World Radiocommunication Seminar 2016

Modern Maritime Communications

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Overview of presentation

1. Maritime Radio Communications
2. Terrestrial systems
3. Satellite systems
4. Future maritime communication trends

Questions

1. Maritime Radio Communications

- **The Global Maritime Distress and Safety System (GMDSS),** was implemented from 1992-1999
- **GMDSS uses HF, MF and VHF terrestrial radio communications systems**
- The International Maritime Organization (IMO) is in the process of **modernizing** the GMDSS, ITU has developed Recommendations and Reports to support this work
- **100,000 large commercial merchant ships** and millions of other vessels use the GMDSS
- New **mandatory systems** have developed 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
- In addition the electronic-navigation (eNAV) system is under development and GMDSS modernization is in progress

2. Terrestrial, (MMS) Maritime Mobile Service communications

- Traditionally terrestrial maritime communications has used **HF, MF and VHF frequencies**, for Morse-code telegraphy, then radio telephony

- **Radio telex was introduced (late 1960's),** then radio-facsimile and NAVTEX, this work was supported by ITU recommendations such as, (Recommendation ITU-R M.1467)

- **GMDSS** introduced **Digital Selective Calling (DSC)** for automated watch-keeping and alerting on **HF, MF and VHF** frequencies, supported by (Recommendation's ITU-R M.493 and M.541)

- These new systems led to a global revision of the maritime distress and safety system between 1987 and 1992 and the **implementation of the GMDSS,** which began between 1992 and 1999

- **Automatic Identification System (AIS),** (Recommendation ITU-R M.1371) provided navigation and communications information, LRIT and SSAS were also introduced

- ITU studies and reports have supported all the work in these areas

E-Navigation (eNAV), Electronic Navigation

- This concept is based on the interconnection of ships and shore facilities by communication links, including high speed broad band 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 on 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 areas and vessel traffic schemes (VTS)

- **eNav** is only partially implemented, it will encourage on board connectivity, **eNAV** is under development at IMO and ITU is cooperating in this work

- ITU Reports ITU-R M.2122 and ITU-R M.2092 support ITU's ongoing work in this area

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

- The (Recommendation ITU-R M.2092) was completed at WRC-15, however studies are continuing on VDES, to fulfill spectrum requirements for the satellite downlink component

Mobile phone systems.

- For decade's coastal mariners, particularly fishermen and pleasure users have been using **mobile phone systems on board vessels**
- Shore service providers have **specifically located base stations in maritime ports and along the coast line** to take advantage of this lucrative business model
- In many coastal areas mobile phone 2G and 3G coverage extends out from 15 to 30 kilometers from shore. These stations are used only for commercial calls
- Tests have indicated that with appropriate antenna and power configurations 4G may have a range of up to 100 kilometers out to sea, providing LTE 4G data rates of 100 Mbps

3. Satellite systems, Maritime Mobile Satellite Service MMSS

- Cospas-Sarsat and Inmarsat (are approved GMDSS service providers)
- Additional Commercial systems are; Iridium/HIBLEO 2, Thuraya, Thor–Telenor and Orbcomm
- Iridium/HIBLEO 2 is in the process of applying to become a GMDSS service provider. Thuraya has also indicated that it may be interested in becoming a GMDSS service provider in the future
- It is estimated that over 100,000 vessels and over 8,000 oil and gas production platforms use some form of satellite service on board.
- In 2016-about 400,000 maritime satellite terminals are in operation
- 10,000 Very Small Aperture terminal (VSAT) are used on board ships
- One example of VSAT maritime use is the cruise ship industry where VSAT's are used as the backhaul for onboard mobile phone, picocell systems
- Some of the related ITU standards are; Rec. ITU-R M.1478 and ITU-R M.633

The use of satellite communications on board ships

- The amount of commercial radio telephone traffic handled at coast stations has decreased as ships are connecting directly to offices onshore via satellite

- The need for the SAR (Search And Rescue) infrastructure has increased. People and property need to be rescued and secured, to save lives and prevent further environmental damage

- Many coast stations have become Marine Rescue Coordination Centers (MRCC) with their own integrated radio communications systems

- Other types of land based stations have also increased, Port operations, Vessel Traffic, Pilot stations, Coast Guard etc.

