2010 NMEA Conference

HISTORY, CURRENT STATE, AND FUTURE OF THE VHF MARITIME SPECTRUM, THE MARITIME COMMUNITY’S MOST CRITICAL SPECTRUM RESOURCE
• …How much exclusively allocated maritime spectrum above 26 MHz there is?
Did you know?

• 100 kHz
• 156.8 MHz (Channel 16, 75 & 76)
• 157.1 MHz (channel 70)

THIS IS THE STORY ON HOW THAT CAME TO BE
These blocks represent LF 30-300 kHz, MF 0.3 to 3 MHz and HF 3 – 30 MHz. Maritime Spectrum is pale green-grey.
Current US VHF Maritime Band (not to scale)
USA/International mode?

Why do radios have a USA mode?

Do all marine radios have a USA mode?

What is the difference between a USA and International mode?
Current US VHF Maritime Band (to scale)
International VHF Maritime Band (to scale)
VHF Spectrum Lost by Maritime in the US
Why do radios have a USA mode?

Blue indicates maritime channels not available in the USA

“A” Channels (Ch5A, 22A) are USA only single frequency channels created from international two-frequency channels

Source: http://www.navcen.uscg.gov/marcomms/apps18.htm
Ch22: A bit of a safety problem

- Original USCG maritime broadcast/liaison channel 12
- 1970s FCC moved this USCG function to USA-only Channel 22A
- 10 yrs later a foreign ship being piloted in LI Sound unable to receive a CG Bcast of an adrift gasoline barge, and complained
Ch22: A bit of a safety problem

How was it resolved?

- Congress legislated interoperability requirement (OPA 90)
- USCG issued regulation requiring foreign ships carry USA-mode capable radios
  - Ch22A – USCG marine broadcasts
  - CH05A – VTS Puget Sound
• FCC requires VHF radios sold in US operate in USA Mode

• Manufacturers add International Mode to allow radio use and sales outside the US

• US influence as a major port state and marine electronics market is the only reason most foreign VHF radios have a USA mode
## Frequency Allocation

### Frequency Band and (Bandwidth) Mc/s

<table>
<thead>
<tr>
<th>Band Range</th>
<th>World-Wide</th>
<th>Regional 1</th>
<th>Regional 2</th>
<th>Regional 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>132–144 (12)</td>
<td>Aerospherical mobile (OR)</td>
<td>a) Fixed</td>
<td>a) Fixed</td>
<td></td>
</tr>
<tr>
<td>144–146 (2)</td>
<td>Amateur</td>
<td>b) Mobile</td>
<td>b) Mobile</td>
<td></td>
</tr>
<tr>
<td>146–235 (89)</td>
<td>146–156 (10) Aerospherical mobile (OR)</td>
<td>146–148 (2) Amateur</td>
<td>146–148 (2) Amateur</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b) Mobile except aero-spherical mobile</td>
<td>b) Mobile</td>
<td>b) Mobile</td>
<td></td>
</tr>
</tbody>
</table>

(cont’d)

### Notes

1. Chapter III, art. 5 RR
2. 50-E

(196—199)
The frequency 156.80 Mc/s is designated for world-wide use for safety, calling, and intership and harbour control communications in the maritime mobile service (simplex telephony). Any other use of this frequency should be avoided in areas where such other use is liable to cause harmful interference to the maritime mobile service. The interested administrations will ensure, by special arrangements where necessary, that an adequate guard-band is provided. In Region 2, its use for this purpose will be restricted to the frequency modulated type of transmission (F3) and it is strongly recommended that the same type of transmission be adopted for this purpose in Regions 1 and 3.
Gradual Establishment of a US Maritime VHF Band

• In 1948, USCG/IRAC gave FCC 200 kHz of VHF spectrum in exchange for maritime allocation, which eventually became ch21A-24A and 81A-84A

• From that start, other spectrum was gradually garnered over time and allocated around this block and around 156.8 MHz both in the US and in other countries

• It all came together in 1959, at the first major ITU World Administrative Radio Conference held since 1947
### APPENDIX 18

Table of Transmitting Frequencies for the Band 156-174 Mc/s for Radiotelephony in the International Maritime Mobile Service *

