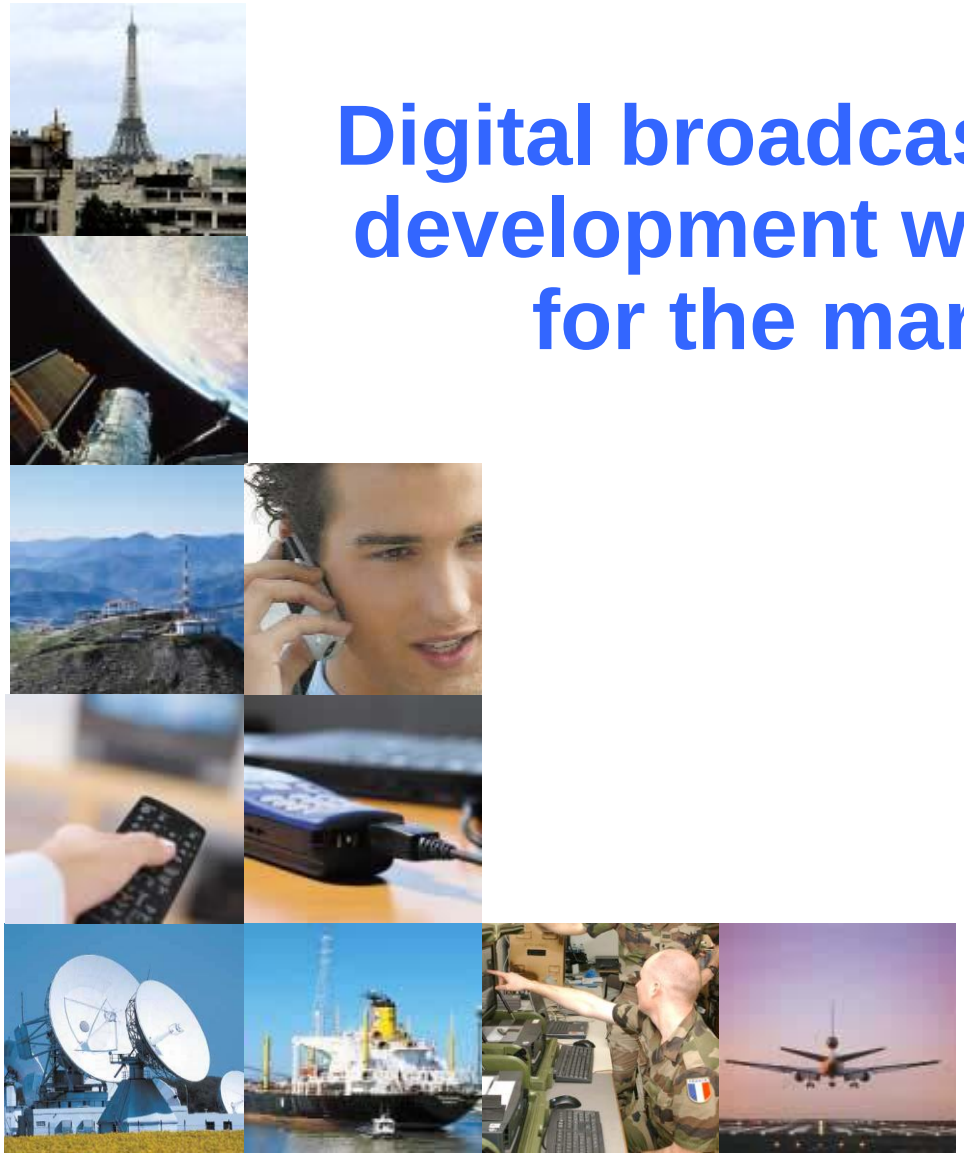
Agence Nationale des Fréquences



# Digital broadcasting systems under development within ITU-R of interest for the maritime community

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IHO, WWNWS 5
Monaco, 2nd October 2013

# Background for the 500 kHz band

The TITANIC sent its  SOS on 500 kHz in telegraphy mode,

The TITANIC sank on April 15th, 1912 at 2:20

After the Introduction of the GMDSS, the frequency has been gradually phased out and quickly lost for the mariners

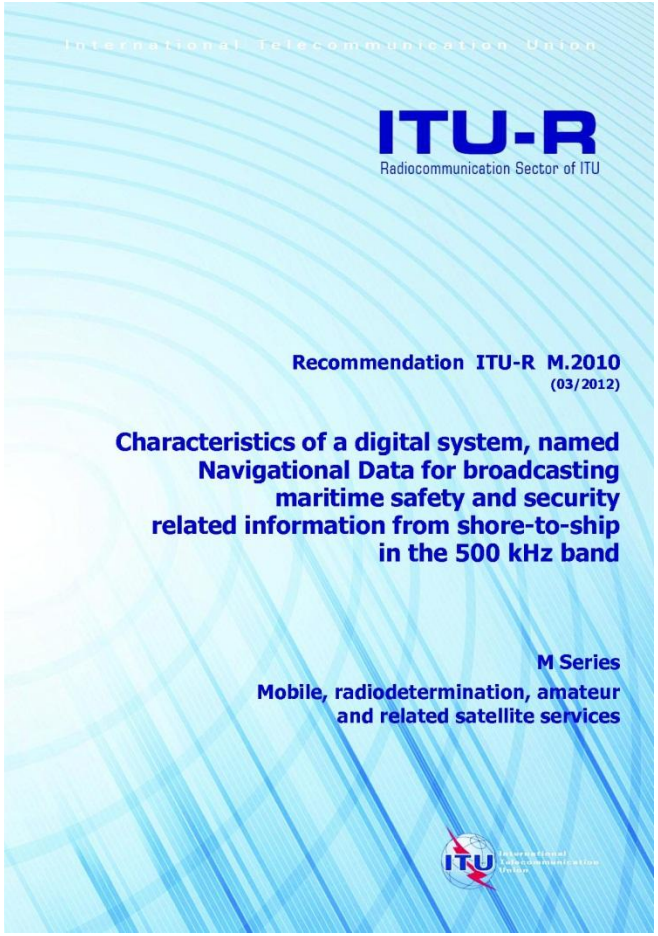
**… 100 years afterwards**

**On the French initiative:**

The World Radio Conference 2012 approved the worldwide exclusive usage of the frequency band 495 - 505 kHz for the maritime mobile service.

