“VHF Radio and Beyond”

Marine VHF Radio

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SAILAPALOOZA

Agenda

Marine VHF radio, its use and operation

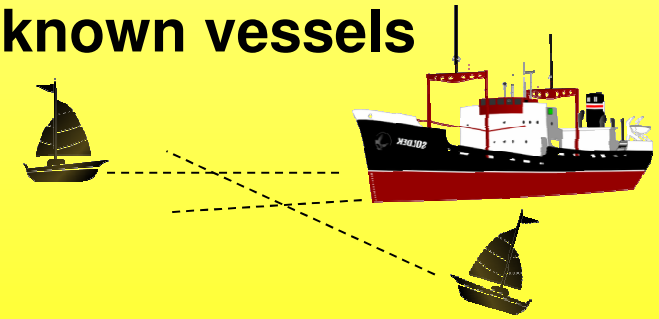
- ❑ **Why VHF Marine Radio?**
- ❑ **How VHF Radio Works**
- ❑ **Radios & Operation**
  - Fixed Mount & Handheld
- ❑ **Digital Selective Calling (DSC)**
- ❑ **Procedures & Rules**
  - Routine & Emergency
- ❑ **Summary**
- ❑ **Q&A**

Why VHF Marine Radio?

VHF radio communicates directly with vessels and shore stations

- **VHF Radio ("VHF") can be heard by all stations in range**
  - Reaches closest vessels in emergency
  - Groups can easily keep in touch 
- **USCG continuously monitors VHF**
  - Voice and Digital Selective Calling (DSC)

- **VHF allows communicating with unknown vessels**
  - For safety or courtesy purposes
  - Vessel ID or name not needed

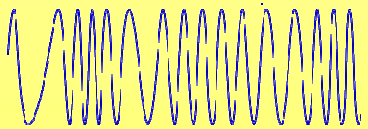


- **Many shore facilities monitor VHF**
  - Marinas, Gas Docks, Restaurants, Yacht Clubs

VHF Radio Characteristics

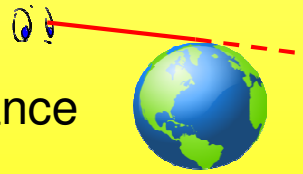
VHF marine radio is 2-way simplex FM

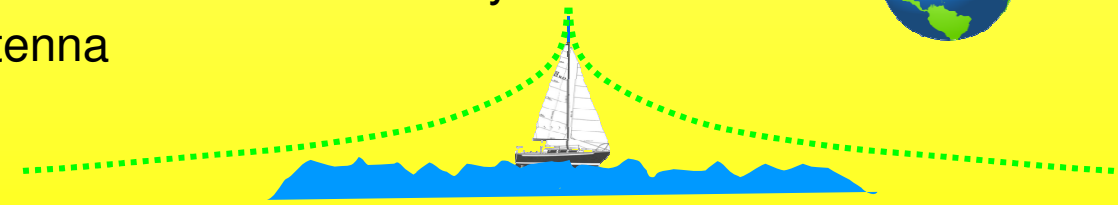
- **VHF Marine Radio uses FM (Frequency Modulation)**
  - Clear sound except for very weak signals
  - Strongest signal will "capture" receiver



- **VHF marine radio is Simplex (one way at a time)**
  - You can't hear the other station when you are transmitting
  - Station take turns talking

- **Usable distance (range) depends on several factors**
  - Line of Sight
  - Transmitter Power – Decays with distance
  - Antenna