- Satellite communications systems are being increasingly used on board ships for commercial and safety related communications

Next generation Cospas-Sarsat system

- Cospas-Sarsat's mission is distress alerting
- It already operates Low Earth Orbit Search and Rescue (LEOSAR) and Geostationary Earth Orbit SAR (GEOSAR) satellite systems
- It is based on the detection and location of 406 MHz distress beacon signals (i.e. Maritime EPIRB), it has been doing this successfully for decades
- 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)
    - Positions will be available almost in real time with higher accuracy and with an acknowledgement that the distress alert has been received

Future application, Machine to Machine (M2M) in maritime via satellite

- Maritime Radio communications is developing, person to person
- Communication is now developing between computerized devices, these devices are talking to each other, machine to machine
- The bridge of every SOLAS convention (commercial) ship, of which there are about 100,000 worldwide, currently contains on average 50 plus computer systems
- Throughout every ship there are hundreds more computers working tirelessly, they are embedded within communications, navigation, engine and cargo monitoring systems
- The future radio communications landscape will include the interconnection of many component devices onboard ships, with shore-side networks
- Satellite systems can provide a wide range of machine-to-machine M2M communication services, to monitor and correct onboard systems

4. Future maritime communications trends

- 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 eNAV and VDES
  - Monitoring onboard systems using M2M technologies via satellite
  - Increasing use of mobile phone systems in coastal areas

- The challenge is to provide seamless communications between ship and shore

- There may also be challenges in the area of cyber security and regulatory oversight

Thank you

There are four additional slides which provide additional information on maritime related items at WRC-15 and those under study for WRC-19

Spectrum for on-board communications

agenda item 1.15

- **Background**
  - There was a problem of congestion in on-board UHF communications since only 6 frequencies around 460 MHz were available for this purpose
- **WRC-15 results**
  - no new spectrum was allocated, but measures were adopted for more efficient usage of existing frequencies (in modified No. **5.287**):
    - Introduction of new channeling arrangements of 6.25 kHz and 12.5 kHz through Rec. ITU-R M. 1174-3, while retaining 25 kHz channeling for analogue systems
    - Recommendation to use new digital technologies, e.g. digital coded squelch
- **Implications**
  - provides more channels for on-board communications with the same amount of spectrum available, removes congestion

Automatic Identification System (AIS) in maritime communications

agenda item 1.16

- **Background**
  - Development of new Automatic Identification System (AIS) applications, aimed at improving maritime communications and safety of navigation, required additional frequency resource
- **WRC-15 results**
  - Enabling application-specific messages in AP18 chan. 2027, 2028; protection AIS by prohibiting chan. 2078, 2019, 2079, 2020 for ships
  - Identification of bands for terrestrial VHF Data Exchange System (VDES): 157.200–157.325/161.800–161.925 MHz in R1, 3 and 157.200–157.275 MHz /161.800 – 161.875 in some R 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 AP18 channels 80, 21, 81, 22, 82, 23 and 83 for digital systems in Regions 1 and 3

Earth stations located on-board vessels (ESVs)

agenda item 1.8

➢ ***Background***

- **5.457A** and Res. **902 (WRC-03)** provide technical, regulatory and operational conditions under which ESVs may communicate with space stations of FSS in bands 5 925-6 425 MHz and 14-14.5 GHz

➢ **Results of WRC-15**

- Possibility to use smaller (1.2m) antenna for ESVs transmitting in the frequency band 5 925-6 425 MHz
- Resolution **902 (WRC-03)** continues to apply

	Before WRC-15		After WRC-15		
Frequency band	5 925-6 425 MHz	14-14.5 GHz	5 925-6 425 MHz		14-14.5 GHz
Minimum diameter of ESV antenna	2.4 m	0.6 m	2.4 m	1.2 m	0.6 m
Minimum distance from the low-water mark as officially recognized by the coastal State beyond which ESVs can operate without the prior agreement of any administration	300 km	125 km	300 km	330 km	125 km

➢ **Implications**

- Increased use and further development of ESVs in the frequency band 5 925-6 425 MHz with sufficient protection to the terrestrial services

Maritime related agenda items for WRC 19

- 1.8 Consideration of regulatory provisions for updating and modernization of the Global Maritime Distress and Safety System
- 1.9.1 Autonomous maritime radio devices operating in the frequency band 156-162.05 MHz
- 1.9.2 Satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication
- 1.3 In relation to the protection of 406 MHz and 460-470 MHz.
- 1.5 ESIM Earth Station In Motion Res. 158, on board ships.