(See Article 35)

<table>
<thead>
<tr>
<th>Channel designators</th>
<th>Transmitting Frequencies (Mc/s)</th>
<th>Intership</th>
<th>Port Operations</th>
<th>Public Correspondence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ship Stations</td>
<td>Coast Stations</td>
<td></td>
<td>Single Frequency</td>
</tr>
<tr>
<td>1</td>
<td>156-05**</td>
<td>160-65</td>
<td>10</td>
<td>8</td>
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<tr>
<td>2</td>
<td>156-10</td>
<td>160-70</td>
<td>8</td>
<td>10</td>
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<tr>
<td>3</td>
<td>156-15**</td>
<td>160-75</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td>4</td>
<td>156-20</td>
<td>160-80</td>
<td>11</td>
<td>7</td>
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<tr>
<td>5</td>
<td>156-25</td>
<td>160-85</td>
<td>6</td>
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<td>6</td>
<td>156-30</td>
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<td>7</td>
<td>11</td>
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<tr>
<td>7</td>
<td>156-35</td>
<td>160-95</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>156-40</td>
<td>156-45</td>
<td>5</td>
<td>5</td>
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<tr>
<td>9</td>
<td>156-45</td>
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<td>3</td>
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<tr>
<td>10</td>
<td>156-50</td>
<td>156-55</td>
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<td>4</td>
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<td>11</td>
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<td>3</td>
<td>4</td>
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<td>12</td>
<td>156-60</td>
<td>156-60</td>
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<tr>
<td>13</td>
<td>156-65</td>
<td>156-65</td>
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<td>2</td>
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<td>14</td>
<td>156-70</td>
<td>156-70</td>
<td>1</td>
<td>2</td>
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<td>15</td>
<td>Guard band 156-725 - 156-775 Mc/s</td>
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<tr>
<td>16</td>
<td>156-80</td>
<td>156-80</td>
<td>1</td>
<td>CALLING AND SAFETY</td>
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<tr>
<td>17</td>
<td>Guard band 156-825 - 156-875 Mc/s</td>
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<td></td>
</tr>
<tr>
<td>18</td>
<td>156-90</td>
<td>161-50</td>
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<td>19</td>
<td>156-95</td>
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<td>21</td>
<td>157-05</td>
<td>156-05** or 161-65</td>
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<td></td>
</tr>
<tr>
<td>22</td>
<td>157-10</td>
<td>161-70</td>
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</tr>
<tr>
<td>23</td>
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<td>28</td>
<td>157-40</td>
<td>162-00</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

* For assistance in understanding the Table, see notes a) to g) below.
** See Note e).  *** See Note f).
The frequency 156.8 Mc/s is the international safety and calling frequency for the maritime mobile VHF radiotelephone service. Administrations shall ensure that a guard-band of 75 kc/s on each side of the frequency 156.8 Mc/s is provided. The conditions for the use of this frequency are contained in Article 35.

In the bands 156.025-157.425 Mc/s, 160.625-160.975 Mc/s and 161.475-162.025 Mc/s, each administration shall give priority to the maritime mobile service on only such frequencies as are assigned to stations of the maritime mobile service by that administration (see Article 35).

Any use of frequencies in these bands by stations of other services to which they are allocated, should be avoided in areas where such use might cause harmful interference to the maritime mobile VHF radiotelephone service.

“RR 287 Type of Problem” – that the only international maritime channels a nation needs to make available are those that the nation decides to make available. You can drive a bulk carrier through that loophole!
Mr. Earl Holliman, a US Army delegate to the 1959 World Administrative Radio Conference made this statement:

“The WARC59 was the worst experience and disappointment that I ever had in international and allied negotiation. The railroads organized an effective fight using a few near accidents and how they had improved the channels by narrow band voice. The railroads sent a three-man lobby to Washington and Geneva, the US position was more favorable to the railroads at the time, and when we got to Geneva only the Norwegians and Swedes gave active support. The railroads were using several channels to transmit remote control to the rear-end pusher engines, and after radio interference (hinted as a boat transmission) pushed a sidetracked freight onto the main line in front of a passenger train, it was called a safety issue.”