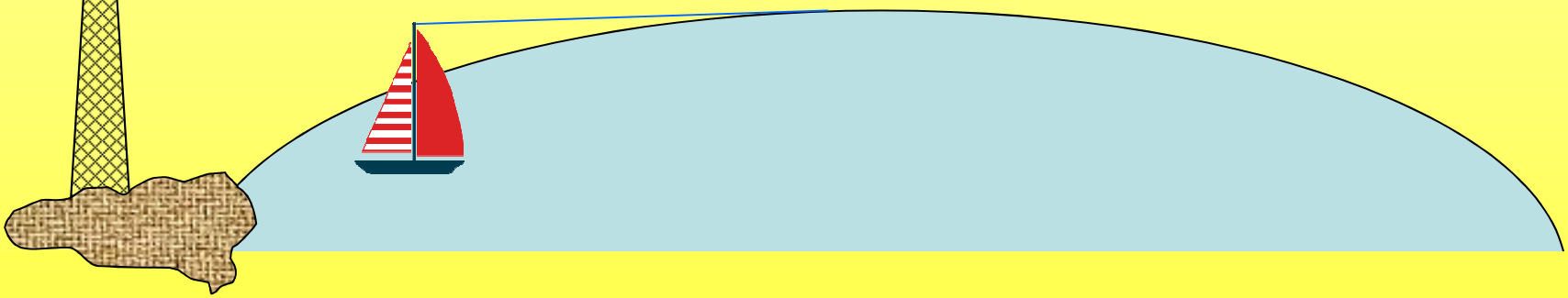
Line of Sight

The horizon is the ultimate line-of-sight obstruction

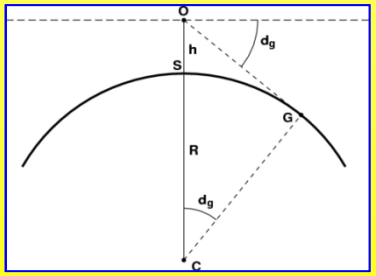
Rule of Thumb $\quad Horizon\ (nm) \approx 1.2 \times \sqrt{height\ (ft)}$

Example:

9 feet height $\quad Horizon \approx 1.2 \times \sqrt{9} = 1.2 \times 3 =$ *3.6 nm*



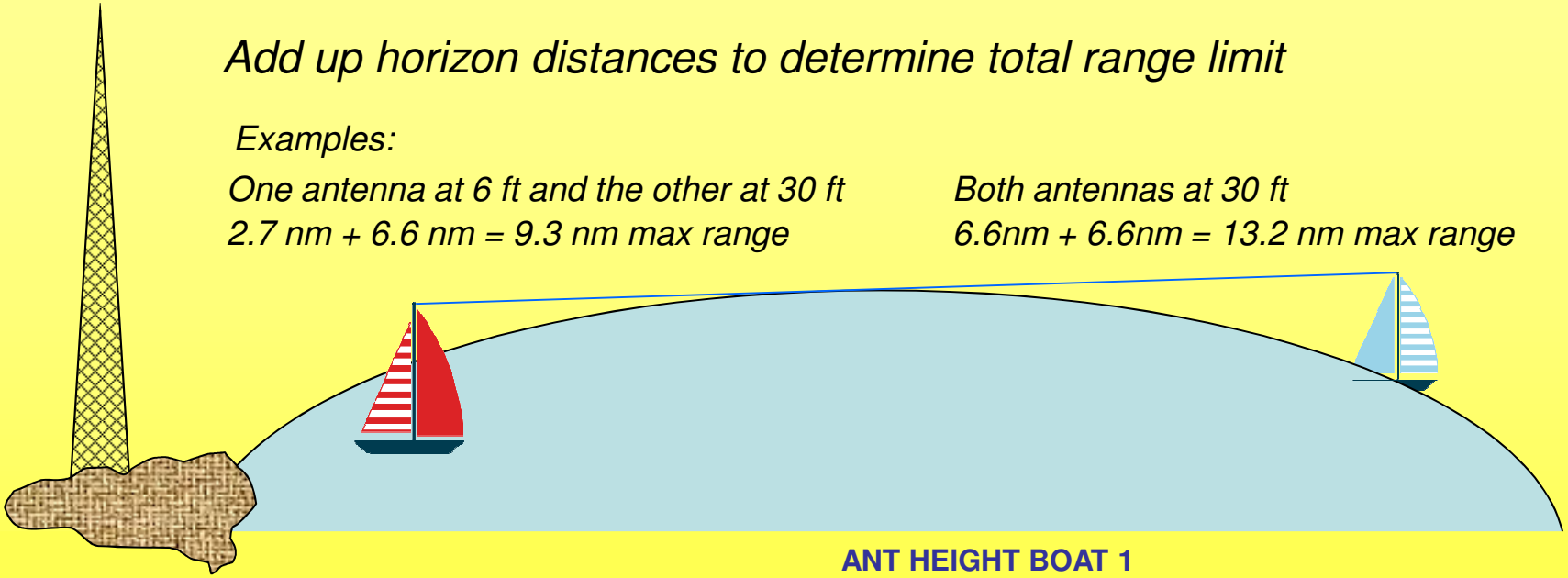
Be aware of units when using rules of thumb*!*
This one is only for height in *ft* and distance in *nm*



Approximation based on "round" earth and partial refraction

Line of Sight more

Range limitation depends on antenna heights at both ends



Add up horizon distances to determine total range limit

Examples:

One antenna at 6 ft and the other at 30 ft
2.7 nm + 6.6 nm = 9.3 nm max range

Both antennas at 30 ft
6.6nm + 6.6nm = 13.2 nm max range

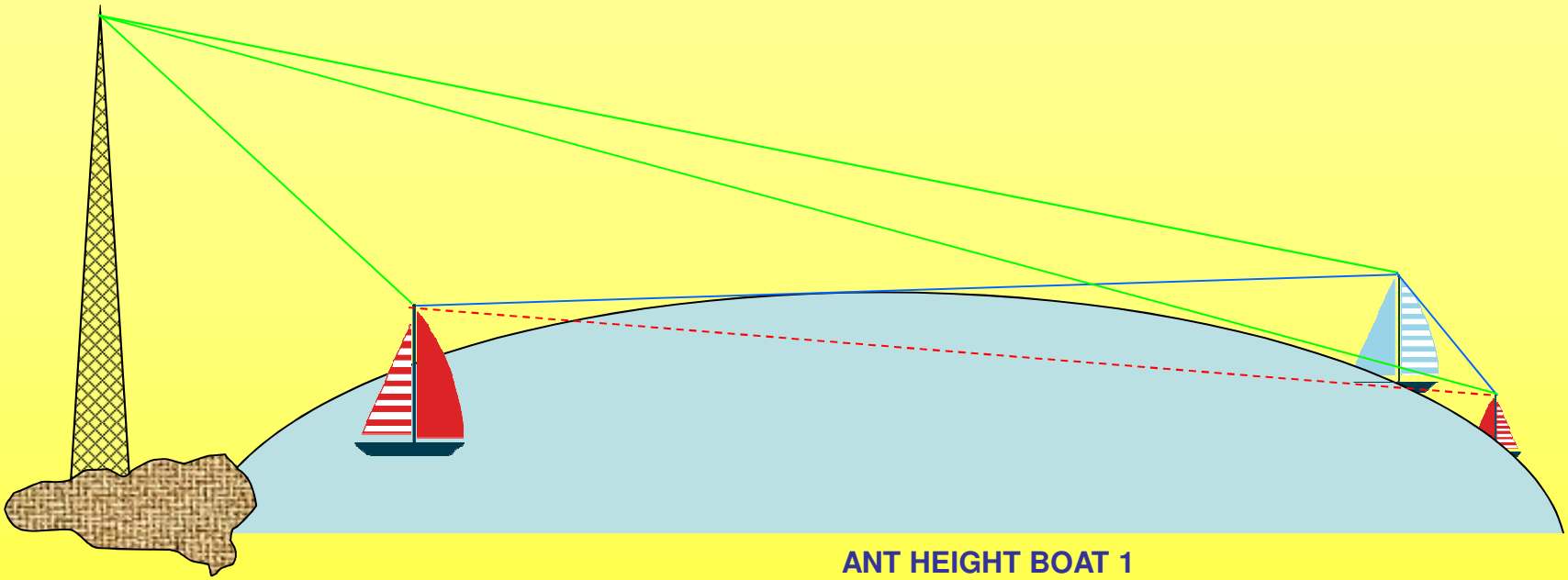
Table gives total horizon-limited range

ANT HEIGHT BOAT 1

ANT HEIGHT BOAT 2 H (ft)	6	9	30	45	60	200	Max Range (nm)
6	6	7	9	11	12	20	
9	7	7	10	12	13	21	
30	9	10	13	15	16	24	
45	11	12	15	16	17	25	
60	12	13	16	17	19	26	
200	20	21	24	25	26	34	
Max Range (nm)							

Line of Sight more

High land-based antennas achieve the best range (duh)



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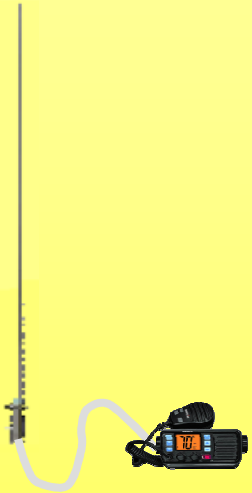
60	12	13	16	17	19	26
200	20	21	24	25	26	34

Max Range (nm)

Max Range (nm)

Transmit Power & Antennas

Transmitted power and antennas affect range too



❑ Fixed mount VHF marine radios

- 25 watt and 1 watt power settings
- Usually used with 17”- 3 ft “whip” at masthead
- Antenna sometimes mounted on stern rail

❑ Hand held VHF radios

- Between one and six watts, often selectable
- “Rubber Duck” antenna - less effective than whip*

❑ Antenna Orientation

- VHF marine antenna standard is vertical. Keep yours that way.
  Cross-polarization can cut signals by *factor of 10*
- Keep antennas away from metal structures and people
  They will detune and absorb power

Rough Power Limited Ranges	
1w & rubber duck	~4nm
5w & rubber duck	~7nm
25w & masthead whip	~30nm

