VHF Marine Radio

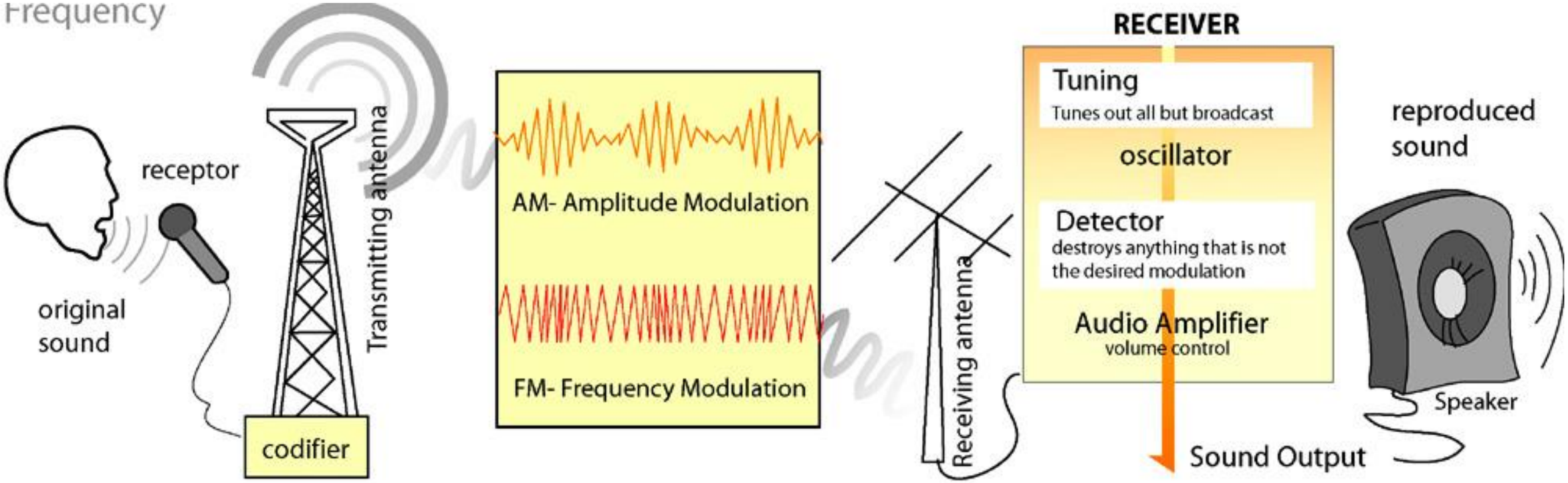
Part 1 of our Trilogy:
VHF & AIS

Scott Richard Berg
WAØLSS /MM, WDC8214, KCQ

- Licensed Marine Radio Operator
- Commercial Marine HF Station Operator (GMDSS)
- USCG GMDSS Taskforce Member
- Extra Class Ham Operator
- AIS Dealer and Installer
- Full Time Cruiser
- USCG Licensed Captain

What is Radio Anyway?

- Encoding, Transmitting, Receiving, & Decoding Information
- Little real change from early days of Marconi and Morse to your Pactor Modem and Sat Phone



"Modes" of Transmission

- CW (Morse Code using Continuous Waves)

- AM/FM (Amplitude and Frequency Modulation)
- SSB (Single Sideband)

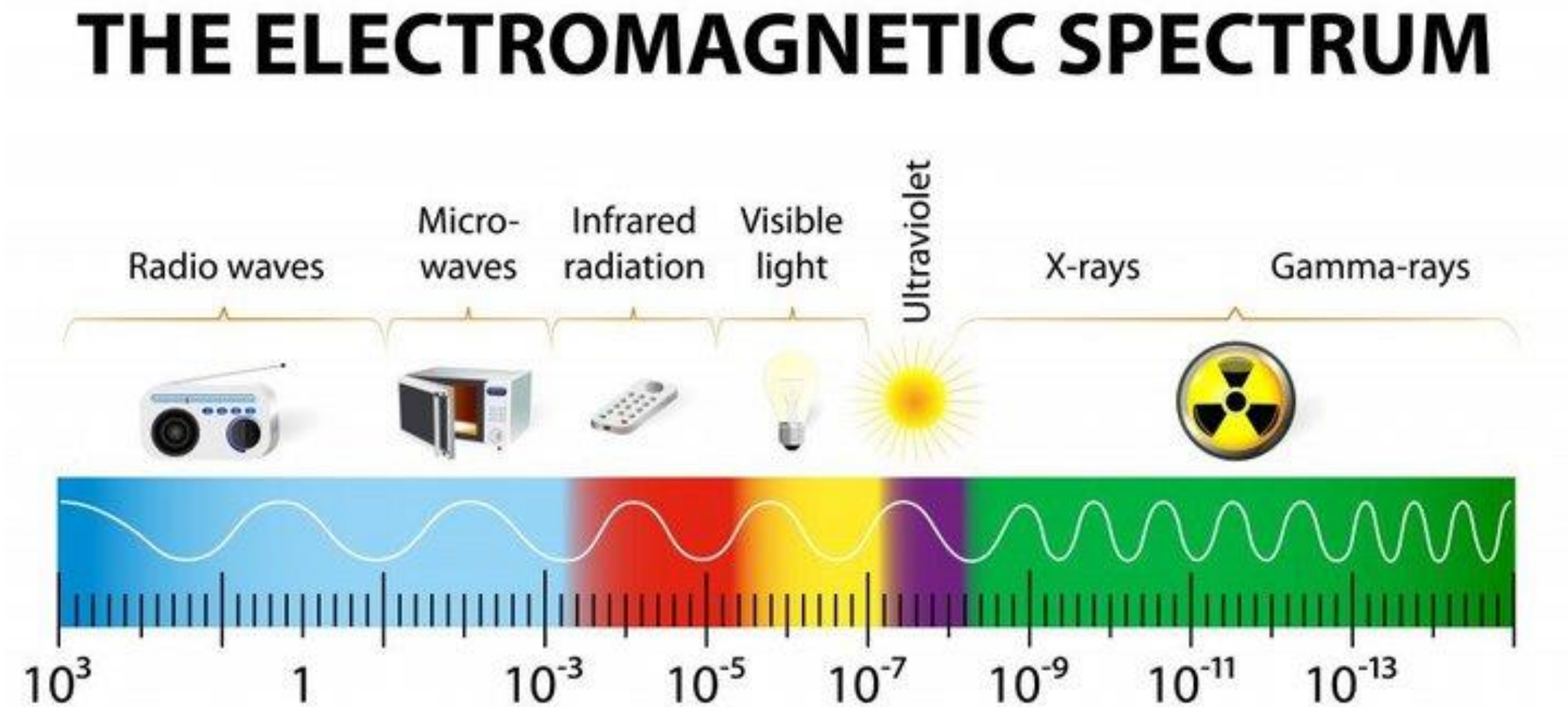
- Marine VHF (FM, Aircraft VHF is AM)
- SSB (a type of AM as well)
- Digital modes like Pactor over HF are types of AM