In November 2011 the ITU-R Study Group 5 adopted the recommendation ITU-R M.2010 published on May 2012.

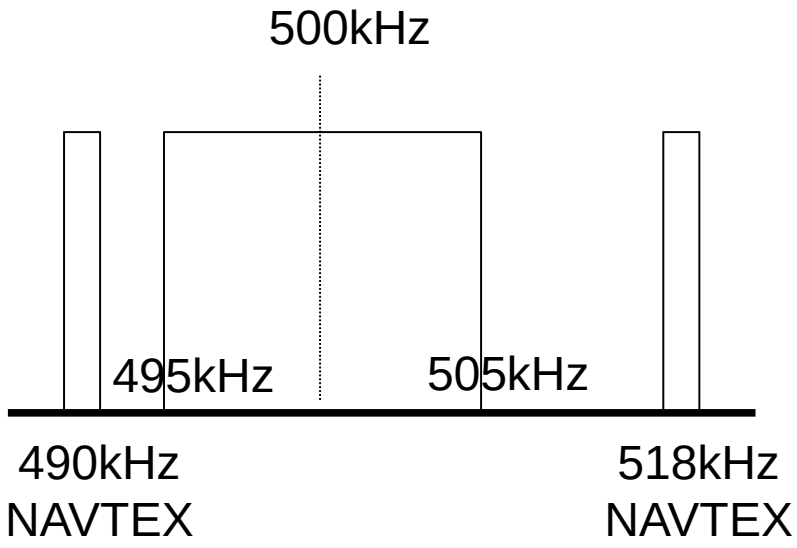
***“ Characteristics of a digital system, named Navigational Data for broadcasting maritime safety and security related information from shore to ship in the 500 kHz band”***



# NAVDAT 500 KHz

- Use digital Modulation allowing more important flow
- Allow 15 to 25 kbit/s in a 10 kHz channel (more than 300 times the NAVTEX transmission)
- Offer faster transmission time per message
- Transmissions files not limited to the texts but also:
  - Drawings
  - Graphs
  - Pictures
  - Data…

- This band procure a stable propagation on surface wave
- Good radio coverage of 250/350 NM by coast station