* Rubber duck cuts effective radiated power by factor of 3-5 compared to1/4 wave

Controls and Features

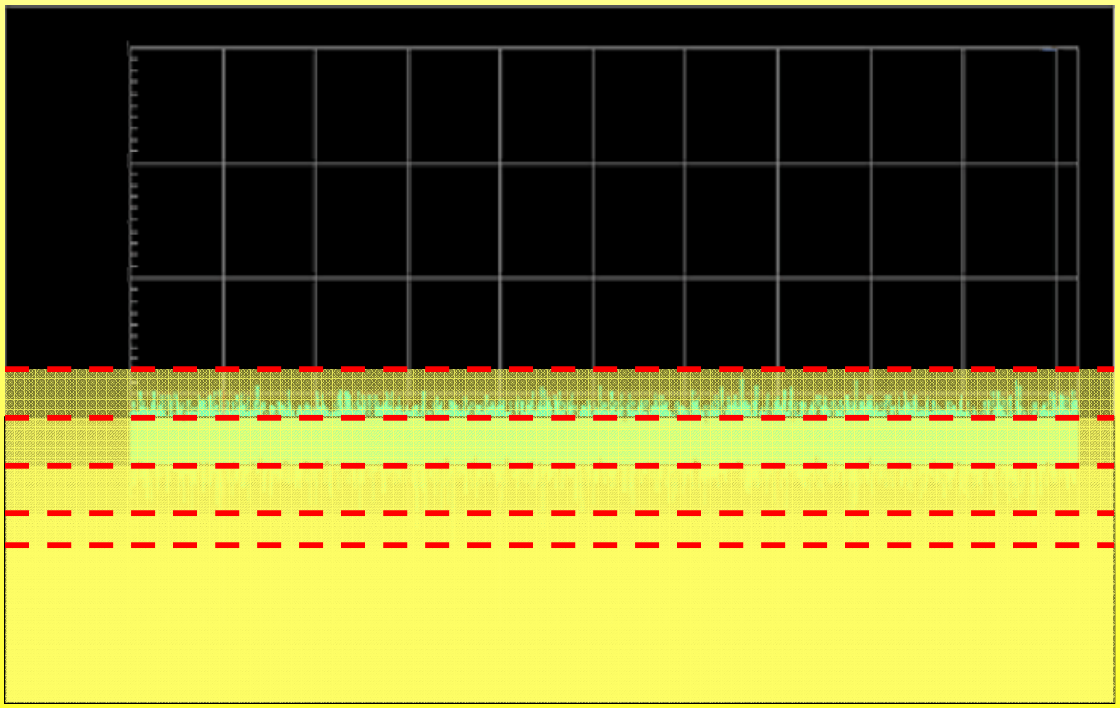
All VHF marine radios have four basic controls

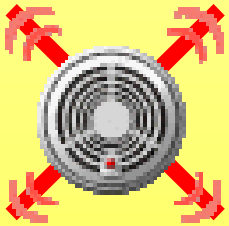
VHF Radio Controls

Squelch is unique to communications radios

Squelch

Squelch is used to mute stand-by noise

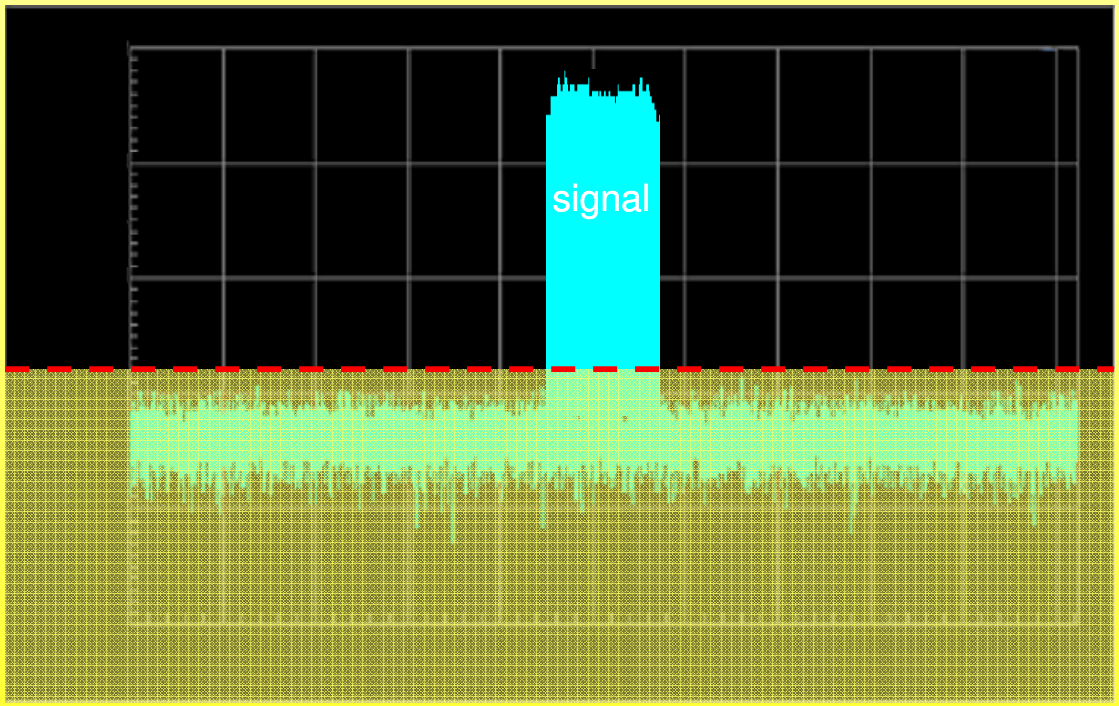




Noise level control is adjusted so that noise is cut off . . .

