Search and Rescue Communications

Safety at Sea Seminar

Annapolis, MD
30 March 2014

Captain Kip Louttit
U.S. Coast Guard
Retired & Auxiliary
The Objective: lots of this...
...Not this:

Person on hoist cable
The problem… You are here…

4 people in water
...and you want to be *here*:
SAR Comms will help you get there

Overall Concept… whatever works best, the CG will use…

406 EPIRBs
Agenda

- Overview
- Distress Signals
- Global Maritime Distress & Safety System (GMDSS)
- VHF-FM & MF/HF SSB
  - Rescue-21
  - DSC & MMSIs
- EPIRBs & SATCOM
- Closing thoughts

Air Mail Annapolis/Hampton Race 2010
Communications are a critical but often weak link in the SAR system.

Personnel in distress have a variety of methods, ranging from sophisticated electronic devices to waving a piece of cloth, for alerting the SAR system.

Priority goal: Provide communications which are highly reliable, simple, problem-free, interoperable, and as functionally effective as possible.
Recognized Distress Signals

- Slowly raising and lowering outstretched arms
- Continuous sounding of fog horn
- Red flares (night) and Orange smoke flares (day)
- Morse code SOS . . . - - - . . . by any signaling method (horn/flashlight). SOS outlined in logs/seaweed on the beach, written/taped on cabin top
- Three of anything… 3 fires, 3 whistles, 3 piles of brush
- Square Flag and Ball (often sold on an orange background in form of a flag)
- Radiotelephone Voice **Mayday** or **Pan** call
- Radiotelephone Digital Selective Calling (DSC) and other automatic alerts
- **EPIRBs, PLBs, ELTs**
- White Strobe Light (Inland Waters only) …*don’t use strobe as anchor light Inland*
  - *But…* You will see white strobes marking fishing gear in International Waters
Guess what the light source is!

- 3 Jan 2012
- 12 ft seas & 35 kts of wind South of Jamaica
- CG Lookouts sighted the light at 2 miles
- Photo thru CGC Venturous Infra Red Camera
- Rescued 5 fishermen who had been in the water 10 hrs

A cell phone!

Captain Kip Louttit, U.S. Coast Guard, Retired & Auxiliary
Global Maritime Distress and Safety System (GMDSS)

- Components:
  - VHF-FM
  - HF
  - INMARSAT
  - EPIRBs

- Four “Sea Areas”
  - A1: **VHF-FM**, 20 miles from shore
  - A2: **HF**, 20-100 miles from shore
  - A3: INMARSAT, 70N to 70S
  - A4: Polar Regions

*Air Mail start of 2004 Annapolis/Bermuda Race*
SAR & GMDSS Communications Zones

1. Bays, Rivers, Sounds, & Coastal to 20 miles
   VHF-FM & Cell Phones

2. 20-100 miles offshore

3. Beyond 100 miles
   EPIRBs, MF/HF & SAT Phones

Bottom Line:
Once you get more than 20 miles from shore, you need more than VHF-FM & Cell Phones.
Voice Communications

- **Satellite and Cell Phones**
  - Good and clear
  - Can get weather/e-mail/web etc. via laptop or smart phone
  - But…
    - No one else can hear you
    - Coast Guard can’t DF on the signal
    - Handoff between 911 & CG can be poor

- **VHF-FM and MF/HF**
  - Party-line nature yields *Good Samaritan* help
  - All CG and many others can DF on the signal
For all of you who are going to call the Coast Guard by with satellite or cell phones, here is the ##...

757-398-6700

USCG Atlantic Area Command Center, Portsmouth, VA
Case Study: Self-Rescue & Sat Phone
Annapolis/Bermuda Race 2008

Great race for 400 miles…
Then we lost control...