- Digital Cell Phones & Sat Phones are types of FM

From "DC to Daylight"

Thinking in Powers of 10

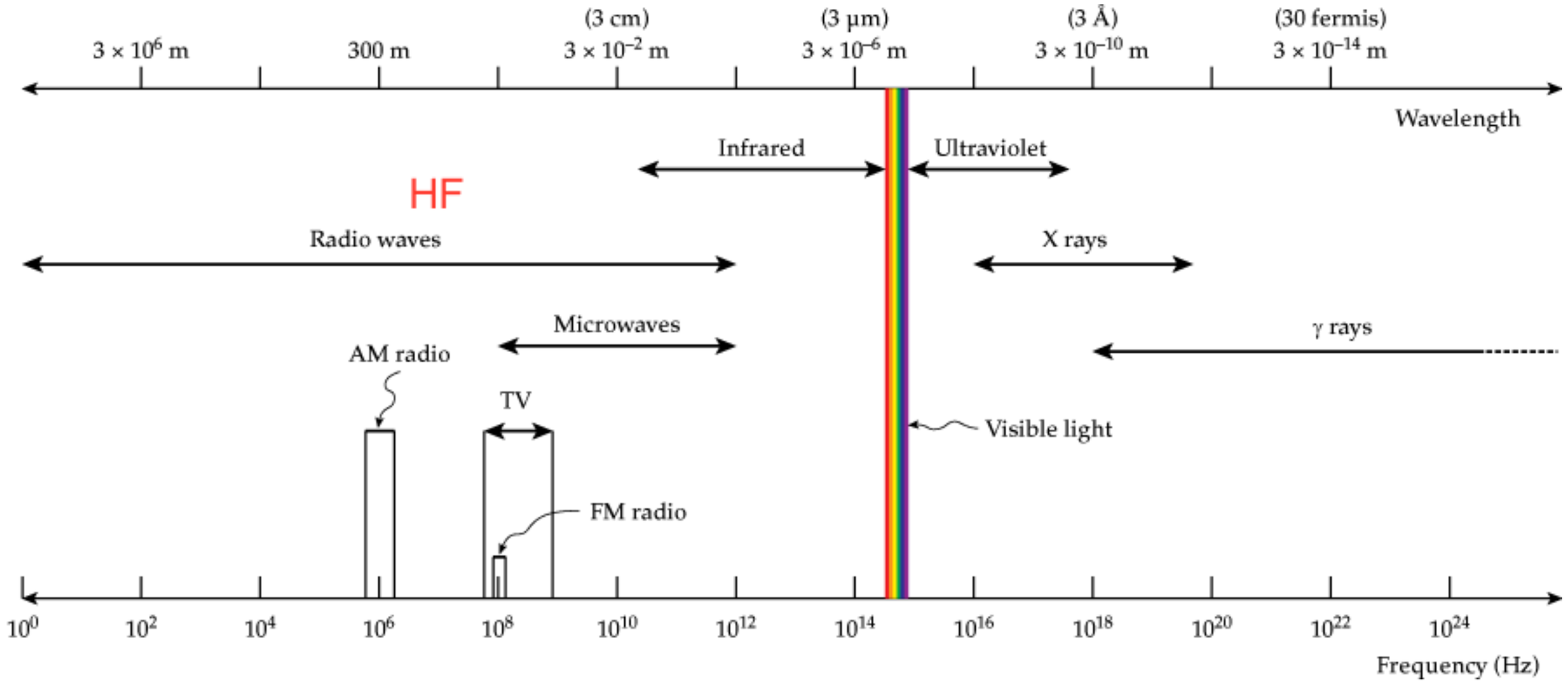
Frequency vs Wavelength



For Extra Credit: Understanding Orders of Magnitude

- $10^{1} = 10$
- $10^{2} = 100$
- $10^{3} = 1000$
- $10^{-2} = .01$
- 10^{100} = a GooglePlex!