Squelch

Squelch is used to mute stand-by noise



Only signals above the level setting will be heard

Controls and Features - DSC

DISTRESS button sends Digital Selective Calling distress message

VHF Radio Controls

Requires a Maritime Mobile Service Identity No. . .

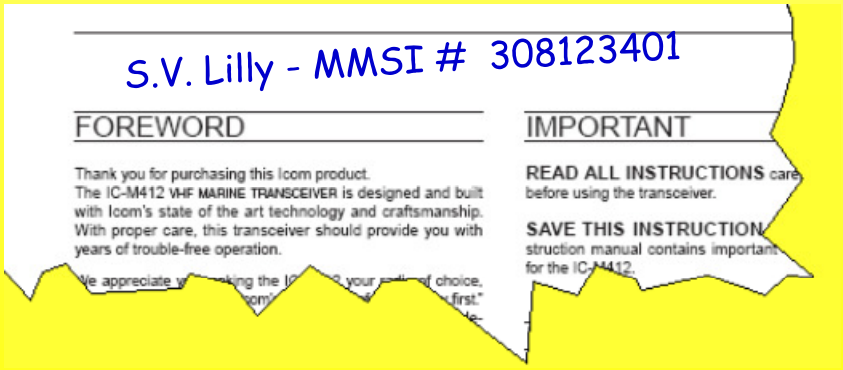
SkipTopic

Maritime Mobile Service Identity

MMSI number is unique to a specific vessel

- **Maritime Mobile Service Identity (MMSI) number**
  - Associated with the vessel, *not the equipment*
- **Obtain and register an MMSI number***

  308123401
  - Recreational vessels under 65ft LOA may use authorized agents
    - BoatUS, Sea Tow, and United States Power Squadrons
    - Free of charge
  - Apply to FCC if radio legally required or for international use
- **Write MMSI No. on emergency card and in radio manual**
  - Vessel's unique digital address

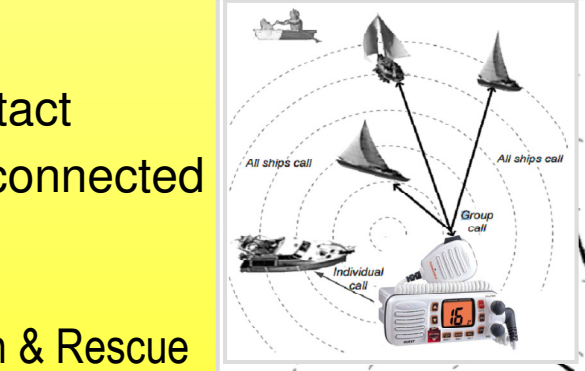


* If AIS-equipped, must use the AIS-associated MMSI No. for *all* equipment on board

Digital Selective Calling (DSC)

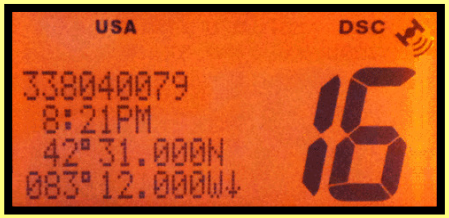
DSC provides both routine and distress signaling capability

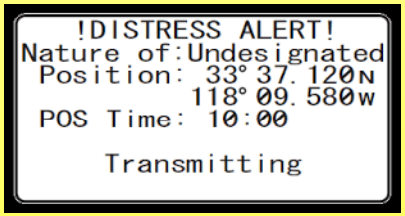
- **DSC sends and receives preformatted messages**
  - Uses Maritime Mobile Service Identity (MMSI) “addresses”
  - Audible alert and preformatted information
  - Send to Individual MMSI, Group, or All Ships
- **Routine signal types**
  - Audible alert to make voice contact
  - Position Request/Send if GPS-connected
- **DISTRESS signal**
  - Takes the “Search” out of Search & Rescue
  - Initiated by button push
  - Sent to USCG and All Ships
    - Vessel MMSI number
    - Position & Time if radio is GPS-connected
    - Nature of Distress (selectable, manual, or