In the end, while the Radio Conference established the maritime channels we know today, the agreement was carefully worded to allow its use to be optional in each country.
Where the USA channels came from

• In 1965, the FCC issued final rules implementing this 1959 Radio Conference decision:
  
  – Channels 1A-4A: land mobile - public safety
  – Channels 5A-28A: maritime mobile per 1959 Conference
  – Channels 1B-7B, 18B, 19B: land mobile – land transportation
  – Channel 20B: maritime mobile per 1959 Conference
  – Channels 21B-23B: land mobile – remote pickup broadcast
  – Channels 24B-28B: maritime mobile per 1959 Conference

• Mariners received two-thirds, 30 of the total 46 50-kHz channels
### Only one channel truly allocated maritime

<table>
<thead>
<tr>
<th>Channel</th>
<th>Usage</th>
</tr>
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<tbody>
<tr>
<td>150.05-153</td>
<td>FIXED</td>
</tr>
<tr>
<td></td>
<td>MOBILE except aeronautical mobile</td>
</tr>
<tr>
<td></td>
<td>RADIO ASTRONOMY</td>
</tr>
<tr>
<td>153-154</td>
<td>FIXED</td>
</tr>
<tr>
<td></td>
<td>MOBILE except aeronautical mobile (R)</td>
</tr>
<tr>
<td></td>
<td>Meteorological Aids</td>
</tr>
<tr>
<td>154-156.7625</td>
<td>FIXED</td>
</tr>
<tr>
<td></td>
<td>MOBILE except aeronautical mobile (R)</td>
</tr>
<tr>
<td>156.7625-156.8375</td>
<td>MARITIME MOBILE (distress and calling)</td>
</tr>
<tr>
<td>156.8375-174</td>
<td>FIXED</td>
</tr>
<tr>
<td></td>
<td>MOBILE except aeronautical mobile</td>
</tr>
<tr>
<td>CH16 is the only portion of the VHF spectrum truly allocated as “maritime”</td>
<td></td>
</tr>
</tbody>
</table>
Remember the 200 kHz the federal government gave to maritime in 1948?

<table>
<thead>
<tr>
<th>Channel designator</th>
<th>Notes</th>
<th>Transmitting frequencies (MHz)</th>
<th>Inter-ship</th>
<th>Port operations and ship movement</th>
<th>Public correspondence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ship stations</td>
<td>Coast stations</td>
<td></td>
<td>Single frequency</td>
</tr>
<tr>
<td>16</td>
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<td>156.800</td>
<td>156.800</td>
<td>DISTRESS, SAFETY AND CALLING</td>
<td></td>
</tr>
<tr>
<td>76</td>
<td>n)</td>
<td>156.825</td>
<td></td>
<td>x</td>
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<tr>
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<td>161.600</td>
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<td>x</td>
</tr>
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<td>161.675</td>
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<td>x</td>
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<td>161.700</td>
<td>x</td>
<td>x</td>
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<td>82A</td>
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<td>157.125</td>
<td>161.725</td>
<td>x</td>
<td>x</td>
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<tr>
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<td>m, o)</td>
<td>157.150</td>
<td>161.750</td>
<td>x</td>
<td>x</td>
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<td>83A</td>
<td>m, o)</td>
<td>157.175</td>
<td>161.775</td>
<td>x</td>
<td>x</td>
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<tr>
<td>24</td>
<td>m, o)</td>
<td>157.200</td>
<td>161.800</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>84</td>
<td>m, o)</td>
<td>157.225</td>
<td>161.825</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U.S. Coast Guard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Federal Agencies</td>
</tr>
<tr>
<td>Environmental Protection Operations</td>
</tr>
</tbody>
</table>
More VHF Maritime Channels are Coming?

- Remember VHF Maritime Radio ads in the 1970s and 80s saying that more VHF channels may be added soon?

- Where did that rumor come from?

  - long waits which used to be needed to contact a VHF marine operator to make a ship-to-shore call.
The plan to recover international maritime channels in the US

- During the 1970s various maritime interests, including the U.S. Coast Guard, advocated that Footnote 287 be deleted at the upcoming 1979 WARC.