Marine Communications along the Radio Spectrum



Converting Frequency to Wavelength

λ = Wavelength
f **= Frequency**
v (or c in a vacuum) = Velocity (speed of light)

$$\lambda = V / f$$

And

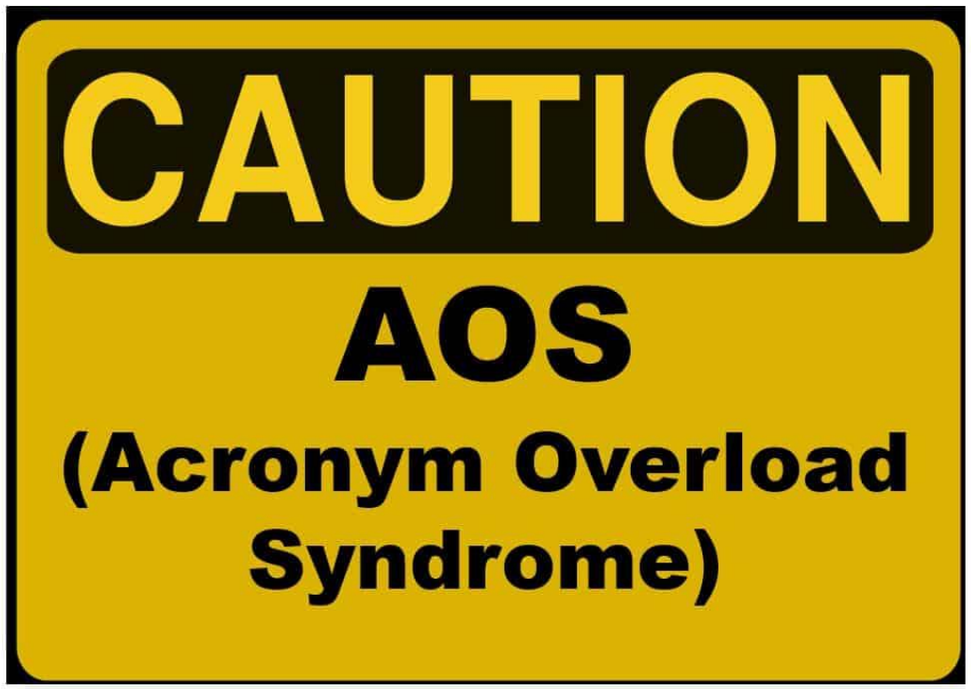
$$f = V / \lambda$$

Which is great for calculating the color of the blue sky but for our needs a simpler formula (derived from this) is:

Wavelength (λ) = 300 / frequency (*f*) in MHz
so:
The 20m Ham Band is at 14.300mhz. This will be important!

Acronym Check

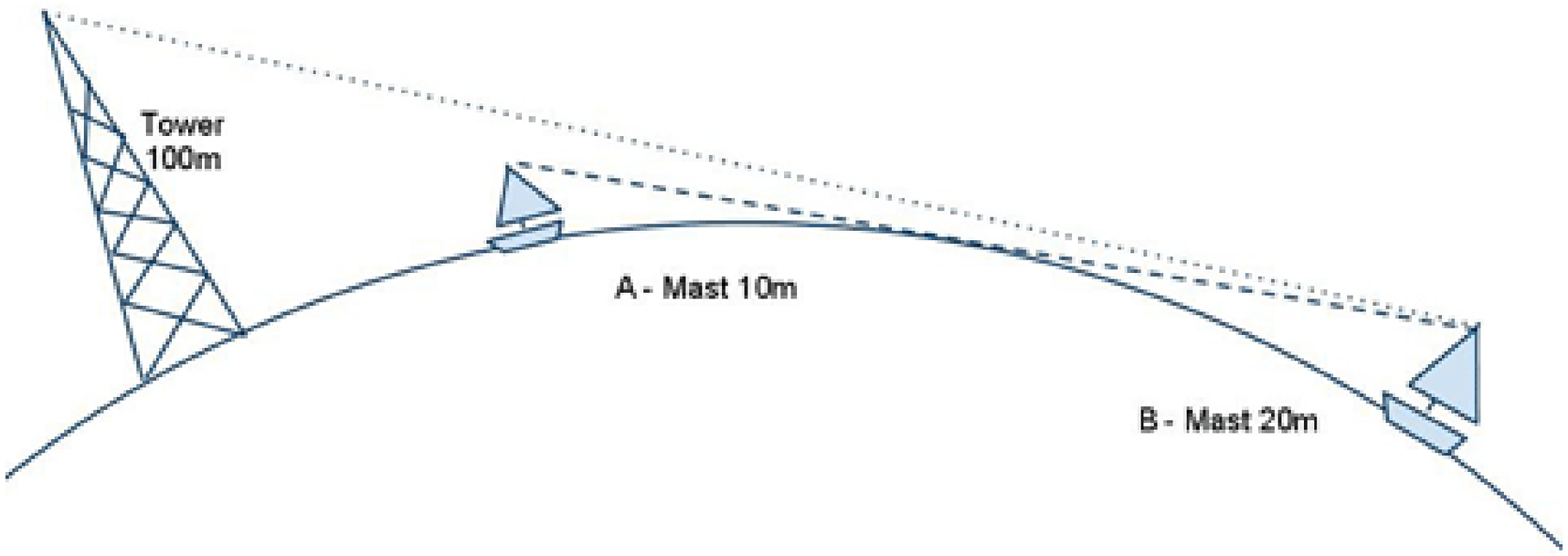
- GMDSS (Global Maritime Distress & Safety System)
- VHF (Very High Frequency)
- HF (High Frequency)
- AIS (Automatic Identification System)
- AM/FM (Amplitude & Frequency Modulation)
- SSB (Single Side Band)
- CW (Continuous Wave)
- AMTOR (Amateur Teleprinting Over Radio)
- PACTOR (Portmanteau of Packet Radio & AMTOR)
- RADAR (RAdio Dectection And Ranging)