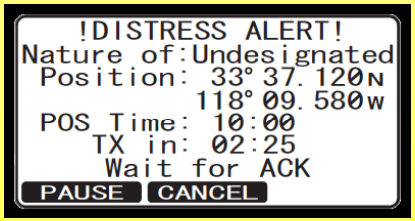


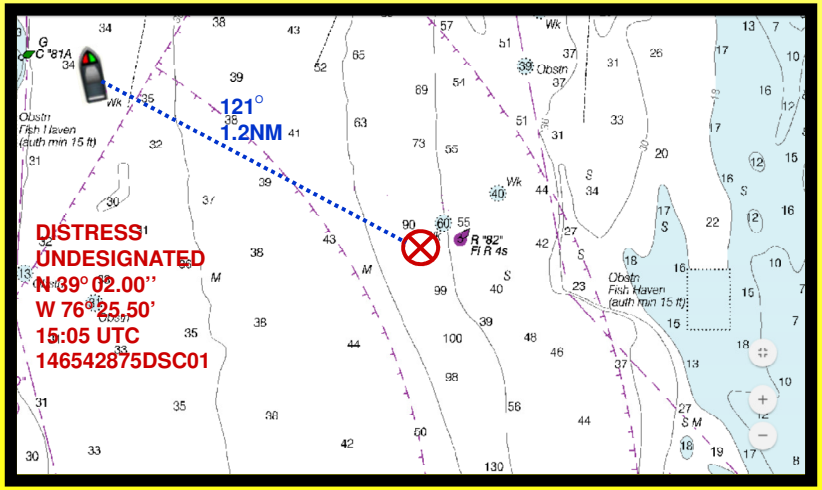
DSC Distress signal

DISTRESS sounds audible alert and appears on various displays







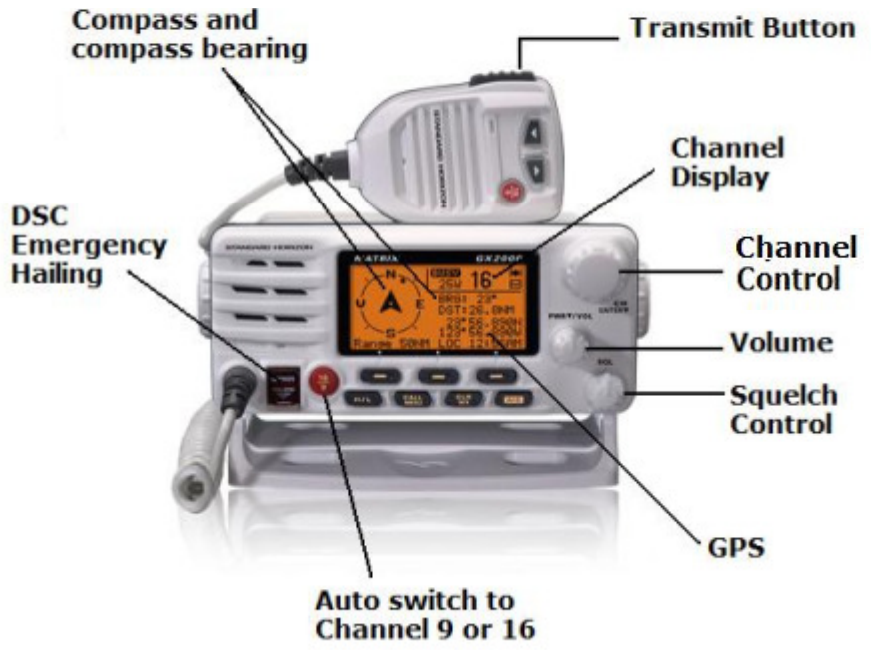


Controls and Features more

Your radio may have other functions available

- *Channel 9/16 button*
- *WX button*
- *Favorite channel*
- *Scan*
- *Dual/Triple Watch*
- *WX Alert*
- *Hi/Lo Power*
- *GPS display*
- *GPS*
- *Nav display*
- *PA (ext speaker)*
- *DSC autoswitch*

VHF Radio Controls



Read the Manual!

Rules

VHF marine radio is regulated by the FCC, NTIA, and USCG*

- **No license is required for *recreational* vessels**
  - Exceptions are vessels over 20m LOA
- **Emergency & Safety "traffic" takes absolute precedence**
  (more later)
- **Channel 16 Watch must be maintained**
  - Whenever radio is not being otherwise used
  - Try using Dual Watch
- **Prohibited Conduct**
  - False emergency messages or interfering with emergency traffic
  - Profanity

* Federal Communications Commission FCC), the National Telecommunications and Information Administration (NTIA), and the U.S. Coast Guard (USCG)

Channels

The Rules designate specific channel usage

Overall Channel Designations

Channel Designations
Intership Safety and SAR
Non-Commercial (Recreational)
Bridge to Bridge Navigation
Distress, Urgency, Safety, & Hailing
Coast Guard Liaison and Safety Information Broadcasts
Public Correspondence (Marine Operator)
Digital Selective Calling Only (No Voice)
Commercial
Port Operations
State Government
AIS and other special use
Weather Radio (7 Receive Only channels)

