service of terrestrial VDES component and enables the implementation of complete VDES concept to support implementation of e-navigation.

(Reference: the VDES terrestrial and satellite components are described in Recommendation ITU-R M.2092)

WRC-23 expectations concerning maritime communications



Existing systems are being improved and new technologies continue to emerge, in parallel with efforts to improve safety at sea, protect the maritime environment and transport cargoes efficiently. ITU-R studies and resulting Recommendations and Reports are supporting all the work in these areas.

Main trends in the development of maritime communications may be noted as follows:

- Transition to digital technologies in all bands, particularly in voice communications and MSI;
- Increased global coverage and higher data transmission rates;
- GMDSS modernization, including deployment and introduction of new satellite systems and networks (in line with SOLAS Convention);
- Implementation of e-navigation;
- Continue to develop AIS technology;
- Adaptation of new proven and innovative technologies to enhance the potential of maritime communications.

GMDSS modernization and implementation of e-navigation are parts of WRC-23 agenda 1.11:
"to consider possible regulatory actions to support the modernization of the Global Maritime Distress and Safety System and the implementation of e-navigation, in accordance with Resolution 361 (Rev.WRC-19)".

Thank you!

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