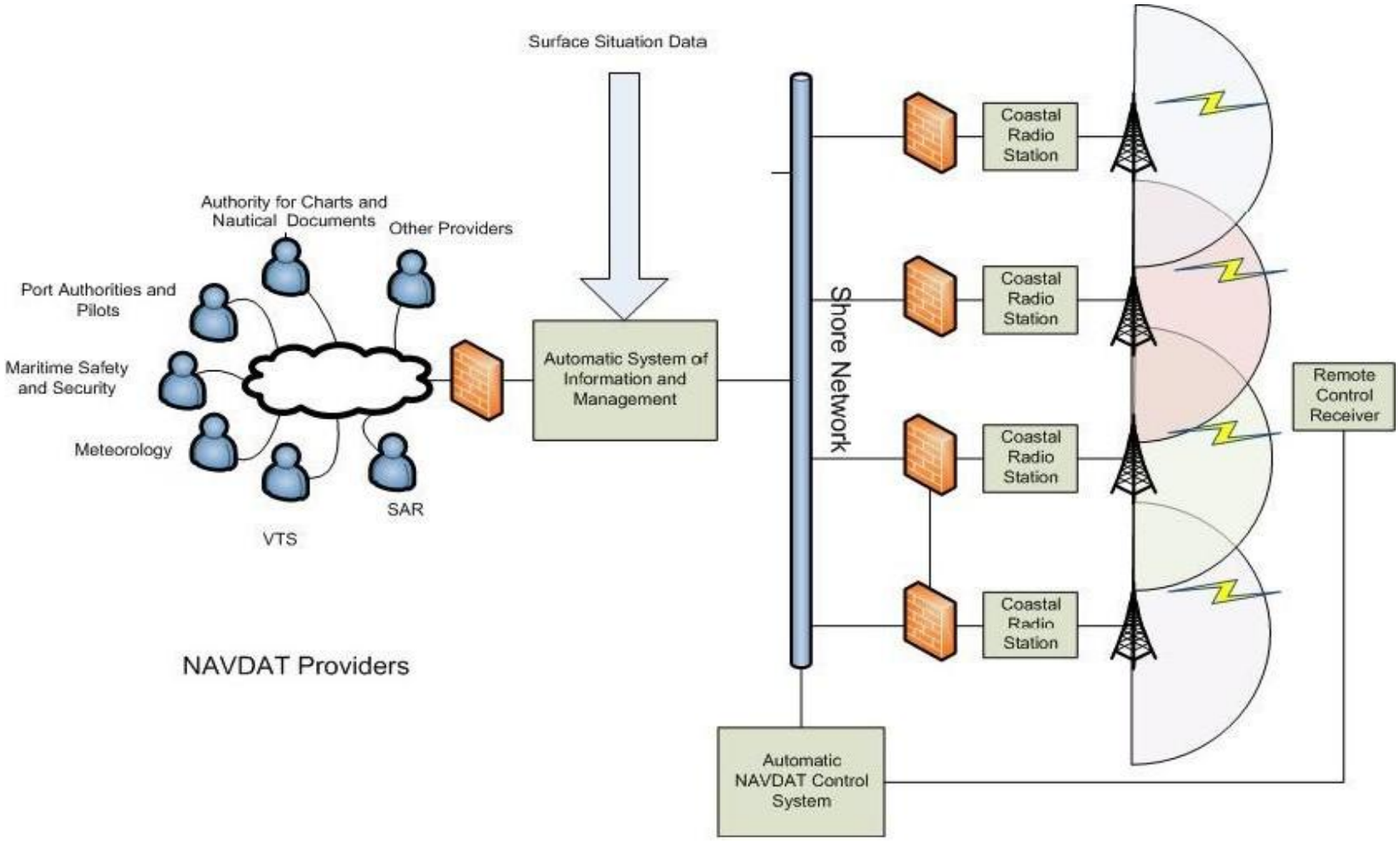


# NAVDAT general principle

Agence Nationale des Fréquences

- 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

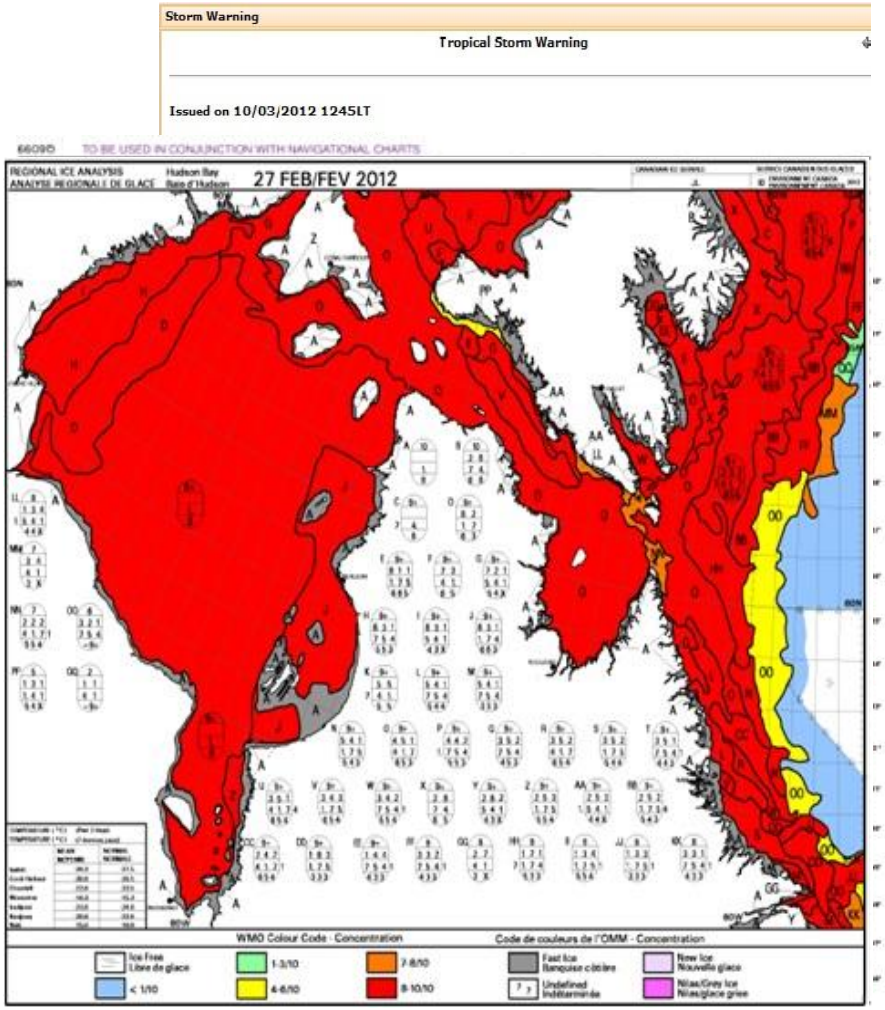
# NAVDAT: Synoptic



# NAVDAT functionalities (1)

***Given as example:***

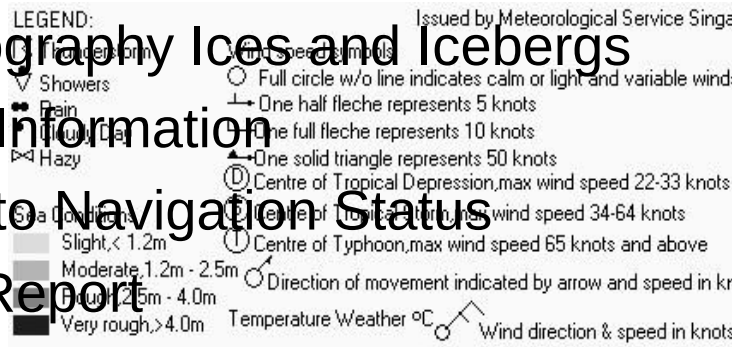
- Type of messages: PRIORITY
  - Navigational warning
  - Meteorological warning
  - Search and Rescue
  - Piracy warning
  - Ices warning
  - Distress and Emergency Message

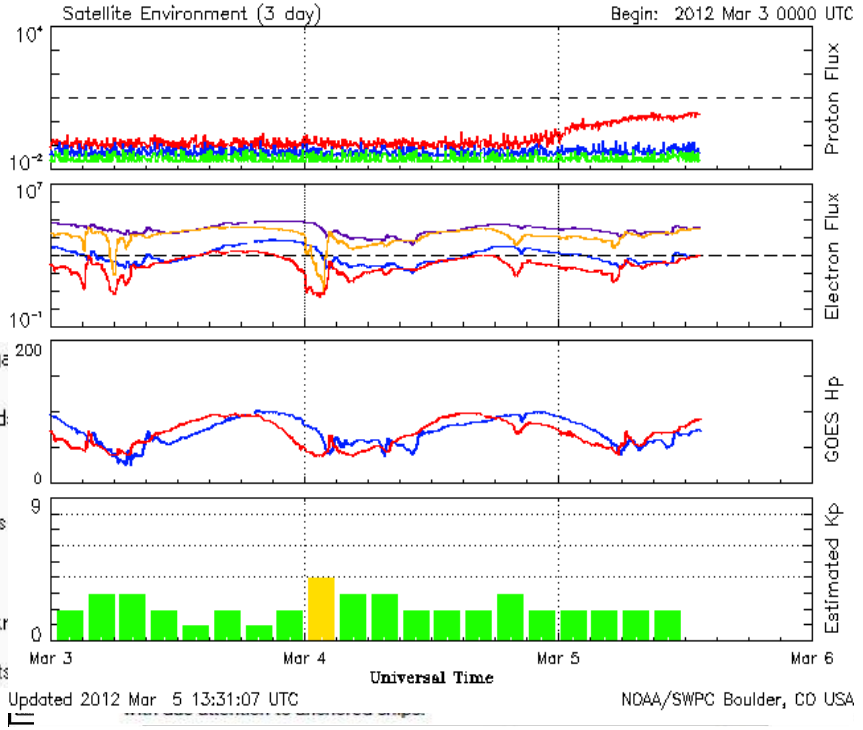


# NAVDAT functionalities (2)

***Given as example:***

- Types of messages: INFORMATION OF NAVIGATION
  - Meteorological forecast
  - Local meteorological information
  - Tides and current information
  - VTS Traffic
  - Cartography Ices and Icebergs
  - Pilot Information
  - Aids to Navigation Status
  - AIS Report