VHF

- Used by Everyone from Hams to Aircraft
- Amateur, Military, First Responders, and more
- Installed and Hand-Held
- Line of Sight Communication

$$\text{Horizon (km)} = 3.57\sqrt{\text{Mast height (m)}}$$



Marine VHF

- “Line of Sight” “Party Line” communication using FM with Fixed Station and Hand Held Radios
  - Digital Selective Calling
  - GPS Enabled
  - That "Little Red Button"

- 1st Line of Boat to Boat and Emergency Communication

Installation 1

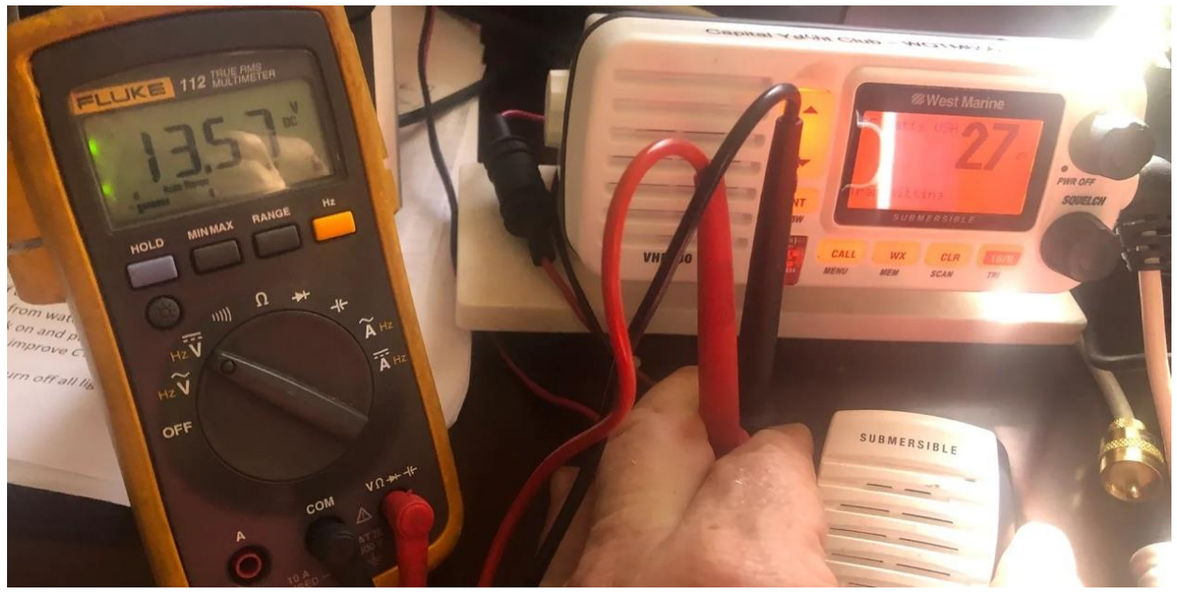
- Radio Location
- Power Voltage, Cabling, and OCP
- Antenna Feed Line
- Antenna Location

Radio Location

- Dry unless truly Water-Proof Radio
- Remote Mic in Cockpit
- Good cable runs available
- Easy to reach Mic from helm
- Easy to reach by 2nd User

DC Power Supply

- Tinned Copper Wire with <3% Voltage Drop
- Circuit Breaker to protect Wire
- Factory fuse to protect Radio
- Chafe Protection for all wire



Antenna Feed Line

- Best COAX CABLE you can source
- Professionally Crimped or Soldered TOP Connection
- Test Connection with VSWR Meter or Analyzer
- Seal outside with COAXSEAL
- Pro Hint: Solder the ‘top’ sailboat connection below!

COAX

The Good, The Bad, & The Ugly

Common *RG8X* looses 4.7db or almost 70% of it's total power in 100' @ VHF Frequencies

***LMR400UF* less than 1db or about 30%**

GOOD COAX MATTERS!

