VHF Data Exchange System (VDES)

ETSI Workshop “Future Evolution of Marine Communication”

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With acknowledgments to the members of IALA WG3, especially Derek Love, Stefan Bober and Jillian Carson-Jackson
AIS - success story

- Introduced in 2002
- Initially conceived for collision avoidance
- Mandatory for SOLAS vessels
- Expanded to encompass other users:
  - fishing fleets
  - Inland shipping
  - Recreational vessels
- Evolved into safety, security and tracking applications
  AIS AtoN, AIS SART, AIS MOB, AIS EPIRB, Satellite tracking, ...
- AIS shore-based infrastructure for Vessel Traffic Systems - Now an integral part of maritime communications
- AIS is becoming overloaded
- Channels are saturated
World wide view from satellite
AIS – a success story

• Expanding use of AIS technology causes significant loading of the AIS channels
• Emerging high loading in busy areas:
  – Gulf of Mexico
  – Korea
  – Japan
• Future introduction of e-Nav will increase the need for more data exchange
• Existing AIS channels and technology will not be able to cope
VDES is the solution

- Next generation maritime digital communications system
- Provides an efficient, robust and global data exchange in the maritime VHF band
- Integrates existing and new communication functions:
  - AIS
  - ASM
  - VDE terrestrial
  - VDE Satellite
- New channels for Application Specific Messaging (ASM)
- New channels for high speed data (VDE)
VDES is the solution

• VDES address the need for additional capacity for digital data exchange
  – preserves the original function of AIS for identification, position reporting and tracking, support for search and rescue etc.
  – Provides capability for maritime data exchange for safety, security, efficiency and protection of the environment
  – Provide terrestrial and satellite data with global inter-operability and availability (including polar regions)
  – Improved data rates and capacity
  – Support for eNav, maritime data communication
AIS channel plan

AIS - TODAY

75 76
Long range AIS

1024 1084 1023 1085 1026 1086
VDE1 VDE2
SAT Up SAT I

4.6 MHz separation

2014 2024 2025 2026 2027
VDE1 VDE2
SAT2 Possible extension SAT1
ASMI SAT Up

2028 AIS1 AIS2
ASMO SAT Up
VDES channel plan

VDES

Satellite detection AIS

Shore-to-Ship VDE 2

Ship-to-Ship VDE 2

Ship-Shore VDE 1

Ship-Shore VDE

Satellite broadcasting

AIS

VDE channel plan

75 76

Long range AIS

1024 1084 1025 1085 1026 1086

VDE1 - A

SAT Up3

Ship transmit channels for VDE

2024 2084 2025 2085 2026 2086 2027 2028

VDE1 - B

SAT2 Downlink

AIS-VDE ship receiving bandwidth

4.6 MHz separation

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VDES channel Plan

- AIS (two channels, 25kHz, 9600bps GMSK)
  - Existing AIS functionality
- ASM (two channels, 25kHz, 19,200bps pi/4 QPSK or 4FSK)
  - Handles AtoN, hydro data, metrological data, shipping info etc
  - Moves Application-specific messaging off the AIS channels
- VDE terrestrial (25 / 50 / 100 kHz pi/4 QPSK or 8-PSK or 16-QAM)
- VDE Satellite (25 / 50 / 100 kHz pi/4 QPSK or 8-PSK or 16-QAM)
VDES single global system

- VDES *
- 3G/4G (LTE)
- (Wifi)

* VDES includes AIS, ASM, VDE-T & VDE-S
VDES and e-Navigation

- e-Navigation aims to enhance berth-to-berth navigation and related services for safety and security at sea and for the protection of the marine environment.
- VDES supports the IMO prioritised e-Nav solutions:
  - Standardised and automatic reporting
  - Using internationally standardised messages similar to ASM
  - Extended ship static and voyage related data
  - Dangerous cargo indication
- Improved reliability, resilience and integrity of navigation information
  - Met/Hydro data, tidal windows, area notices to mariners, berthing data, clearance times for port entry/exit
- Improved communication of VTS services
  - Route information, navigational intentions
VDES and GMDSS

• IMO considering adding VDES functions for:
  – Position information by AIS
  – Assisting SAR operations using AIS-SART, AIS-MOB, AIS-EPIRB
  – Global coverage through satellite
  – Capability of broadcasting Marine Safety Information for Navigational warnings, Notices to Mariners, Ice Maps etc
  – Receiving acknowledgments from ships
• VDES provides a robust and reliable data exchange capability in machine-readable format
VDES Status

- ITU-R M.2092-0
- First edition available now
- 2092-1 currently being drafted by IALA working group - 2019
- Hardware trials performed in Brisbane, Harwich, Baltic verifying radio parameters
- Test satellite now operational (NORSAT)
- Prototype hardware under development from a number of manufacturers
Market requirement

- Complete VDES solution combining:
  - AIS Class A, ASM data and VDE (Terrestrial and Satellite) high speed data

- A full VDES unit needs min of 6 concurrent receivers:
  - 2 x AIS, 2 x ASM, 1 x VDE, 1 x DSC

- High performance
- Small enough to fit within existing enclosures
- Provide a rapid deployment path
- Flexibility to adapt as the VDES specification is refined
- Single transmitter negotiates time slots to minimise interference with AIS operation
- Availability for field trials
- Certification path
VDES Solution

• Available now
• Enabling:
  – Wide availability to a VDES platform
  – Realistic field trials to be performed
  – Application development
• Designed to be future proof
  – Software updates track standard evolution
VDES development

• CML Microcircuits has a long history supplying integrated maritime solutions
• Technology partner Stone Three Venture Technology is based in Cape Town, South Africa, experts in cutting edge SDR technology
• CML and Stone Three have been pioneering VDES since the middle of 2014 within IALA
• Successfully trialled VDES technology in Brisbane in 2015
• The combined skill sets of CML and Stone Three, have delivered a market leading, fast time-to-market, SDR based VDES solution
The VDES Solution

- VDES1000 – Fast Time-to-Market VDES Solution
- Flexible SDR platform running a multi-channel VDES implementation
- The SDR platform will enable new functionality to be included as VDES develops and new features are added
- Designed to be a future proof and upgradeable
- Solutions for Original Equipment Manufacturer (OEM) and Original Design Manufacture (ODM)
- Provides a rapid path to market
- A complete multi-channel VDES solution providing:
  - A “ready-to-go” VDES solution
  - AIS, ASM and VDE communication requirements
  - Designed and verified to be certification ready
  - Small overall footprint
VDES1000 – the detail

• Fully compliant to ITU-R M.2091-0 (+, 1)
• Bespoke wideband Software Defined Radio (SDR)
• Uses a simple line-up, majority of processing is done digitally
• Dynamically adjusts for high power blocking interferers
• Field upgradable to adapt to ever changing standards
• 7 concurrent receiver channels
• Better than -107dBm sensitivity
• All interfaces fully compliant with IEC 61993-2
• API to simplify system integration
• 12.5W Tx power (50W peak for 16-QAM mode)
• Linearised PA for improved noise performance and efficiency
• iGNSS receiver
VDES1000

- Worlds smallest complete VDES solution
- Out-of-the-box VDES operation
- Market leading performance
- Future proof by design
- Low risk
- Certification path
- Available now
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Thank You