

THE RED BUTTON

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Owners of some Inmarsat terminals have had it for a while. Then, starting a few years ago, it began appearing on our marine radio equipment as well. We saw it first on new VHF radios, and now even SSB transceivers from companies like Icom have it. "It" is The Red Button -- that switch on the radio panel sitting under its protective lift-up guard, ominously labelled "DISTRESS".

The red button is there thanks to something called the Global Maritime Distress and Safety System, or GMDSS for short. While GMDSS has been in the making for over 20 years, it represents a new school of thought when it comes to maritime safety and distress communications. To put GMDSS in perspective, it's helpful to know a little about the "old school" system it replaces.

Marine distress communication procedures trace their origins to the Titanic disaster in 1912. In the wake of this tragedy, a special radio frequency, 500 kHz, was adopted worldwide for distress calling, using Morse Code with the special "SOS" signal reserved for emergencies. Ships were required to carry trained radio operators and monitor continuously for emergency calls. A voice frequency, 2182 kHz, and the word "Mayday" came along later. And so it went, pretty much unchanged, for almost 100 years...

But this system had drawbacks. It relied on human beings to sit at radio consoles and strain to listen for emergency traffic. The radio frequencies used for distress calling, whether 500 kHz, 2182 kHz and especially VHF Channel 16, travel only relatively short distances. The thinking was that a vessel in distress was best served by other vessels in her immediate vicinity, so long-range communications were not a priority for distress hailing. GMDSS changes this thinking.

Stated simply, GMDSS creates a more modern communications network that can use satellites, earth-based radio, or both for calling in an emergency. Its goal is to reduce distress alerting to the mere press of a button, and in so doing it eliminates the need for dedicated radio monitoring personnel aboard ships of any size. The system is endorsed almost universally by international treaties among nations.

The equipment used in the GMDSS system is familiar to most of us, and includes 406 MHz EPIRB's, Inmarsat terminals (Sat-C and some Fleet systems, but not mini-M), as well as marine VHF and SSB. Strictly speaking, GMDSS equipment is required only on cargo ships over 300 gross tons and passenger ships carrying more than 12 persons, who engage in international travel. So it's tempting for those of us who don't fit into either of these categories to dismiss GMDSS as something that's "only for big ships", or "not in place, anyway". But as a practical matter, that line of thinking really doesn't work.

Here in the US at least, it's true that red button GMDSS-style alerting won't be available on VHF until the Coast Guard completes their modernization project, probably around 2006. But other nearby vessels who have modern VHF equipment will still receive the call. And since the FCC

endorsed this technology in 1999 by requiring "the red button" on any new marine radio equipment introduced for sale in the US, you'll be able to reach quite a few boats even if the Coast Guard doesn't hear you.

Moving beyond our own coastal waters, the reality is that on the high seas and in many places outside the US (especially Europe) this new system is already widely embraced. Then there are those commercial ships, which may well be one's best hope for rescue at sea. They're no longer required to maintain a "listening watch" for voice calls while at sea on the international distress frequency, 2182 kHz -- but they are supposed to keep a "GMDSS watch" instead. That's been true since February of 1999, the date the GMDSS system formally took effect worldwide. In fact, in some places on the planet the likelihood that anyone is listening for anything but an automated GMDSS distress call is gradually diminishing.

So let us take a closer look at GMDSS, with a nod to the victims of the tragedy that dramatically pointed out the need for some kind of international maritime distress calling system in the first place.

If only Titanic's Captain Smith had known in advance about the precise location of that that iceberg...

For starters, GMDSS routinely and automatically collects weather and safety information. In GMDSS-speak this is called Marine Safety Information, or MSI, and examples would be severe weather alerts or navigation warnings for a vessel's planned travel area, icebergs included. While the red button on the equipment may be the attention-getter, this "ounce of prevention is worth a pound of cure" approach is one of the GMDSS system's most powerful and valuable features. The idea is that a vessel with timely, accurate weather and navigation information on hand is much less likely to encounter a distress situation in the first place. Under GMDSS, this safety info is broadcast via a worldwide radio system called NAVTEX, which can be captured using an SSB receiver hooked to a computer with special decoding software, or by a dedicated NAVTEX receiving device. Inmarsat users get the same information, via a service called SafetyNET. Best of all, both NAVTEX and SafetyNET are free services (beyond the acquisition cost of the receiving gear, of course). The broadcasts, by international agreement, are in English worldwide.