- Wild ride for a few minutes while we shortened sail
- Found a course we had control... North toward Montauk
- Looked over-the-side...bottom 3 ft. of rudder gone and sides delaminated
- Called CG Atlantic Area Command Center, Portsmouth, VA by Sat. Phone
- CG put us on a 4 hr. then 12 hr. check-in schedule...position, course, speed, weather, ops normal
- Sailed home under #4 jib & reefed main
- “Preparation Equals Performance”
- Self-rescue worked
New CG VHF-FM system...

**RESCUE-21**

**Features:**

- Direction Finding (DF)
- More towers reduces coverage gaps
- Record and playback capability
- Digital Selective Calling
- Portable towers for emergencies
- Designed Range: Receive 1 watt transmission fm 2 meter height at 20 miles
  - (You in your cockpit w/ a handheld)

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Rescue-21 Coverage Today

U.S. Coasts, Great Lakes, Virgin Islands, Hawaii, Guam & Northern Marianas Islands done

Western Rivers 2014

Alaska 2017

NOTE: Coverage rings are depicted for illustration purposes only
NOTE: Inset maps are not to scale with the US mainland.
Pros/Cons of VHF-FM

Pros:
- Very clear
- Lots of users and channels
- Hand-helds very capable

Cons
- Line-of-sight, so range based on antenna height:
  - 300’ = 20 mi
  - 115’ = 12 mi
  - 50’ = 8 mi
  - 7’ = 3 miles
What is digital selective calling? (DSC)

- Digital transfer of information between radios
- Instantly sends an automatically formatted distress alert to the Coast Guard & other vessels
What does DSC do?

- Provides a one-touch button for distress
- …and the CG will call you back on Channel 16
- …prevents missed distress calls
- Your vessel is identified by unique Maritime Mobile Service Identity (MMSI) number
- Privately hails other DSC equipped vessels or shore stations
- Decreases non-emergency radio traffic on emergency channels
- Notifies boater of a call and automatically switches to the channel caller is waiting on by audible alert of message on screen
- Transmits GPS location of caller (if equipped)
MMSI number

- Maritime Mobile Service Identity number (MMSI)
  - 9 digit number with vessel & owner’s information
    - Like a phone number
  - Identifies and helps find boater in a distress situation
  - Coast Guard maintains database with vessel info
  - Store other vessels MMSI’s into your radio
    - Like a contact list in your cell phone
    - You have to know a boater’s MMSI to call them using DSC
- If there is a problem with MMSI number, the radio still works in the normal VHF-FM mode
  - However, without a proper MMSI, automated systems won’t work to identify you and aid rescue
Getting a MMSI

- It’s free

- Places to get MMSI numbers:
  1. BoatUS, SeaTow, U.S. Power Squadron
     - For Domestic U.S. use only
  2. Federal Communications Commission
     - For International and Commercial use

- Once you obtain your MMSI number, enter it into your DSC radio
  - May need manufacturer if you make too many errors
  - Don’t forget to change the info if you sell the boat or radio

- Info:
  - Federal Communications Commission: wireless.fcc.gov/services/index
  - Coast Guard: www.navcen.uscg.gov/marcomms/GMDSS
What we see…

MMSI ##
Position
Nature of Distress
Pros:

Long range:

2182: 200 miles daytime; 500 miles at night; hops/skips

“Free” … no per/minute charge as with Satellite Phones

Party-line nature…lots of info just by listening (e.g.: 4125 KHz)

Get weather-fax, e-mail, etc.

Cons:

Need right installation (antenna/tuner/grounding) & license

May not be clear…often lots of static

Need to know what you are doing for frequency selection;
    Lower at night & Higher in daytime

“Duplex” channels are complex but powerful/useful;
    Transmit on one freq and receive on another

CG CAMSLANT = Chesapeake + Boston + Miami + New Orleans
Radio Rules & Etiquette

- After establishing communications on Channel 16 shift to an appropriate working frequency.
  - Do not converse on 16
  - Do not do radio checks on 16

- Wait 2 minutes between hails to give time for response.
  - You can’t hear when you are transmitting
  - Make sure you release the transmit button