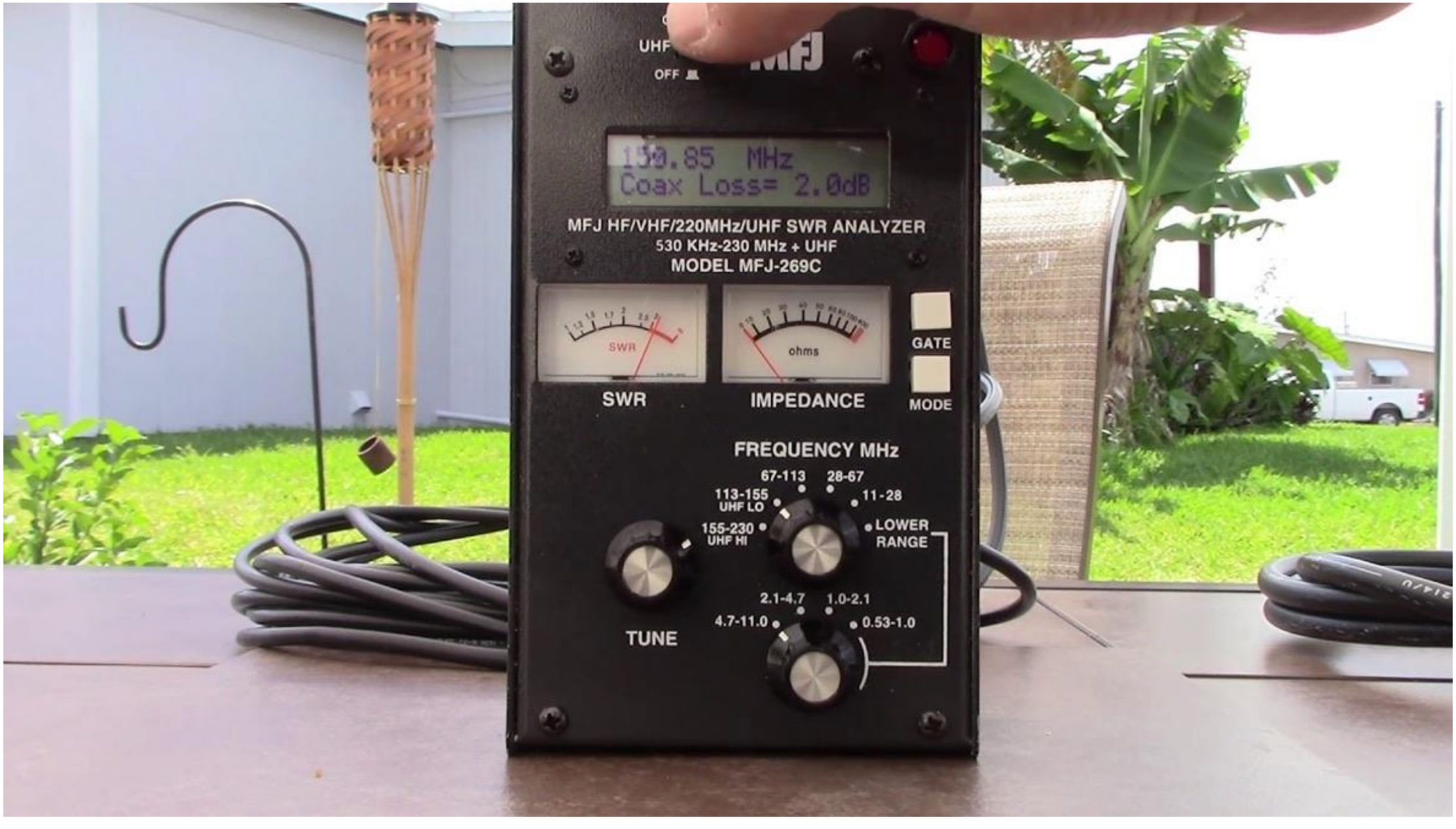
Save This…

	30	50	100	144	150	440
LMR-100A®	3.9	5.1		8.8	8.9	15.6
RG-58A/U	2.5	4.1	5.3	6.1	6.1	10.4
LMR-200®	1.8	2.3		3.9	4	6.9
RG-59		2.4	3.5			7.6
RG-8X	2	2.1	3	4.5	4.7	8.1
LMR-240®	1.3	1.7		3	3	5.2
LMR-240 Ultra®	1.3	1.7		3	3	5.2
RG-8/U		1.2	1.8			
RG-213		1.5	2.1	2.8	2.8	5.1
RG-214	1.2	1.6	1.9	2.8	2.8	5.1
LMR-400®	0.7	0.9		1.5	1.5	2.7
LMR-400 Ultra®	0.7	0.9		1.5	1.5	2.7

Testing the Antenna

- Using an SWR/Watt Meter & Dummy Load
- Using an Antenna Analyzer
- DB Loss is the issue. Every 3db cuts power by 50%
- Few Cruisers will have an Analyzer
- Find a local Ham Radio Club!

