

SAR Beacons and Systems ...the technical stuff explained

So here we are ...we're out there wanting to buy a safety system but are not sure what we should be looking for.... we have all these different SAR safety systems...confused ? Oh Yes...

...as the world leader in Maritime Survivor Locating Devices we are regularly asked the following questions so we thought we'd put down some of this knowledge in a format which is useful to you ☺.

As you've probably seen, there all different types of beacons and systems...so the questions are...

1. **What are they ?**
2. **What do they do ?**
3. **What's the difference between them all ?**
4. **Which one is right for me ?**

Let's start with 406MHz...

...if you've seriously been looking for a system which will get you located by somebody, you will more than likely have had 406MHz thrust at you from some direction. Let's break it down... 406MHz is a satellite alerting frequency which can be utilised via a PLB (Personal Locator Beacon) or the larger ship's EPIRB (Emergency Position Indicating Radio Beacon). 406MHz is simply an alerting frequency. When a 406MHz beacon is set off it sends an alert through a dedicated satellite system to a ground station, which could be hundreds of miles away from your current location, they are then tasked with the responsibility of initiating a SAR operation from there. However there is a significant time delay inherent to 406MHz beacons, it can take up to 90 minutes for an alert to be registered, also the position of the of the signal is not precise.... the resolution is only to approx 6 km square which is a large area where the oceans of the world are concerned. There are 406MHz units available which are fitted with GPS, the idea being that the GPS co-ordinates of the beacon are sent out through the satellite to the SARground station...good idea but in reality they have been proven to fail to work correctly in over 90% of instances. Because of these limitations all 406MHz beacons are fitted with a lower power 121.5MHz homing transmitter. This homing signal is used by approaching SAR vehicles to precisely home into the beacon. Another *however*...each 406MHz beacon is required to be registered with the authorities, which means if you are using the small personal version you cannot swap them amongst crew or friends...if you don't register the beacon then the authorities are less likely to respond to your signal. Also the smaller personal 406MHz beacons do not have an automatic water activated function.

IN SHORT – 406 MHz ...beacons are primary alerting beacons, they are intended to provide an alert of an incident directly to the SAR authorities. It is worth noting that the smaller 406 beacons known as 406 PLBs do not have a water activated function which means they are no good for Man Overboard alert and locate.

So... is 406MHz the right choice for me?

Yes – If you want to alert the authorities that your vessel is sinking or in distress.

NO – If you are looking to quickly alert other crewmembers that you have fallen in the water.

Let's move on to 121.5MHz and 121.5MHz Alerting Units/PLBs...

121.5MHz ...we've already acknowledged the role of 121.5MHz in providing homing on the 406MHz beacons. Typically a 121.5MHz beacon with a power output of 100mW can be tracked by an inbound SAR helicopter at 10,000ft from as much as 30 miles away. So what does 121.5MHz offer?...well, it allows precise tracking of the target to within a few square metres and can provide an immediate alert of an incident when used in conjunction with an onboard receiver/alarm or Locator Unit (DF); which makes it ideal at providing Man Overboard cover for vessels, Jetty workers, Divers etc. You've probably come across the confusing reports about 121.5MHz no longer being a recognised SAR frequency...what has happened is a global tidying up of the use of frequencies for SAR. The 121.5MHz satellite channel has now been switched off globally which means the duty of alerting the SAR authorities of an incident has now been passed over to 406MHz...the role of tracking and homing is now firmly in the domain of 121.5MHz. Moving on...121.5MHz lends itself perfectly to self managed Alert & Locating systems....why? Because it can provide an immediate alert of an incident, precise tracking of an individual in the water through onboard locator units ...and importantly it integrates with all SAR world wide which means if you need the intervention of outside SAR then they can very quickly and precisely track and locate the 121.5MHz signal coming from a person (or multiple persons) plbs. To give you an example of how this has been adopted around the world...to date the Spanish fishing fleet utilises daily in excess of 34,000 121.5MHz PLBs for all their fishermen, several thousand 121.5 PLB units are in operation in the Oil & Gas industry worldwide on a daily basis, hundreds of Coastguards world wide use 121.5MHz plbs daily, thousands of sport and commercial divers rely on 121.5 MHz PLBs to keep them safe every day...the list goes on.

IN SHORT - 121.5MHz ...beacons are primarily homing beacons, they have the advantage that when they are used as part of a self managed system they can provide an immediate alert of an incident (typically within 5 to 10 seconds), they also allow very quick locating of lost individuals.

So...is 121.5MHz the right choice for me?

Yes – If you are looking to quickly alert other crewmembers that you have fallen in the water.

No - If you want to alert the authorities that your vessel is sinking.

Yes – If your vessel is sinking and you want to be located by the SAR authorities.