- If you hear 1 side of a conversation, don’t “step-on” the other side

- No CB radio or “10 code” lingo
VHF-FM Distress & Working Freqs

- **16 - International Distress, Safety, and Calling**
- **22 - CG to Maritime Public working frequency**
  - Distress traffic after establishing comms on 16
  - CG Urgent Marine Information Broadcasts after being announced on 16
- **13 - Bridge to Bridge**
  - You to ship, ship to ship, you to real bridges
  - Security broadcasts (can also be done on 16 depending on situation)
- **Vessel Traffic Services use a variety of freqs...11, 12, 13 & 14 common**
  - Great for situational awareness even if you are not a required participant
  - E.g.: New York: 11, 12 & 14
HUGE CHANGE REGARDING HF

- Effective 1 August, 2013, the CG terminated its radio guard of the international voice distress, safety and calling frequency 2182 kHz and the international digital selective calling (DSC) distress and safety frequency 2187.5 kHz.
- Marine info & wx transmitted on 2670 kHz also terminated.
- **Now, use the freq appropriate for time of day and your area.**

### Distress & Safety Frequencies

<table>
<thead>
<tr>
<th>VOICE</th>
<th>DSC</th>
</tr>
</thead>
<tbody>
<tr>
<td>n/a</td>
<td>2,187.5 kHz</td>
</tr>
<tr>
<td>4,125 kHz</td>
<td>4,207.5 kHz</td>
</tr>
<tr>
<td>6,215 kHz</td>
<td>6,312.0 kHz</td>
</tr>
<tr>
<td>8,291 kHz</td>
<td>8,414.5 kHz</td>
</tr>
<tr>
<td>12,290 kHz</td>
<td>12,577.0 kHz</td>
</tr>
<tr>
<td>16,420 kHz</td>
<td>16,804.5 kHz</td>
</tr>
</tbody>
</table>

These are all Simplex freqs (xmit/rcv the same)
The Distress Call…

- Make sure **radio** is on (not the loud hailer)
- Select Channel 16 VHF-FM *or appropriate HF freq*
- Press and Hold the transmit button
- Clearly say MAYDAY MAYDAY MAYDAY, or PAN PAN PAN
- This is the Sailing Vessel *Kip*

1. **MY POSITION IS __________________________________**
2. Number of people on board
3. Nature of Distress
4. Description of Vessel (name, length, type, make, color)

“Over” …Release the transmit button, ensure volume is up & listen

**(Put Life Jackets On)**
Position Tips

When giving your position, 1 decimal place is usually plenty:

- **.1 minute** = 200 yards
- **.01 minute** = 20 yards
- **.001 minute** = 2 yards

E.g.:

“U.S. Coast Guard, my position is:

32 degrees, 56.5 minutes North,
75 degrees, 37.3 minutes West,

Over.”

Adding a geographic reference can be useful…

“…..2 miles South of Wolf Trap Light.”
“…75 miles Southeast of Montauk Point.”
When giving your position with respect to another vessel, give your position relative to him…that is, tell him what direction to look.

“When Northbound black APL container ship South of Thomas Point Light this is the Southbound sailing vessel Kip 1 mile off your port bow, over. …may add at night… “…with white flashlight on our sails.”
The big 6 that get you in trouble...

1. Cold
2. Wet
3. Tired
4. Hungry
5. Scared
6. Seasick

Case Resolved by a good VHF-FM Mayday Call
Case Study: Outside Assistance
Big 6 & Cascading Casualties…

- June 1991
- Pearson 34
- 2 Couples from Philadelphia … 3 sailors … 1 non-sailor
- 2 Week vacation
- Plan: Cape May to Block Island in 1 leg; multiple stop return
- Weather: Departed Cape May into Nor’ Easter
- 24 Hours Later… ”Mayday Mayday Mayday… We’ve blown out our sails, the engine won’t start, and we’re sinking!”
The Cascade…