If only the radio operator on the California, the vessel closest to Titanic at the time of the collision, hadn't taken off his headphones and retired for the evening...

GMDSS automates watchkeeping, eliminating the need for round-the-clock human attention. A VHF or SSB operating in GMDSS mode, or for that matter an Inmarsat-C terminal, remains blissfully silent until an important call is received. Anyone who's spent a summer afternoon tuned to VHF 16 on Long Island Sound can appreciate this feature immediately. When a call with some degree of urgency is transmitted, the equipment sounds an alarm to draw your attention to the message. But the point is that the gear sounds off only when it needs to, not every time Bay Screamer hails Thunderbolt to compare fishing spots.

If only the radio operators on the Titanic could have assisted with the rescue effort, helping fit lifejackets and deploy lifeboats instead of confining themselves to the radio room tapping on their Morse keys for help from anybody, anywhere...

The equipment used for GMDSS automates the way vessels send out distress calls. When the button is pressed, the equipment transmits a digital "squawk" that contains the precise identity of the vessel in distress, their exact location (from GPS), and the nature of the emergency. Rescue authorities and other GMDSS-equipped vessels in the area receive this "squawk" and

decode it -- and are presented instantly with a clear picture of exactly who is in trouble, where they are, and what's gone wrong. For vessels using Marine Single Sideband or VHF, this "squawking" is accomplished using a technology called Digital Selective Calling in conjunction with a vessel numbering system called a Maritime Mobile Service Identity, both of which are explained below.

The equipment continues to transmit this distress call, over and over without any operator intervention, until an appropriate acknowledgement is received. In other words, once the button is pressed you can then move on to pumping, firefighting treating the injured party or whatever it is you need to do to manage the onboard emergency, confident that your distress signal is going out. As we'll see shortly, you also get the relief and comfort of knowing that your call's been received.

If only the Titanic could have put themselves in direct contact with someone who already knew which other vessels were in the area, and could dispatch those resources to her assistance...

Finally, there's the matter of who's listening for these digital squawks. In a dramatic shift from "old school" thinking, GMDSS puts the emphasis on contact with land-based authorities for distress calling. While nearby ships do indeed still get alerted, the GMDSS system routes calls for help to a Rescue Coordination Center, or RCC, an agency directly responsible for the geographic area in which a vessel is operating. As the name implies, this shore-based center then assumes the task of coordinating an appropriate response (which may indeed include nearby vessels), given the distressed vessel's location and the nature of the emergency.

In this "call and dispatch" sense, GMDSS is very much like having 911 at sea. If you dial 911 to report a burglary the response you get is a police car, not a fire truck. In a maritime sense, the GMDSS system is supposed to work the same way.

These four concepts - up-to-date safety information gathered automatically, automated watchkeeping, automated distress calling with built-in position information, and call routing to an RCC who can send out appropriate help - are the principles on which the whole GMDSS system rests.

Digital Selective Calling (DSC) is the technology that gives both Marine SSB and VHF radios the automatic watchkeeping and calling capability. We've already mentioned that DSC equipment is designed to get precise location information from onboard navigation equipment like GPS, a connection which is essential for the system to work as intended. DSC equipment that's not connected to a GPS is a lot like a safety harness buried deep in a locker - way less useful than you want it to be in an emergency.

Think of DSC as a hailing system, like a pager. It's used to efficiently notify others that you want to communicate, much like you might dial a coworker's pager or cellphone and leave a callback number. When you transmit a DSC call, the digital message the equipment broadcasts contains:

1. The ID number (called an MMSI) of the station(s) being called
2. The ID number (MMSI), or "self identification", of the station calling
3. The priority of the call, categorized as Distress, Urgent, Safety or Routine
4. The time and position of the calling vessel (from GPS)
5. If a distress call, the general nature of the distress
6. What channel or means you wish to use for followup communications

A station receiving a DSC call sees, on their equipment's display screen, the ID and location of the calling station, along with the contents of the message. As noted earlier, if the message is categorized as being of a Distress or Urgent nature an alarm is sounded to attract attention.

A key feature of DSC is its addressability. Messages can be sent to a single station, a group of stations, or all stations within radio range. Stations that are not intended to get the call don't, and their radios remain silent. We should point out that DSC isn't just for use in emergencies. If your friends also have this kind of equipment, you can use the system to "dial up" each



other for routine chats, and the radio will even switch to your requested working channel automatically when the call is answered. In this sense, DSC makes your VHF or SSB work like a telephone - if someone calls you, your radio "rings", but otherwise it stays "on the hook".