Main Channels of Interest to Recreational Boaters

Channel	Use
WX1 - WX7	NOAA Weather (receive only)
9	Hailing Commercial and Non-commercial
16	Distress, Urgency, Safety, and Hailing Keep a radio watch on channel 16 or both 9 & 16
68, 69, 71, 78A*	Non-commercial
72	Non-commercial Intership Only
13	Bridge to Bridge Intership Navigation Vessels over 20m LOA must keep watch on Ch 13
22A*	USCG Liaison and Info
6	Intership Safety and Search and Rescue (SAR)
17	State Government (Marine Police in MD)
24-28, 86-87	Marine Operator (duplex)
70	Do not select - DSC Only. No Voice

Some channels have 1W limit. Radios automatically adjust.

* *"A" suffix is not usually shown on radio displays*

Routine Use

Routine VHF radio use is straightforward

- **Select Ch 9 or 16 (or a prearranged working channel)**
  - Wait for the calling channel to be clear
  - Make your call
  - Move to a working channel

    Good idea to first find a clear *working channel* and keep it in mind
- **Remember VHF marine radio is Simplex**
  - **"OVER"** indicates you have finished talking and will listen
  - **"OUT"** indicates you are done with the conversation

- **Monitor Ch 16 when not otherwise using your radio**
  - Emergency/Safety requirement

- **Channels are shared, be considerate**

Routine Use more

VHF radio has a standard protocol

- **Other station's name is always sent first, then your own**
- **Calling (hailing)**
  - **"HAPPY DAYS, HAPPY DAYS, THIS IS BIG DOG. OVER"**
    - Repeating other station's call helps gets his attention
    - **"OVER"** signifies you are ready to receive, an Invitation to transmit.
- **Answering and moving to working channel**
  - **"BIG DOG THIS IS HAPPY DAYS. SWITCH TO 68"**
    - Repetition not necessary as the first station is known to be listening
- **Acknowledgement**
  - **"HAPPY DAYS THIS IS BIG DOG. ROGER 68"**
    - Lets other station know you received OK and are switching
    - ROGER means "I understand what you said"

Note: Individual or group DSC alerts may be used for initial hailing

Routine Use more

VHF radio has a standard protocol

- **After you have switched to a working channel**
  - Listen to make sure it is clear.
  - If not, go back to 9/16 and pick another working channel
- **Call your partner station to make sure he's there**
  - **"HAPPY DAYS THIS IS BIG DOG. OVER"**
- **Partner station answers**
  - **"BIG DOG THIS IS HAPPY DAYS"**
  - **He can now begin conversation or simply say "OVER"**
  - **Call signs are not required until your conversation is finished**
  - **After your final transmission say "BIG DOG OUT"**
- **"OUT" indicates end of series of transmissions**
  - Simply identify yourself and add "OUT" (Don't combine with OVER)

Note: Individual or group DSC alerts may be used for initial hailing

Emergency VHF Use

Distress, Urgent, and Safety messages are strictly defined

- **Distress "*MAYDAY*"**
  - ***GRAVE AND IMMINENT*** danger requiring immediate assistance
- **Urgent "*PA*** **(pronounced pon pon)**
  - ***URGENT*** ance
  - Also used
- **Safety "*SÉ***
  - **IMPORT** ge
- **All of the al** **rity**
  - Stop trans
- **Sending fal** ***Felony***
  - Carries cri s

Mayday

MAYDAY message has a specific format

- ❑ **Send DSC DISTRESS if available**
- ❑ **Switch to channel 16, Speak Slowly and Clearly. Example follows:**

MAYDAY-MAYDAY-MAYDAY [EMERGENCY PREAMBLE]

THIS IS BLUE DUCK-BLUE DUCK-BLUE DUCK MMSI 123456789 [VESSEL IDENTIFICATION]

MAYDAY THIS IS BLUE DUCK [PREAMBLE & VESSEL NAME AGAIN]

BALTIMORE LIGHT BEARS 260 DEGREES MAGNETIC-DISTANCE 1 MILE [LOCATION]

STRUCK SUBMERGED OBJECT [NATURE OF EMERGENCY]

NEED PUMPS-MEDICAL ASSISTANCE AND TOW [KIND OF ASSISTANCE REQUIRED]

THREE ADULTS, TWO CHILDREN ON BOARD [PERSONS ON BOARD]

ONE PERSON COMPOUND FRACTURE OF ARM [MEDICAL STATUS]

ESTIMATE CAN REMAIN AFLOAT TWO HOURS [SEWORTHINESS]

BLUE DUCK IS THIRTY TWO FOOT SLOOP-WHITE HULL-BLUE COACHROOF [DESCRIPTION]

OVER [LISTENING]