- ¾ crew sick…only one not sick was the non-sailor
- No one made rounds below and checked bilge
- No one ate or slept
- Reefed Main…Improperly
  - Reef points tighter than clew…ripped out the reef points
- Tried to start engine…wouldn't start
- Looked at engine and found water in bilge…we’re sinking!
- “Mayday Mayday Mayday Mayday”
Initial CG actions

- CGC HARRIET LANE (270’ w/ 100 crew)
- Sent over a machinery technician and electrician
- Found a cockpit drain hose had come off, which let cockpit water pour on the engine
- A little magic with spray electrical drier and engine start spray…
- Engine started…
- “OK skipper, no more flooding, we fixed the hose, we pumped the bilge, the engine is running, we furled your sail, your electronics work…she’s all yours…”
- “PLEASE, TAKE US TO SHORE…”
Final CG actions & Impact of *Big 6*…

- CG Options…(1) Tow her or (2) we crew her
- We chose #2…I was XO (LCDR) & went over with an Ensign
- Sent all 4 to bed with water/crackers
- Put *Jimmy Buffet* on stereo
- Double reefed main (above rip) & unrolled the jib
- 7 knots on a reach toward Long Island
- *6-8 hrs. later the crew came alive*…
- We were relieved by CG small boat from Shinnecock
- *Guard against cold, wet, tired, hungry, scared & sick*
EPIRBS, ELTs & PLBs

- Total rescues in 2013: 261 people
  - At Sea: 140 people in 47 incidents
  - Aviation: 34 people in 16 incidents
  - PLB Land: 87 people in 59 incidents

- Total: >35,000 people saved worldwide since 1982; 7,270 in the U.S.

- 406 EPIRBs and PLBs:
  - Satellites process the 406 signal
  - CG aircraft can home in on both the 121.5 & 406 MHz signals
  - Commercial aircraft can home on the 121.5 MHz signal
  - Ensure it’s registered…very easy on NOAA web site
406 EPIRB Beacon Types

• 3 Variants:

1. **Maritime** - Emergency Position-Indicating Radio Beacon (EPIRB)

2. **Personal/Land** - Personal Locator Beacon (PLB)

3. **Aviation** - Emergency Locator Transmitter (ELT)

• Automatic or Manual Activation

• All EPIRBs float in the right position for transmitting and operation

• PLBs, however, may “float”, but not in the right position to transmit and operate
**406 MHz EPIRBs/PLBs:** Transmit signal to satellites, which alerts rescue forces, worldwide.

**H-60 helo hovering over Paradox**
Classic Tactic...fixed wing up high & helo down low

- 11 April 07
- S/V Paradox
- CG 1504 (C-130)

FLIR pictures

150nm Southwest of St. Pete, FL
C-130 at 10,000 ft... DF locked on at 15 miles

Captain Kip Louttit, U.S. Coast Guard, Retired & Auxiliary  ©April 2014
406 EPIRBs are International

16 Feb 2008

406 Personal Locator Beacon (PLB) Rescue
British National
75 mi NW of
Puerto Plata, DR

USCG H-60 Helo
Recovery

PLB Registered in New Zealand

Light Plane Crash
Info on EPIRBs/ELTs/PLBs from CG Program Manager

- The CG dials every number on your contact list when they get an alert
  - 50% of the registrations have errors.

- PLB antennas must be held vertical and out of the water

- Newer EPIRBs/ELTs/PLBs with GPS can generate a position in between 1 and 3 minutes
  - Old EPIRBs without GPS could take 8 hours
Importance of Registration

- We can do a better rescue calling your points of contact
- We can avoid launching on false alarms by being able to call you
  - 9 out of 10 alerts are false
  - 80% of these are resolved by phone
- Is your registration up-to-date? Update if you:
  - Change contact info
  - Sell the boat or EPIRB
  - Loan your EPIRB
  - Change boating locations
  - Change your comments as supplemental “float plan”
Registration

www.beaconregistration.noaa.gov

NOAA Satellite and Information Service
National Environmental Satellite, Data, and Information Service (NESDIS)

UNITED STATES 406 MHZ BEACON REGISTRATION DATABASE SYSTEM

Beacon Owners

Please note that a Beacon ID is required to use the on-line system.