It's something called a Maritime Mobile Service Identity or MMSI, which makes this addressability possible. An MMSI is a 9-digit code that gets programmed into DSC-enabled equipment.

In the United States, the Federal Communications Commission (FCC) assigns MMSI's to commercial and recreational vessels, but you have to specifically ask for one when the radio equipment is licensed by

checking the right box on an FCC form. If the equipment is already licensed, but no MMSI was issued, it's possible to amend your existing paperwork for a small fee. Industry Canada issues these numbers for Canadian-flagged vessels.

MMSI numbers are designed to be unique to the vessel in question. It's important when licensing and programming equipment aboard that a boat receives only one identity, with the same number programmed into all devices. Because MMSI numbers are unique, authorities can use them to positively identify a vessel in distress. There's actually an international database maintained in Geneva, Switzerland which is designed to help them do this.

As an aside, be careful when programming an MMSI number into new equipment. Most gear allows you to enter the number up to two times only. If you mess up twice there is no third strike -- the radio must be shipped back to the manufacturer for a reset. This is actually a safety feature, to discourage people from carrying equipment (perhaps programmed with an incorrect MMSI number, which would ID the wrong vessel) from one boat to another.

Another new aspect of GMDSS is the concept of Sea Areas. For the big ships who are required to comply with the system, the types of communications gear which must be carried aboard is dictated by where the ship will travel. The idea is that a ship in distress must have equipment capable of summoning a land-based Rescue Coordination Center (RCC) from wherever it may be. The table below describes the four Sea Areas defined under GMDSS.

GMDSS Sea Areas

SEA AREA	DESCRIPTION	APPROXIMATE RANGE	CALLING METHOD
A1	Inland/Coastal	Out to about 20 miles	within range of coast via VHF
A2	Near Shore	From A1 limit out to about 100 miles	within range of coast via MF SSB radio
A3	High Seas	70°N to 70°S outside of A1 and A2	within range of coast via INMARSAT satellites or HF Marine SSB
A4	Polar	N of 70°N and S of 70°S (polar regions)	Within range of coast via Marine SSB (no INMARSAT coverage in polar regions)

It's more helpful to think of these Sea Areas not so much in terms of equipment requirements (which don't apply to us as recreational vessels, anyway), but rather as a guide to which tool should be used for summoning help. Basically, you choose a communications method depending on where you are. As the table suggests, if you're operating inshore or within about 20 miles of the coast, VHF would be the preferred means of initiating a distress call. Out on the high seas, the best method would be via Inmarsat satellite (for those who have such gear) or HF SSB radio.



Bermuda Harbor Radio is an example of an RCC

Finally, there's the whole idea of a Rescue Coordination Center. These are the contact points with equipment that listens for emergency calls from vessels at sea.

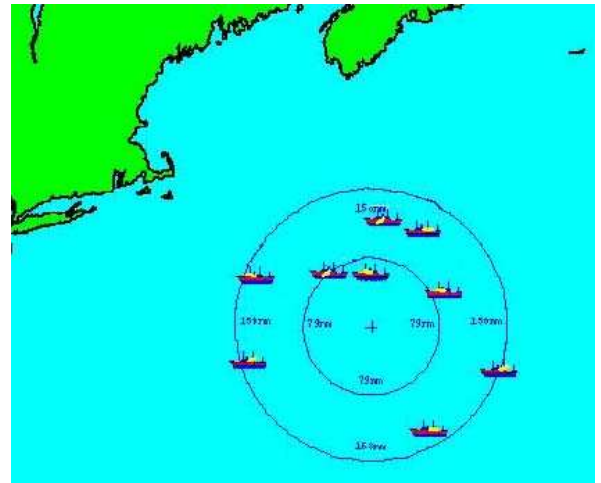
Under GMDSS, the world's oceans are divided into areas of responsibility, with each nation handling its own coastal and territorial waters. The international "high seas" are sectioned off as well, with different countries taking responsibility for defined regions. For example, the US pretty much takes care of the Western Atlantic, from about 7°N to 70°N, with help from neighbors like Bermuda (see photo), Canada and others.

But don't confuse these areas of responsibility with the Sea Areas discussed above - we're talking here about who you end up relying on when you request assistance, not how you place the call.