Antenna Analyzer



SWR Meters


WATTS
THRULINE®
BIRD ELECTRONIC CORP
25W
100-250MHz
25C
CLEVELAND, OHIO USA
SUBMERSIBLE
West Marine
Yacht Club – WQTM656
VOLUME
SQUELCH
Transmitting at
25 watts
ENT
CALL
MENU
WX
MEM
CLR
SCAN
TRI


MFJ
FORWARD
REFLECTED
SWR


RADIO
ANT
WATTS/VSWR
Shakespeare®
ART-3
Antenna
Radio
Tester
VHF Band

Aircraft VHF

- Still “Line of Sight” “Party Line” communication using AM(!) with Fixed Station and Hand Held Radios
- "Guard” Frequency is 121.5 (same as an SART Beacon)
- Your marine VHF can’t call most commercial aircraft
- Your aircraft VHF can in an emergency!
- We carry an Icom A23 in our ‘Ditch Bag’

Automatic Identification System (AIS)

- A Boat to Boat VHF Based System using GPS to Transmit your Boat's Position, Course, Speed and More

- Class A, B, B+ (with more on the way)

- Transmit vs Receive Only

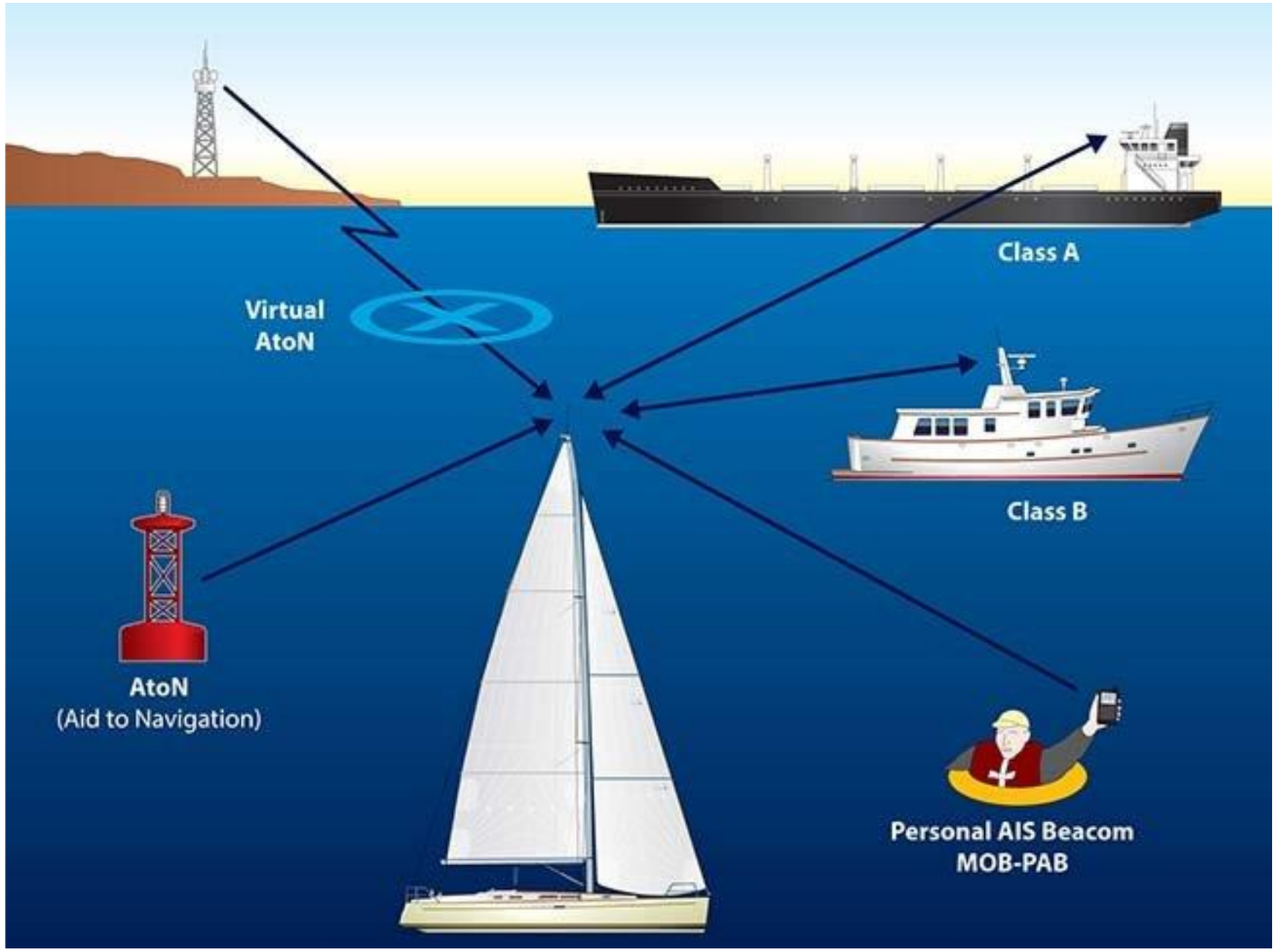
- A True “Game Changer”

- Privacy Concerns

Classes of AIS

- Class A—12w, variable output
- Class B — 2w, fixed output, slower packets
- B + Models (now 5 watt, more packets, evolving
- Receive Only
- Shore Stations