Yes – If you are sailing at night time or in bad weather conditions

Yes – If you are sailing in areas with strong currents

Ok so we've now looked at the two main frequencies utilised for SAR...in that case why am I coming across other Alert and Locating systems which use obscure frequencies away from the SAR homing frequency 121.5MHz ? Some companies have developed self managed systems which operate on other frequencies, although these systems provide alert and locating of lost persons they do not have the significant advantage of

integrating with local SAR...which means that if you go out range of the boats tracking unit then you are quite simply ...lost 😞.

Other types of systems...What there's more?

Proximity alert systems

What are these I hear you say ? A proximity alert system is basically a radio tag which has a dedicated link back to a base unit...when this link is broken an alarm is raised...the idea being that the position of the vessel is plotted at the time the person fell overboard and the crew can then sail back to that position in the hope that the person is still there...Problem...unlike the 121.5MHz alert and locate system described above there is no signal being transmitted by the pendant worn by the person in the water ...which means there is no way of tracking them...not good if it's night time or you are in an area with strong currents. Proximity alert systems only work on smaller vessels and require repeaters to be fitted on the vessel to overcome radio blind spots which result in false activations.

IN SHORT – Proximity Systems ...give an alert that somebody has fallen overboard, that's all.

So...is a proximity alert the right choice for me?

Yes – If you want a very basic system to alert other crewmembers if you have fallen overboard.

NO – If you want to be able to track and recover a MOB at night time or in low light conditions.


NO – If you are sailing in areas with strong currents... as there is no way of tracking the MOB.

NO – If you have a larger vessel ie. more than 40ft or it is made from metal.

NO – If you want a system which will alert the Coastguard that your vessel is sinking.

NO – If you want a system which allow the SAR crews to locate you if your vessel sinks.

DSC beacons

A few of you some of you may have come across DSC personal beacons on your travels, most of you will know about DSC within your VHF radio. DSC stands for digital selective calling and is a system found readily within ship based and handheld VHF radios on vessels of all shapes and sizes. DSC personal beacons are a  and it is worth saying 'unproven' technology. The basic idea of DSC is that automated messages such as "vessel on fire" or "vessel sinking" can be quickly transmitted at the push of a button directly to the coastguard...each vessel's DSC radio is issued with a unique MMSI number which is recorded with the SAR authorities. The MMSI number is basically a personalised log of information about that vessel...name, size weight etc. when the button is pressed all this information together with the vessel's GPS location is transmitted to the coastguard. Typically ship based VHF radios have around a 25W power output which gives them a long transmission range of approximately 25 + miles...whereas any hand held/personal beacon type units are much lower powered and have much shorter ranges, typically a few miles. However....each DSC device has to have a unique MMSI code unique to it's owner which means the beacons cannot be swapped amongst crews, they have limited ranges...also they won't work until they have acquired a GPS fix which means they are no good for immediate

man overboard alerting. It is also worth noting that on these personal beacons the antennas have to be manually deployed which again is a big no no for man overboard situations where it is likely the casualty is going to be rendered immobile through unconsciousness or is suffering from cold shock response and is unable to perform such an operation. Multiple targets also become a big issue for these kinds of beacons as they pump out all their MMSI data to other DSC radios it is down to the people at the receiving end to convert all this GPS data into immediately useful tracking information which takes valuable time and is open to human error ...something which is not wanted in a Man overboard incident where seconds can mean the difference between life and death. If multiple persons go into the water the DSC receivers on nearby vessels could be overloaded with information and rendered useless, this includes inbound SAR vessels. Let's look at this simply...a person goes overboard and after their DSC beacon has acquired a GPS satellite fix which could be a few minutes or more then the beacon transmits this on Channel 70 to nearby vessels with VHF DSC radios...here's another crunchy bit...somebody has to then write down all that information and then convert it into a course to steer which again takes more time...lets look at some scenarios what happens if you're on a large vessel which is anchored and the only rescue boat is a small rib which is launched in response, the person steering the rib would have to be given the co-ordinates verbally on a radio from the mother vessel continuously and then use these to plot a course to the MOB...and that's assuming the rescue RIB has a GPS plotter to be able to do this...add in there some very heavy seas, heavy rain or thick fog and turn it from day to night...what should be a simple case of quickly tracking a Person in the water turns into a logistical problem with too many time delays and too much room for error and delay ☹.

IN SHORT – DSC personal beacons... send out an automate man overboard message with GPS location information on channel 70 to nearby vessels within a few miles range.

So...is a DSC personal beacon the right choice for me?

No – If you have multiple persons to protect.

No – If you want immediate alerting of a Man Overboard incident i.e. within 5 seconds.

No – If you want to quickly locate the person in the water.

No – If you want to be able to track multiple targets in the water with ease.

No – If you want to swap the beacons between different crewmembers.

No – if you are sailing in areas with strong currents as the GPS data will change constantly.

NOTE – DSC personal beacons are an unproven technology, unlike the 121.5MHz systems listed above which have become industry accepted standards.