- 1974 US Position relating to RR 287 was:
  - “The IRAC/FCC long range plan is to return all Appendix 18 channels to the maritime mobile service” (FCC 2nd Report Docket 19325)
  - “At the earliest practical date, the FCC will take appropriate action with a view to obtaining suitable replacement frequencies outside of Appendix 18 channels for the existing land mobile services”
The proposal by the maritime community prompted FRA/DOT to initiate a study of railroad frequency use (Report No. FRA-RFA-78-02, pursuant to Contract No. AR-64262). The report concluded that the proposal of the maritime interests would, if implemented, have “serious negative ramifications in efficiency and safety for all elements of the railroad industry.” The report recommended that DOT register its opposition to the maritime proposal.

DOT did register its opposition, and the official position of the U.S. government at WARC-1979 was to oppose the maritime proposal. As a result, Footnote 287 (since renumbered as Footnote 5.226) has remained as part of the ITU table of allocations.
An alternative solution?

- “Identification of frequency bands is essential to fit with U.S. operating land mobile systems, which would permit maritime to be implemented in the U.S., and so that RR 287 type of problem could be prevented”.
  - US Alternative Position for 1979 WARC (in seeking maritime mobile allocation in the 216-225 MHz or 800 MHz band)
• 1979 US Position relating to RR 287 was:
  – Little hope existed to satisfy existing requirements on Appendix 18 frequencies, especially public correspondence.
  – Inadequate spectrum is available for growth between 157 and 174 MHz.
  – American Association of Railroads strongly opposed deletion of RR 287, since it would “have consequences endangering the operations and safety of the entire railroad industry”, but also admitted it could be deleted if given seven years to move.
  – FCC questioned how immediate needs of maritime can be met except through domestic rulemaking
    – FCC Docket 2027
So how was this “long range plan” implemented?

- FCC allocated 80 channels in the 216 to 220 MHz band for the Automated Maritime Telecommunications System (AMTS)
  - TV Channel 13 severely restricted use of this band
  - Watercom operated in this band
  - This band was never recognized internationally
  - USCG never used nor had any interest in this band

- AMTS spectrum auctioned in 2005 for $10M

- So, where does that leave us today?
How is the spectrum surrounding the maritime band used?

- International maritime
- Part 80 maritime
- Part 80 maritime (auctioned)

25 watt ship
50 watt shore
FCC wants to move public safety users to 700 MHz for improved bandwidth & interoperability, but VHF is cheaper and still in heavy demand.
Part 90 Industrial/Business

International maritime
Part 80 maritime
Part 80 maritime (auctioned)
Part 90 Public Safety
Part 90 Industrial/Business

500 watt base station

Railroad channels
160.215 – 161.610 MHz
Where this railroad spectrum is being used today
Part 22 Public Mobile Service

- International maritime
- Part 80 maritime
- Part 80 maritime (auctioned)
- Part 90 Public Safety
- Part 90 Industrial/Business

Part 22 Public Mobile Service/Pagers

1400 watt base station
Pagers disrupted bridge-to-bridge communications in lower Mississippi River in mid 1990s

Local/Distance switch is the result
Coast Guard AIS interference at Troy NY

- 34 dB Troy interference occurred this summer every day like clockwork

- Interference traced to 200w pager at 157.7475 MHz
Part 74D Remote Pickup Broadcast

- International maritime
- Part 80 maritime
- Part 80 maritime (auctioned)
- Part 90 Public Safety
- Part 90 Industrial/Mobile

Part 22 Public Mobile Service/pagers
- Part 74D Remote Pickup Broadcast
  - 100 watts

Frequency bands:

- 155
- 156
- 157
- 158
- 159
- 160
- 161
- 162
- 163
Federal Land Mobile

International maritime
Part 80 maritime
Part 80 maritime (auctioned)
Part 90 Public safety
Part 90 Industrial/Business

No federal power limits but generally <500w

1 KW NOAA Weather Radio is the exception
What happened to the auctioned maritime band?

International maritime
Part 80 maritime
Part 80 maritime (auctioned)
Part 90 Public safety
Part 90 Industrial/Business