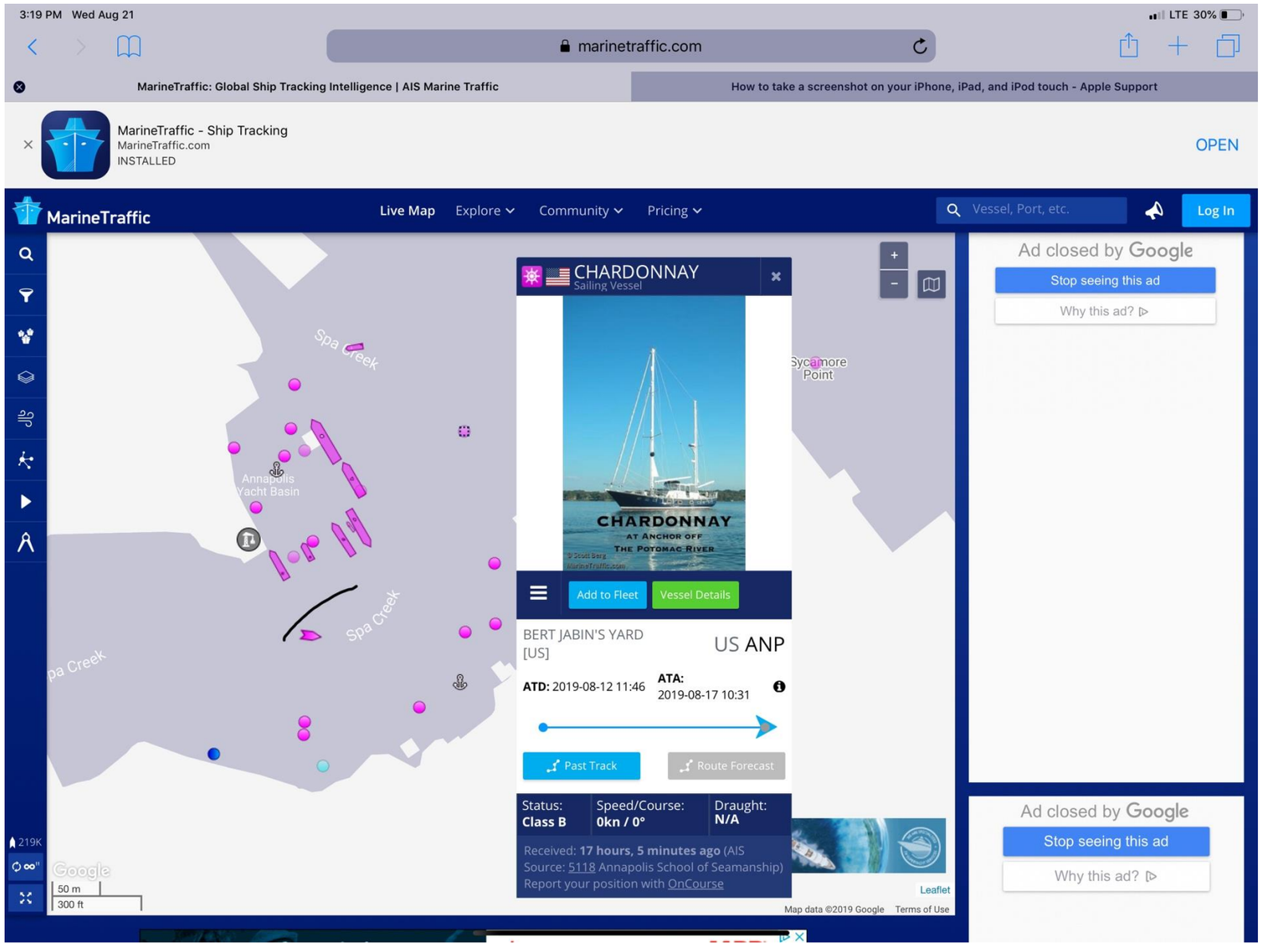
AIS in Action



Cruising with AIS

- Be Followed by Shore Side Friends (MarineTraffic.com)
- Ships Changing Course for you
- Boats Hidden Behind the Bend
- Calling Ships by Name
- Integrated VHF/AIS Systems