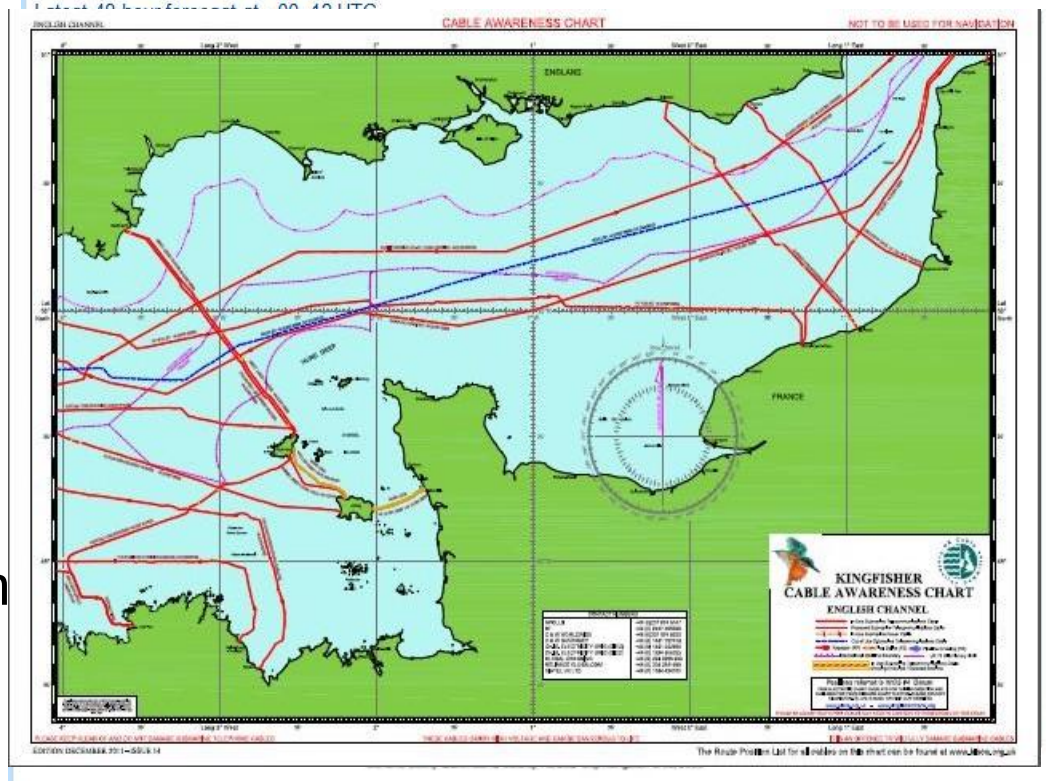


# NAVDAT functionalities (3)

***Given as example:*** Types of messages : WIDE SERVICES

- Update of cartography
- Graph of weather evolution
- Harbour Message
- Information for Fisherman
- Graphs of Traffic evolution



# Conclusion for NAVDAT 500 kHz

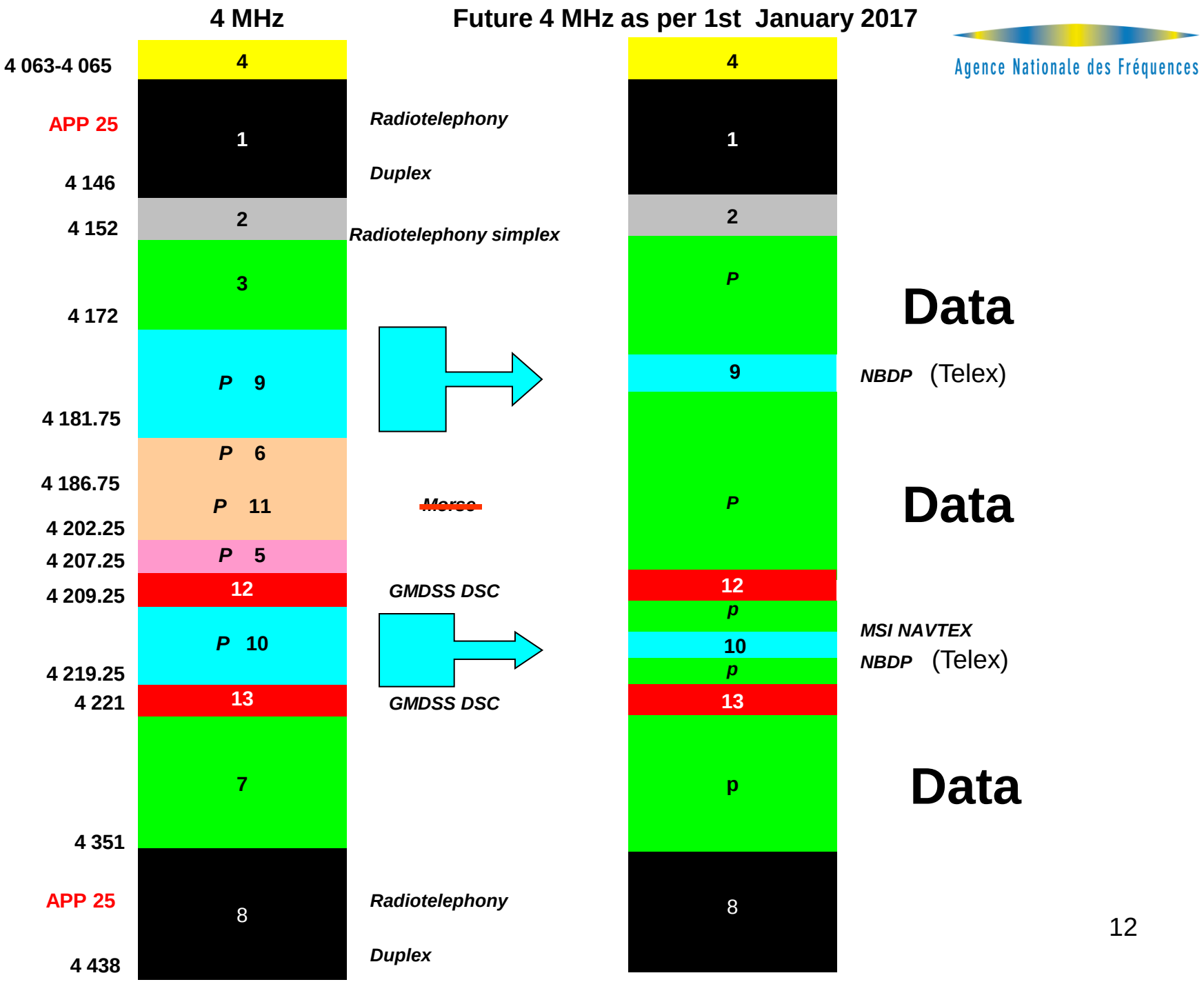
***The NAVDAT system :***

- Use a radio band allocated by ITU ( International Telecommunication Union ) for a **MARITIME EXCLUSIVE** usage on a **WORLDWIDE basis**
- Can re-use the current infrastructure NAVTEX for the information sources
- Simple and safety coastal network. (**NAVDAT station can also be use for NAVTEX )**
- System very open on the next future