- Click New Registration to register a new beacon. Also use this option if you have acquired a beacon that was previously registered for a change of ownership.
- Click Access Beacon Previously Registered By Mail to create a password for your existing beacon registration that was registered by mail. This step only needs to be completed once for each beacon registration.
- Click Access Beacon to access an existing beacon registration. You will need your beacon ID and a current password to use this option.
- Click Access Block of Beacons to access a block of existing beacon registrations.
- Click Create Block Account to create a beacon block user account. Please note that you will need to have at least 3 beacons to create a block account.
- Click Forms to get electronic versions of beacon registration forms.
Other Alternatives

- **SPOT…commercial device**
  - **Pro:** Can transmit an “I’m OK” signal
  - **Con:** Depends on commercial firm to relay distress call to the CG

- **NAVTEX**
  - CG transmission of urgent marine safety info (storms, gales, pirates)

- **HF TELEX (also called SITOR or NBDP)**
  - Weather forecasts & warnings

- **SART…Search & Rescue Transponder;** operates in either:
  - 9.2-9.5 GHz frequency band & generates 20 dots on a radar display, or
  - AIS band

- **HAM Radio**
Automatic Identification System (AIS)
Wonderful & emerging tool
Send and receive, or receive only
Automated Identification System

- **Advantages:**
  - Situational awareness of traffic
  - Ability to call ships by name
    - Merchant vessels much more likely to respond if called by name

- **Limitations**
  - May be confusing by giving *too* much information in heavy traffic (i.e. approaches to Hampton Roads or NY). Therefore:
    - Use filters
    - Reduce range
    - Listen to Vessel Traffic Service if there is one

- AIS Person Overboard Device
Know Your Ship…

Recommend someone other than the owner/skipper know the location & operation of your SAR comms equipment:

Visual Distress Signals
Sound Signals
VHF-FM Radio & AIS
406 EPIRB
Satellite Phone
HF Radio

The further you are offshore, the more crewmembers should be trained.
Backup comms

If your VHF-FM antenna is at the top of your mast,

Or…

If your HF antenna is part of your standing rigging (commonly backstay),

…What will you do for antennas if you are dismasted?

Or…

…If you Capsize?
Search Patterns

- **Expanding Square:** concentrated search of small area
  
  Assume Drift to East (090)

- **Sector Search:** concentrated search of small area with well known datum

- **Parallel:** uniform coverage where approximate position is not well known

- **Creeping Line:** uniform coverage when coverage of one end of search area is desired 1st

\[ \begin{align*}
\text{090} & \quad \text{330} \\
\text{210} & \quad 120 \text{ degree turns}
\end{align*} \]
Giving assistance

- Use GREAT Caution when maneuvering close to a sinking vessel
  - Keep other vessel and shore SAR assets informed
  - Be prepared to recover people from the vessel, life raft, water, or some combination of all 3
  - Ensure you account for everyone, especially if there are multiple rescue assets
  - Use caution for debris/lines/rigging in the water
  - Approach from upwind if other vessel is on fire (stay out of the smoke)

- Understand that a yacht or other “good Samaritan” vessel may be the only source of help

- “Mayday Relay” – you pass on another vessel’s Mayday call

- Per SOLAS, merchant ships must carry International Aeronautical and Maritime Search and Rescue (IAMSAR) Manual
  - AMVER
  - Masts/spreaders of sailboats and sides of ships to not mix
Rules & Legal Requirements

- International Sailing Federation (ISAF):

  “1. SAFETY

  “1.1 Helping Those in Danger: A boat or competitor shall give all possible help to any person or vessel in danger.”