Annapolis Harbor



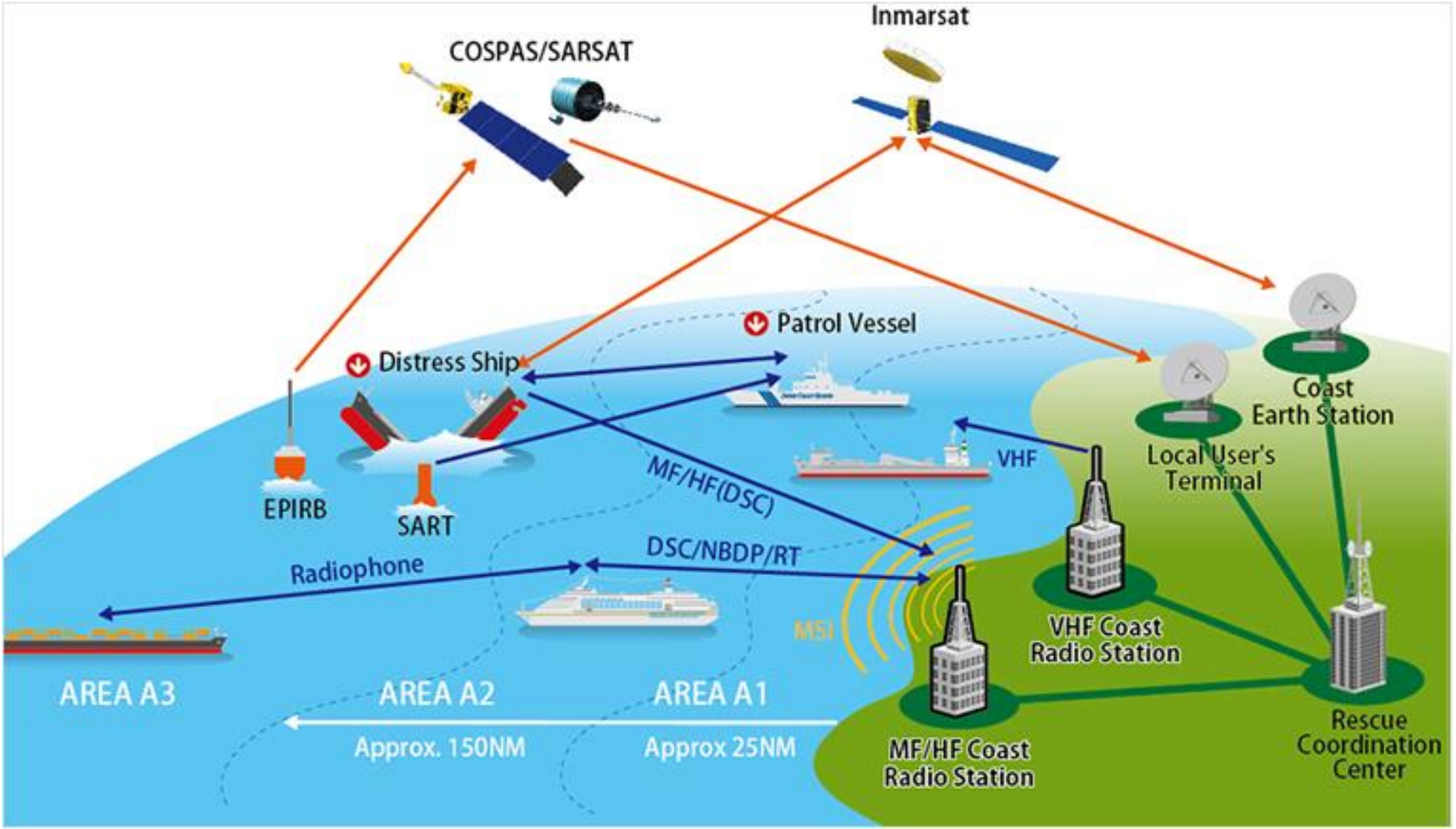
Important AIS Facts

- Be sure your AIS is "Type Approved" for your flag country
- Be sure your AIS is correctly programmed with your yacht information and MMSI—This is done by the dealer usually
- Remember (from our VHF Discussion): Not all MMSI's are the Same (FCC issued critical for cruisers)
- Boat US and USPS ‘OK’ for local waters, but…
- Like with VHF Voice, ALWAYS use best engineering practices: Antennas, Antenna Feed Line, Power Cabling, and Power Supply Voltage

Keeping Legal

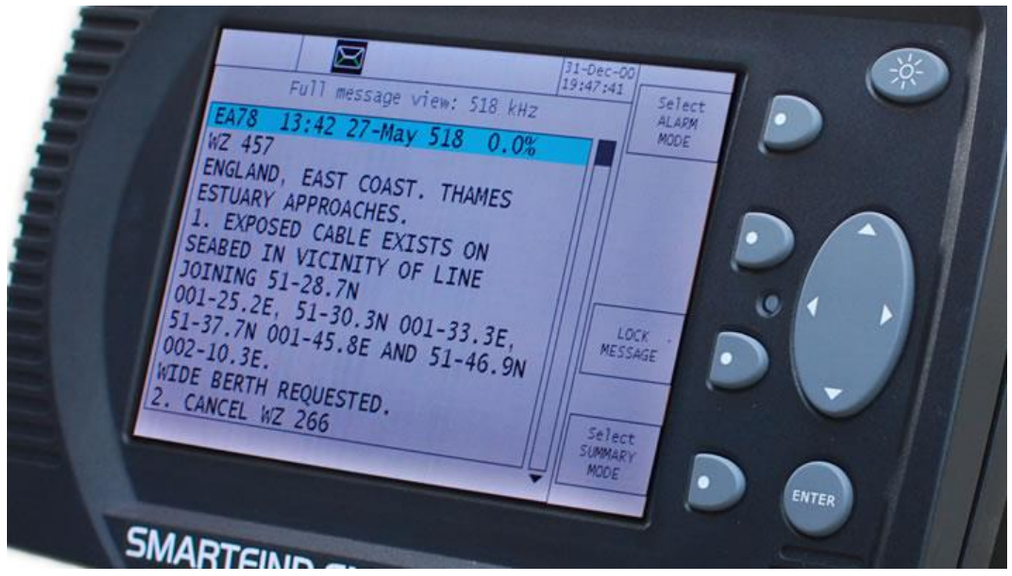
- Ship's Station License (required for all but domestic VHF operation)
  - Issued in the US by the FCC in the US
  - Good for 10 Years
  - Comes with Call Sign & "Real" MMSI
- Station Operator's License
  - **Required for all but fully domestic VHF operation**
  - Restricted (RROP), Marine (MROP), Commercial (GROL)
- Type Approved Equipment
  - FCC Part 15, 80, and 97

GMDSS
(Global Maritime Distress & Safety System)



GMDSS

- VHF & VHF DSC Radio
- MF/HF DSC Radio
- EPIRB (COSPAS/SARSAT)
- SART
- NAVTEX
- INMARSAT
- Iridium (Finally)



Questions?