RCC's can summon resources such as naval or coast guard vessels and rescue aircraft from their own country or in cooperation with other nations. They also have access, via the US Coast Guard, to something called the Automated Mutual-assistance Vessel Rescue (AMVER) system. AMVER is a database that holds cruising plans and position reports from commercial shipping vessels sailing worldwide. This database is updated daily, based on voluntary reports submitted by the ships themselves. On any given day, AMVER contains information on the whereabouts of some 3,000 vessels.

In an emergency the AMVER database can be queried instantly using the latitude and longitude of a vessel in distress to produce a Surface Picture (SURPIC) showing every AMVER-participating ship within steaming range. The database also supplies details about each ship that will help an RCC determine which vessel(s) they may ask to respond to a call for help.

For a medical emergency, for example, a ship with a nurse or medical officer aboard may be requested, even when another vessel without medical capabilities is closer. If the catastrophe were a fire or sinking, the RCC might use AMVER-supplied information and choose to request the ship that can steam there fastest, even if a slower moving vessel is actually closer.



**Example of an AMVER SURPIC
(Surface Picture)**

The point is that Rescue Coordination Centers have this kind of information at their fingertips, and can use it to launch the right kind of assistance to a boat in trouble, based on the nature of the problem.

An example will help illustrate how all the pieces of GMDSS fit together when the system works as its planners designed. So let's consider the imaginary voyage of *s/v Unfortunate*, a 40-footer with an experienced skipper that sets off in late-June from Montauk, NY, on what is supposed to be a pleasure cruise to Bermuda.

Unfortunate loses her rudder about 300 miles NW of Bermuda, and a geyser of seawater starts rushing inside the vessel. Efforts to stem the leak are unsuccessful, and it looks like the crew will have to abandon ship. As they ready the ditch bag and liferaft, the skipper first activates *Unfortunate's* 406 MHz EPIRB. Next he turns to the SSB radio, and initiates a DSC distress call with the message "flooding". He follows this up with a voice "Mayday" call on one of the GMDSS voice calling frequencies.

Within seconds, bells are ringing at the US Coast Guard's Atlantic Master Station (CAMSLANT) in Chesapeake, VA and at Bermuda Harbour Radio as well. A few moments later, COSPAS-SARSAT receives the EPIRB signal and forwards it on to the Coast Guard and RCC Bermuda also. The EPIRB, when combined with the DSC hail from the same vessel, further legitimizes the call and suggests that this is not an accidental or false alarm.

At the same time, aboard a car carrier headed for Baltimore the first mate on the *m/v Valiant Trader* is startled on his watch by the horn blasting on the ship's GMDSS console. Silencing the alarm he records the message in the ship's log, noting that his own position is only about 50 miles east of the sinking boat. Leaving another crewmember in charge, with instructions to keep a close ear tuned to the radio, he goes to wake the Captain.

Unfortunate's DSC alert and subsequent mayday call is copied by the US Coast Guard, at RCC Bermuda, aboard the *Valiant Trader* and by dozens of other vessels operating in the North Atlantic as well. The other vessels stand by, guarding the radio frequency where the alert was sent to confirm that an appropriate authority answers the call. Bermuda does the same, because the position reported by *Unfortunate* is in an area where the US takes responsibility for coordinating rescues.

Within about two minutes of the first button press, the SSB aboard *Unfortunate* shows an acknowledgement message, which was sent by Coast Guard CAMSLANT. A second later the radio crackles to life, with "Vessel in Distress, Vessel in Distress, this is Coast Guard CAMSLANT, Over". One very grateful crewmember leaps for the microphone, and answers the call. The Coast Guard gathers information to confirm they are in fact in need of assistance, confirm their position, and determine the condition and number of persons on board.

While all this is going on, the ever-helpful RCC Bermuda places a call to RCC Norfolk, who will be managing what is now a full-blown Search and Rescue mission. Bermuda advises that one of their government owned ocean-going tugs is available to respond if needed. But the operator at RCC Norfolk is already checking AMVER, where he looks up the Inmarsat phone number of a ship whose last report suggests they should be very close to *Unfortunate's* position. He thanks Bermuda for their offer, and advises he'll let them know if the ship option doesn't pan out. Released from duty for the moment, RCC Bermuda stands down until next time.

Back aboard the car carrier, the Captain has just arrived on the bridge when the GMDSS console blares again. This time it's the ship's Inmarsat-C terminal, with a telex message addressed directly to the Trader from RCC Norfolk. There is a 40 foot sailboat with 4 persons aboard sinking due east of Trader's position. Can you assist?

The Captain of the *m/v Valiant Trader* orders all engines full ahead...

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