# NAVDAT in HF

Agence Nationale des Fréquences

The World Radio Conference 2012 has made substantial changes in the HF band (Appendix 17) in order to introduce digital technology in the maritime mobile service


4 MHz
Future 4 MHz as per 1st January 2017
Agence Nationale des Fréquences
4 063-4 065
4
APP 25
1
Radiotelephony
Duplex
4 146
4 152
2
Radiotelephony simplex
3
4 172
P 9
4 181.75
P 6
4 186.75
P 11
Morse
4 202.25
4 207.25
P 5
4 209.25
12
GMDSS DSC
P 10
4 219.25
4 221
13
GMDSS DSC
7
4 351
APP 25
8
Radiotelephony
Duplex
4 438
4
1
2
P
9
P
12
p
10
p
13
p
8
Data
NBDP (Telex)
Data
MSI NAVTEX
NBDP (Telex)
Data

After the 500 kHz band, France has proposed a NAVDAT system in the HF Band

For the HF band the propagation is mainly in sky wave. In this situation NAVDAT HF will be complementary to NAVDAT 500 kHz in term of radio coverage.

| | | |
|---|---|---|
| Radiocommunication Study Groups | | |
| | | |
| Source: | Document 5B/TEMP/129 | Annex 27 to Document 5B/304-E<br>8 July 2013<br>English only |
| Annex 27 to Working Party 5B Chairman's Report | | |
| WORKING DOCUMENT TOWARDS A PRELIMINARY DRAFT NEW RECOMMENDATION ITU-R M.[NAVDAT-HF] | | |
| Characteristics of a digital system, named navigational data for broadcasting maritime safety and security related information from shore-to-ship in the maritime HF band | | |

# Possible frequencies for NAVDAT HF system

| Maritime band | Central frequency | Limits |
|---|---|---|
| 4 MHz band | 4 226 kHz | 4 221 to 4 231 kHz |
| 6 MHz band | 6 337.5 kHz | 6 332.5 to 6 342.5 kHz |
| 8 MHz band | 8 443 kHz | 8 438 to 8 448 kHz |
| 12 MHz band | 12 663.5 kHz | 12 658.5 to 12 668.5 kHz |
| 16 MHz band | 16 909.5 kHz | 16 904.5 to 16 914.5 kHz |
| 22 MHz band | 22450,5 kHz | 22445,5 to 22455,5 kHz |

# Conclusion for NAVDAT in HF bands

NAVDAT HF under development in ITU, approval in December 2013 or 2014

Approval of the frequencies by WRC-15

# The VHF Data Exchange System
# VDES

# Background information

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The World Radio Conference 2012 has made substantial provisions for the maritime community in the VHF band:

Exclusive Utilisation of AIS 1 and AIS 2 by the maritime mobile service in Region 2 and 3 (in 2025)

Allocation for the mobile satellite service for the channel 75 and 76 in order to detect the Message 27 of AIS for the Long Range AIS

Identification of the channels 27, 28, 87, 88 for testing future AIS applications, e.g. Application Specific Messages (ASM)

Identification worldwide of channels 24, 84, 25, 85, 26, 86 for utilization of digital systems


Long range AIS

Digital systems

Future AIS applications

Exclusive Region 2 and 3

# What to do with this treasure ?

Agence Nationale des Fréquences

Agenda Item 1.16 for WRC-15 provides directions:
to consider regulatory provisions and spectrum allocations to enable possible new Automatic Identification System (AIS) technology applications and possible new applications to improve maritime radiocommunication in accordance with Resolution **360 (WRC-12)**;

## So, what about AIS !

well recognized

important tool

SOLAS vessels (Class-A)

effective and useful technology

## However, so useful that its used for a lot of other applications

AIS SART

AIS MOB

non SOLAS vessels (Class-B)

EPIRB-AIS

AtoN

ASM

# What to do with this treasure ?

Agence Nationale des Fréquences

Agenda Item 1.16 for WRC-15 provides directions:
to consider regulatory provisions and spectrum allocations to enable possible new Automatic Identification System (AIS) technology applications and possible new applications to improve maritime radiocommunication in accordance with Resolution **360 (WRC-12)**;

## So, what about AIS !

This expanding use of AIS technology has caused significant increase in VHF Data Link (VDL) loading which has become an active concern in IMO and ITU.

NOTE: AIS is a navigation system, not fitted for data exchange.

# User requirements

Agence Nationale des Fréquences

More Data exchange Shore to ship, ship to ship, ship to shore

Environmental Information: Meteorological, Ice, Hydrological,
Aids to navigation, charts, restrictions on navigation, VTS, Pilotage
Optimize port arrival operations, cargo indications
Warning/alert due to navigation hazards
Remote maintenance of ship
SAR Operations
Ship reporting
…

Simultaneously, because of increasing demand of radio spectrum for digital communication such as mobile phone and data, ITU now requests more efficient and effective use of radio spectrum

# Solution ?

## The VHF Data Exchange System
## VDES

Objective:

1- Secure the VDL in order to protect the AIS

Use AIS for what it was designed and intended

Move some ASM applications to new channels

| | | | |
|---|---|---|---|
| 27 | 87 | 28 | 88 |
| 1027 | 1087 | 1028 | 1088 |
| 2027 | AIS1 | 2028 | AIS 2 |

| | |
|---|---|
| AIS1 | AIS 2 |

Future AIS applications

# Solution ?

## The VHF Data Exchange System
## VDES

Objective:

1- Secure the VDL in order to protect the AIS

Use AIS for what it was designed and intended

Move some ASM applications to new channels

| | | | |
|---|---|---|---|
| 27 | 87 | 28 | 88 |
| 1027 | 1087 | 1028 | 1088 |
| ASM 1 | AIS1 | ASM 2 | AIS 2 |

Future AIS applications

# Solution ?

2- Improved communications capacity

Terrestrial solution

| | 24 | 84 | 25 | 85 | 26 | 86 |
|---|---|---|---|---|---|---|
| TX | 1024 | 1084 | 1025 | 1085 | 1026 | 1086 |
| RX | 2024 | 2084 | 2025 | 2085 | 2026 | 2086 |

# Solution ?

2- Improved communications capacity

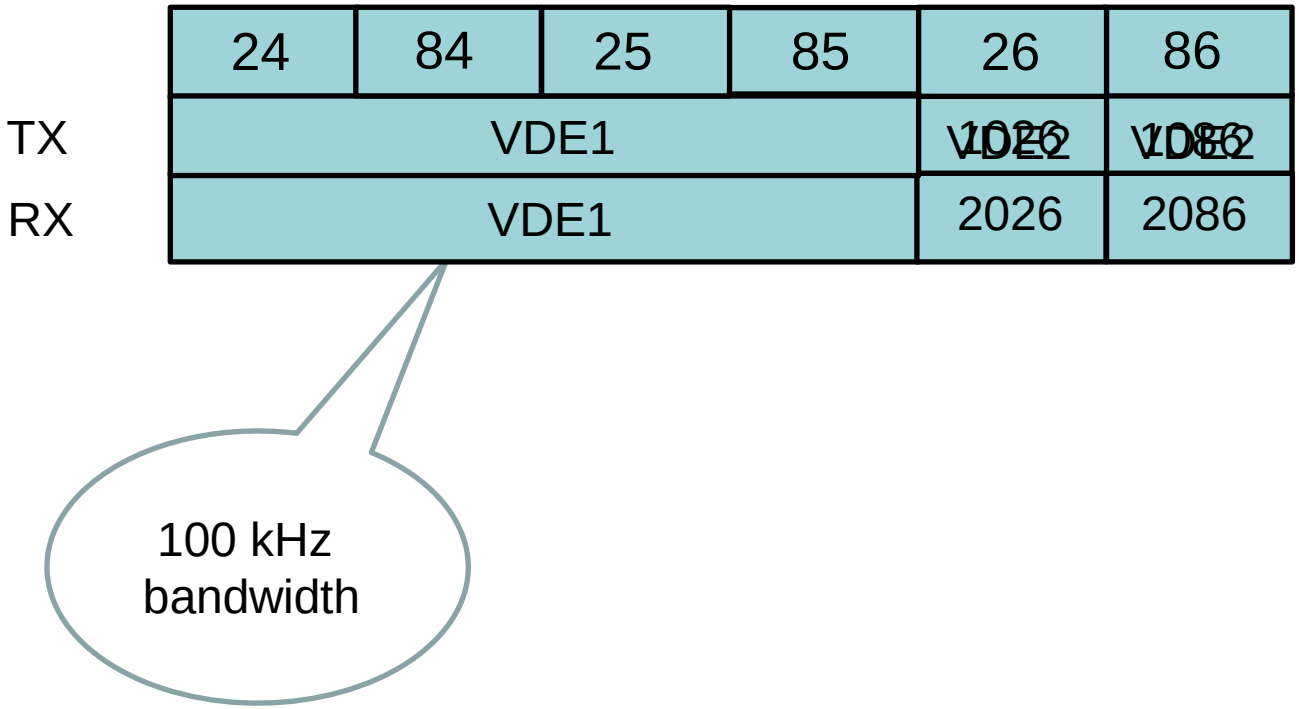
Terrestrial solution

| | 24 | 84 | 25 | 85 | 26 | 86 |
|---|---|---|---|---|---|---|
| TX | 1024 | 1084 | 1025 | 1085 | 1026 | 1086 |
| RX | 2024 | 2084 | 2025 | 2085 | 2026 | 2086 |