- ❑ **Wait briefly for a response**
  - Repeat the MAYDAY call if no answer (DSC will automatically repeat until ACK)
  - Try Channel 22 (USCG) if 16 does not work

Note: URGENT and SÉCURITÉ use similar formats, different message body

MAYDAY more

Have important information ready

- **For USCG or other rescuer**
  - POSITION – Lat/Lon, Dist & Bearing from Landmark or Nav Mark
  - NATURE of Distress
  - KIND of Assistance required
  - NUMBER of Persons On Board (POB)
  - MEDICAL STATUS of Individuals if relevant
  - SEAWORTHINESS of Vessel
  - DESCRIPTION of Vessel
  - If All POB have LIFE JACKETS On (they should)
  - MMSI NUMBER if any - Coordinates responses and avoids confusion
- **Have an emergency placard or list near Radio**
  - Mayday Template, Vessel Description, MMSI Number

MAYDAY more

Relay a heard Mayday message if no one responds

❑ Upon Hearing a Mayday message

- Stop all transmissions and listen
- Write down all relevant information you can
- Listen for responses (no longer than two minutes)

❑ If no response heard

- Contact vessel (Ch 16), tell then you hear them and get any missing info
  Name, Position, Nature of Distress, Assistance Required, POB
- Make a **MAYDAY RELAY CALL**

❑ MAYDAY RELAY (CH 16)

MAYDAY RELAY, MAYDAY RELAY, MAYDAY RELAY
This is Sailing Vessel Blue Duck
Vessel Blue Boy, one mile east of Baltimore Light, reports fire on board
Requires immediate assistance. Blue Boy is a white 30 foot cabin
cruiser with 5 persons on board. OVER

- Stay in contact with the other vessel as long as necessary

Using the Radio - Best Practices

Use phonetic alphabet and other best practices for clarity

❑ International Phonetic Alphabet

- Reduces errors and "fills"
- Used when spelling out names, places, etc
  - "Mojo" becomes "**Mike Oscar Juliet Oscar**"

A-ALFA	B-BRAVO
C-CHARLIE	D-DELTA
E-ECHO	F-FOXTROT
G-GOLF	H-HOTEL
I-INDIA	J-JULIET
K-KILO	L-LIMA
M-MIKE	N-NOVEMBER
O-OSCAR	P-PAPA
Q-QUEBEC	R-ROMEO
S-SIERRA	T-TANGO
U-UNIFORM	V-VICTOR
W-WHISKEY	X-X-RAY
Y-YANKEE	Z-ZULU

❑ Numbers

- Say one digit at a time
  26 is spoken as "**Two-Six**"
  327 is spoken as "**Three-Two-Seven**"
- "Decimal" for decimal point
  23.5 is "**Two-Three-Decimal-Five**"

❑ Common "code words"

Roger* = I understand what you said
Negative = No
Affirmative = Yes

Using the Radio summary

Summary of radio procedures

- ❑ **Make sure channel is clear before using**
- ❑ **Call on channel 9 or 16.** (Other channel if so arranged)
- ❑ **Move to working channel after establishing contact**
- ❑ **Other station's name always comes first**
- ❑ **OVER indicates you are listening** (release transmit button)
- ❑ **OUT indicates you have finished transmissions**
- ❑ **Channels are shared. Keep conversations brief**
- ❑ **Make radio checks on channel 9, never channel 16**
- ❑ **Use phonetics when appropriate**
- ❑ **Remember everyone in range can hear what you say**
- ❑ **Cease operation and listen if emergency call is heard**

Practice

Practice makes perfect

- ❑ **It's smart to train, even if you just talk to yourself** 
- ❑ **Practice Routine calling and "working"** 
- ❑ **Practice Emergency calls**
- ❑ **Listen if you have a chance**
  - You can get a flavor of what VHF marine traffic sounds like
  - Keep in mind that not everyone is a good example

Let's Practice Now!

Overall Recap

VHF radio is an important maritime direct communications tool

- **Primary Emergency and Safety tool**
  - Voice and DSC (DSC requires MMSI no.)
  - Coast Guard, All Ships
- **Good for routine communication**
- **Antenna height is key to distance**
  - Line of sight limited
- **Simplex operation**
  - One talker at a time. Remember to say OVER
- **Switch to working channel after calling**
- **Keep a watch on Channel 16**
- **Use MAYDAY procedure only in serious emergencies**
  - Clear and stand by if you hear a Mayday or other special message

Read the Manual!

Questions?

Goto DSC

Download or view this presentation at **https://danzee.org/SOS2017/SOS2017index.html**

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S.V *Mojo*, *Deep Creek on the Magothy*

recommended links:

https://quality2wayradios.com/store/Using-Marine-Radios

http://www.boatingmag.com/boatingsafety/mayday-use-vhf-radio-emergencies-sea-and-distress-calls