Part 22 Public Mobile Service/pagers
Part 74D Remote Pickup Broadcast
NTIA Federal Land Mobile
### Last of the available internationally-interoperable maritime channels

<table>
<thead>
<tr>
<th>Channel designator</th>
<th>Notes</th>
<th>Transmitting frequencies (MHz)</th>
<th>Inter-ship</th>
<th>Port operations and ship movement</th>
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<td>Two frequency</td>
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<td>24</td>
<td>m), o)</td>
<td>157.200</td>
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<td>AIS 1</td>
<td>l)</td>
<td>161.975</td>
<td>161.975</td>
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<tr>
<td>AIS 2</td>
<td>l)</td>
<td>162.025</td>
<td>162.025</td>
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</tr>
</tbody>
</table>

- Ten years ago the FCC auctioned channels 24-28 and 84-87 to MariTEL, who planned to build an automated nationwide maritime telephone network.
- That business plan failed, and today MariTEL is a spectrum broker.
- These channels are the last of the available internationally-interoperable maritime communications spectrum left in the US.
How are these “public correspondence” channels used?

• Spectrum auction winners lose their license
  – If system not built out within ten years
  – At time of license renewal if system not available for service

• It appears that MariTEL plans to meet FCC build-out requirements through
  – Seatow’s “Seasmart” system
  – License arrangements within dozens of yacht clubs and other users
  – License waiver arrangements with land mobile providers - the demand here is huge
What happened to the auctioned VHF spectrum?

MariTEL retains most coastal spectrum

Motorola/Riverside

Pacificorp

Motorola
- Proposal to “disaggregate” 3 “auctioned” maritime public correspondence channels for Riverside County CA public safety use
- NTIA/USCG filed opposition
- BOAT US & RTCM also filed opposition
- No demonstrated need for these maritime channels?

- FCC Application File No. 0003743672
Last of the internationally-interoperable spectrum left

- The last internationally-interoperable maritime spectrum left in the US. Is it still needed?
  - Interoperable with millions of ship radios on vessels.
  - The international maritime community decides its use

- #1: Only place where growth can occur
  - Channels for harbor pilots, new VTS systems
  - Recreational boaters, Homeland security interoperability

- #2: Only available resource for new maritime technology
  - Past examples: DSC, AIS
  - Where else will spectrum come from for new maritime internationally-interoperable wireless technology?

- Alternate solution #1: redesignate existing channels
  - “Rob Peter to pay Paul”

- Alternate solution #2: buy back from existing land mobile users when needed
USCG spectrum needs

• AIS Channel Management
  – Where can AIS operations be switched in an emergency?
• AIS Blue Force Tracking
• Traffic offloading for satellite detection of AIS
• VTS Growth
• Sector use - unencrypted comms
• Broadcast channel (Supplemental to ch22)
• Permissibility of federal lease or purchase of non-federal spectrum has been questioned
What are the needs of the maritime community?

- FCC doesn’t “preserve” spectrum – it allocates spectrum based upon documented needs and the national interest.
- What are the needs of the maritime community?
- Are existing maritime channels sufficient for the foreseeable future?
- Future spectrum needs must be met from whatever spectrum remains
  - e.g. Ch70 DSC from boater channel in 1983
- How can spectrum be preserved for possible eNAV use?
- If maritime community cannot document need, then remaining spectrum cannot be preserved for maritime
What then shall we do?

What do we do?

Participate in the FCC process

Demonstrate and document the need
Questions?

International maritime
Part 80 maritime
Part 80 maritime (auctioned)
Part 90 Public safety
Part 90 Industrial/Business

Part 22 Public Mobile Service/pagers
Part 74D Remote Pickup Broadcast
NTIA Federal Land Mobile

Railroad
VHF Maritime Band

- US
- Auctioned
- Land Mobile
- Fed

Frequencies:
- 156 MHz
- 157 MHz
- 158 MHz
- 159 MHz
- 160 MHz
- 161 MHz
- 162 MHz
VHF Maritime Band

- **US**
- **Auctioned**
- **Land Mobile**
- **Fed**

Frequency range: 156 MHz to 162 MHz