# Solution ?

2- Improved communications capacity

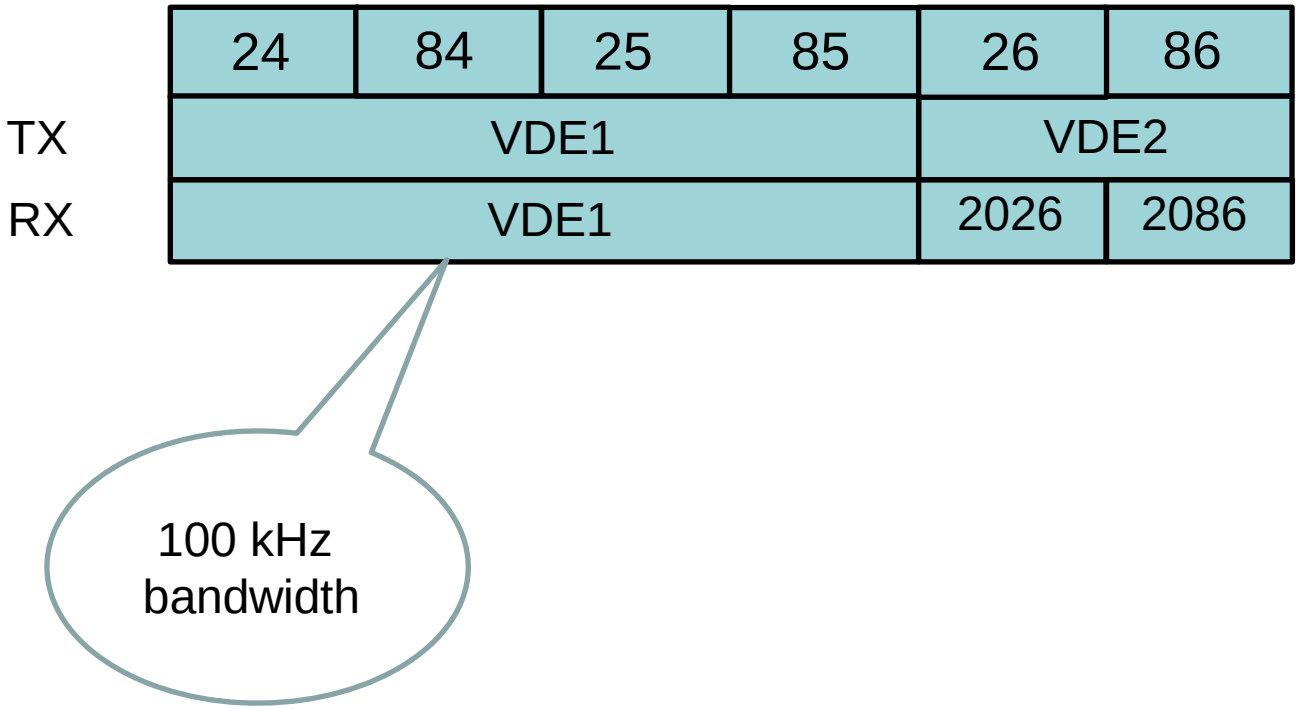
Terrestrial solution



# Solution ?

2- Improved communications capacity

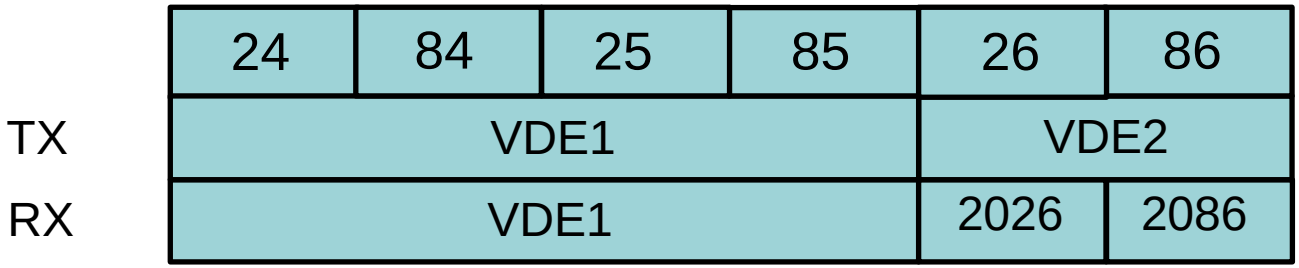
Terrestrial solution



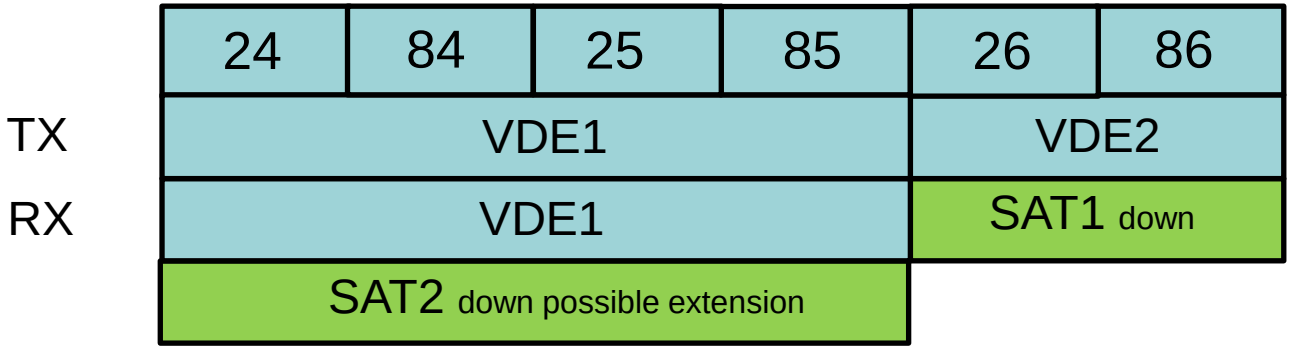
# Solution ?

2- Improved communications capacity

Terrestrial solution



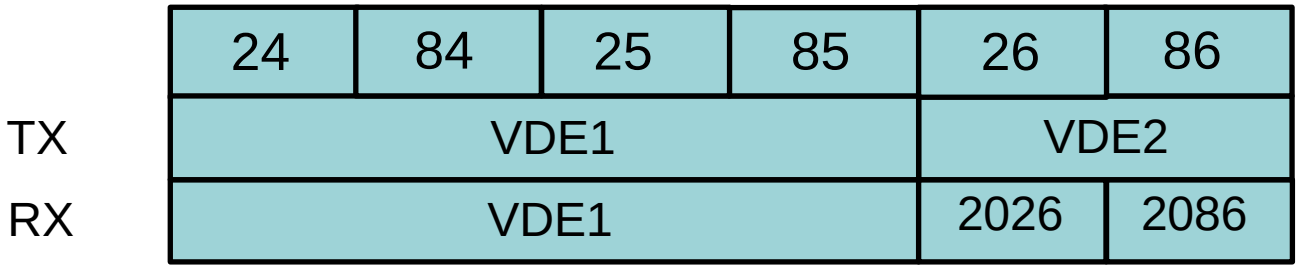

Satellite solution



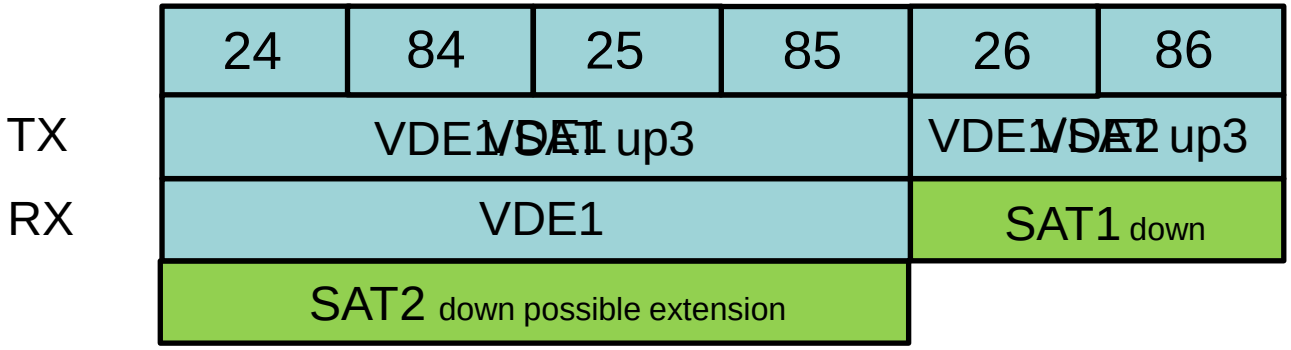
# Solution ?