- Safety of Life at Sea (SOLAS) obligations:
  - Assistance: All ship and aircraft commanders have an obligation to assist those in danger of being lost at sea
  - Communications: GMDSS requires passenger and cargo ships on international voyages to:
    - Carry radio equipment including EPIRBs and SARTs
    - Prior to sailing, ships must log that:
      - GMDSS safety and communications equipment is in an efficient working condition including reserve source of energy

  ✓ Takeaway for you: Test your gear, check your spare batteries. Use test function of EPIRBs/PLBs and check sticker for remaining battery life

- Moral imperative
EPIRB rescue 2 Jan 2010…S/V *Gloria Adios*

USCG District 5 (Portsmouth, VA) received a 406 MHz beacon alert 250 miles East of Cape Hatteras at 5:07 PM (it’s dark)

Beacon is registered to the 34-ft sailboat *Gloria Adios*

Using the Registration Database, USCG contacted owner’s daughter

The daughter didn’t know his location but stated he was alone and sailed out of Chesapeake Bay after Christmas, heading to Caribbean

The CG launched a C-130 from Elizabeth City, NC and established VHF-FM comms with Mr. Dennis Clements aboard the vessel at 6:30 PM

The merchant vessel *Ryujin*, participating in AMVER was diverted, but was unable to assist due to the rough weather

The CG worked with the USN 2\textsuperscript{nd} Fleet in Norfolk and determined *USS Eisenhower* was capable, available & closest. *IKE* launched a helo.
The CG C-130 witnessed the vessel being dismasted via infrared imaging about 9:30 PM.

The mast poked 2 holes in the vessel and it started to sink.

The C-130 dropped a raft and supplies. *Gloria Dios* sank.

IKE’s H-60 helo arrived after flying 100 miles through a snowstorm and hoisted Mr. Clements at 10:30 PM. Flew him back to *IKE*.

A CG H-60 landed aboard *IKE* and took survivor to Elizabeth City, NC, arriving at 3:45 AM.
Final Thoughts
CG Sectors Hampton Roads, Woods Hole, & Delaware Bay

If you want this helo to appear overhead or cutter to come over the horizon…

• Have the right gear
• Know how to use it
• CG can’t DF on SAT/Cell phones
  • Limited ability to triangulate on Cell
• Ensure it’s registered
  • MMSI for DSC radios
  • Registration ## for EPIRBs/PLBs
• Ensure it’s working properly
• Operate it properly
• Speak slowly and clearly

H-65 Helo & New 157 ft. patrol boat
Sail & Race Safely & Well...  
See you on the water!

Remember...  
Position & PFDs...  
Greatly increase the chance of a successful rescue

Saving Lives and Guarding the Coast Since 1790  
The U.S. Coast Guard—Proud History. Powerful Future
Presenter & Contact Info

- Captain Kip Louttit, USCG, Retired
- kiplouttit@yahoo.com
- 310-897-1714
- Me & my son, daughter, and dad
Thoughts from the SAR Controller

• Have a plan. Think of the what you will do in different scenarios. Share your voyage plan in the form of a float plan with a friend of family member.

• Have multiple forms of communications to send out a distress, i.e. VHF Radio, VHF-DSC, EPIRB, MF/HF Radio, or SAT phone. Don’t depend on just one, especially a Cell phone.

• Ensure your equipment is maintained, registered properly and you know how to use it.

• Wear your Personal Floatation Device (PFD) whenever you are on the water. If you go into the water unexpectedly you could be hurt or unconscious and your PFD could save your life.
Resources

Float Plans online:

VHF-DSC Registrations:
http://www.boatus.com/mmsi
http://www.seatow.com/mmsi
http://www.usps.org/php/mmsi
**http://wireless.fcc.gov/services/index.htm?job=licensing&id=ship_stations**
  **Must get your MMSI from the FCC for it to be recognized overseas**

EPIRB Registrations:
http://www.beaconregistration.noaa.gov/

USCG Boating Safety Website:
http://www.uscgb boating.org/

Free Vessel Safety Examination:
http://wow.uscgaux.info/content.php?unit=V-DEPT&category=i-want-a-vsc
END