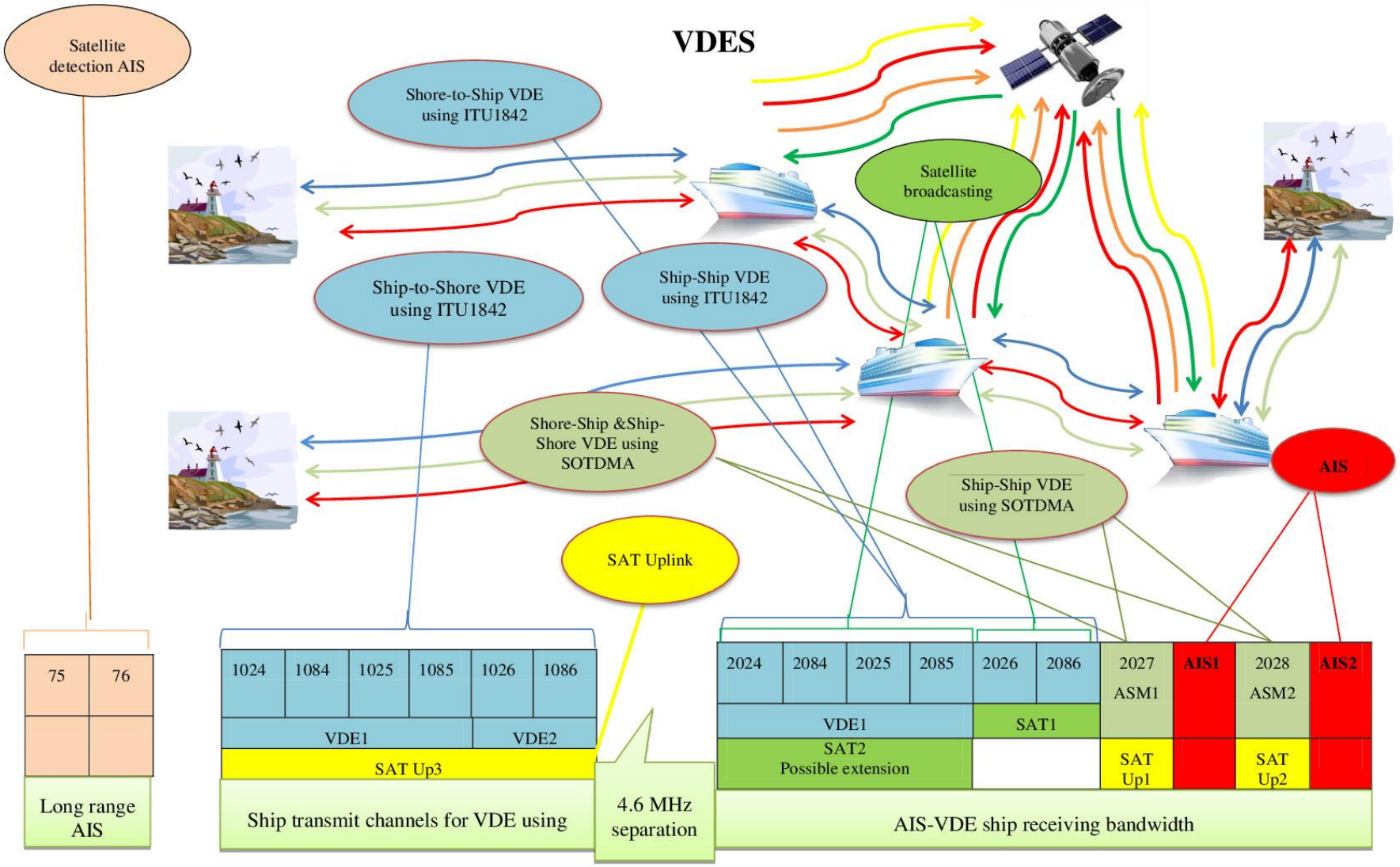
2- Improved communications capacity

Terrestrial solution




Satellite solution




VDES
Satellite detection AIS
Shore-to-Ship VDE using ITU1842
Satellite broadcasting
Ship-to-Shore VDE using ITU1842
Ship-Ship VDE using ITU1842
Shore-Ship &Ship-Shore VDE using SOTDMA
Ship-Ship VDE using SOTDMA
AIS
SAT Uplink
75
76
Long range AIS
1024
1084
1025
1085
1026
1086
VDE1
VDE2
SAT Up3
Ship transmit channels for VDE using
4.6 MHz separation
2024
2084
2025
2085
2026
2086
2027
ASM1
AIS1
2028
ASM2
AIS2
VDE1
SAT1
SAT2
Possible extension
SAT
Up1
SAT
Up2
AIS-VDE ship receiving bandwidth

# Comparison of AIS and VDE Data Transfer Methods by ITU-R M.1842

Agence Nationale des Fréquences

| | AIS1 and AIS2 (25 kHz Channels) | For 25 kHz Channels VDE Data Transfer Methods | VDE Data Transfer Methods For 50 kHz Channels | VDE Data Transfer Methods For 100 kHz Channels |
|---|---|---|---|---|
| **ITU Standard and Digital Modulation** | ITU-R M.1371<br>GMSK | ITU-R M.1842<br>Annex 1<br>π/8 D8PSK | ITU-R M.1842 Annex 3<br>16-OFDM + 16-QAM | ITU-R M.1842 Annex 4<br>32-OFDM + 16-QAM |
| **Data Rate** | **9.6 kbps (1X)** | **43.2 kbps (4X)** | **153.6 kbps (16X)** | **307.2 kbps (32X)** |
| **Sensitivity** | -107dBm | -107dBm | -103dBm (ship stations) | -98dBm (ship stations) |
| **Co-channel rejection (CCR)** | 10dB | 25dB | 19dB | 19dB |
| **Adjacent channel rejection (ACR)** | 70dB | 70dB | 70dB | 70dB |
| **AIS Message types** | 1, 2, 3, 5, 18, 19 … | 6, 7, 8,12,13,14 …and ASM | VDE messages TBD | VDE messages TBD |
| **Rationale** | Optimum choice for recurring position reports in a ship-ship navigation safety environment. | Provides high (4X) data transmission. Inferior CCR (+15dB) and range discrimination. | Provides much higher (16X) data transmission than AIS. Inferior CCR (+9dB) and range discrimination compared to AIS. | Provides much higher (32X) data transmission than AIS. Inferior CCR (+9dB) and range discrimination compared to AIS. |

Agence Nationale des Fréquences

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IHO, WWNWS 5
Monaco, 2nd October 2013