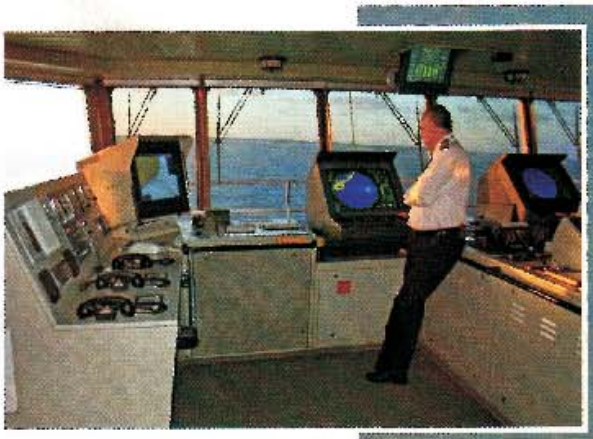
# Will they see your radar reflector?

**How many performance tests does a passive radar reflector need to pass? And are the tests of any real use? Chris Beeson goes to Qinetiq to see the Echomax EM230i being tested**




*In 2006, the ferry Pride of Bilbao is thought to have killed three sailors. The tragedy was partly blamed on a poorly performing radar reflector*

Radar waves are reflected by metallic objects. Sailing yachts, being mostly plastic or wood, are difficult to see on radar as they reflect very little of the microwave energy beamed out by radar. To improve our RCS (radar cross section) and therefore our chances of being seen on the bridge of a ship on a foggy day or at night, most leisure yachts use passive radar reflectors.

For decades we have all bought and fitted them, believing that they will reflect incoming radar energy beamed out by shipping and that we will show up bright and clear on their radar screens. A passive radar reflector, we were convinced, would keep us safe.


How does your reflector perform? Read our 2005 test online at **www.yachtingmonthly.com/reflectortest**

Not convinced you need a good reflector? Download our in-depth analysis of the Ouzo tragedy at **www.yachtingmonthly.com /ouzo**

Then, on the night of 19-20 August 2006, a Sailfish 25 called *Ouzo* was run down by the P&O ferry *Pride of Bilbao* off the south coast of the Isle of Wight. At 0107 her watch officer reported dim lights 'pretty close' off the starboard bow – close enough to change course – but the collision, or sinking, proved unavoidable.

The bodies of her three experienced crew, James Meaby, Rupert Saunders and Jason Downer, were found 40 hours later. No trace of *Ouzo* was ever found but her crew was known to deploy their 6in octahedral radar reflector at night and in fog. Despite this, *Pride of Bilbao's* VDR (voyage data recorder) showed no radar contact at all.

**'A 25ft Sailfish called *Ouzo* was run down by the P&O ferry *Pride of Bilbao* off the south coast of the Isle of Wight'**

## What has changed?

Six years before the *Ouzo* tragedy, an ISO upgrade committee began to revise the standard for radar reflectors (ISO8729-1997) to include active RTEs (radar target enhancers), which amplify radar echoes, and to improve the required standards for passive radar reflectors.

However, the resultant standard for passive reflectors (ISO 8729-1) was set at a level that no passive

*Treasury tags are used to join the EM230's fabric to its outer shell*

reflector has yet met. As a result, COSS (the EU's Committee on Safe Seas) reintroduced the original standard.

So, does any of this matter? In a word, no. In case you're wondering how many tests a passive radar reflector has to pass before it goes to market, the answer is none. Not one.

No manufacturer is under any obligation to prove that its radar reflector raises your RCS in any way at all. Some manufacturers, Echomax among them, pay to have their radar reflectors tested so that they can publish performance figures, but there is no requirement for them to do so.

## What did we discover?

In June 2005, *Yachting Monthly* published a seminal test of passive radar reflectors performed at the Qinetiq laboratory in Funtington, formerly the Admiralty Surface Weapons Research Establishment.

Our report showed that only three of the 10 reflectors tested met the performance required by ISO 8729-1997 (the same as ISO 8729-1). One of those was the Lun'Tech, which weighs 9.5kg and costs around £3,000.

The other two were by Echomax, and the best of those was the 230, which weighs 2.5kg and costs £138. It showed a maximum RCS of 24m² (at heel angles of ±3°) and an average Radar Cross Section of 4.7m².

It is used by, among others, UK and US forces, for target practice. The tests also showed that a passive radar reflector's performance dipped significantly and progressively with heel.

The *YM* team then tested a Sea-Me RTE and, as expected, it massively outperformed all of the passive reflectors with a peak RCS of 308m². There are now two RTEs on the market, both of which are powered by 12v systems and both work on both X- and S-band radar.

The Sea-Me Dual Band costs £834 and the Echomax Active-XS costs £837.40.

If you are looking for a new radar reflector for yacht, make sure you get value for your money. Ask to see the results of independent tests carried out by a recognised ISO-certified test house.

## Which ISO standards apply?

ISO 8729-1997 requires a maximum radar cross section of 10m² (which could be a single spike) and its polar diagrams must show a response of at least 2.5m² over a total angle of 240° with no nulls below that level of more than 10°. At up to ±15° of heel, the RCS cannot drop below 0.625m² for more than 10° in any 30° arc. It must also be within the weight (5kg max) and size restrictions (0.5m³ max).

Meet that standard – and then pass a range of environmental tests – and you can earn a Ship's Wheel Mark (a SOLAS-approved certification) as Echomax did with both of its EM230 and EM230BR radar reflectors.

The standard was then revised in July 2009. ISO 8729-1 (for passive reflectors) requires an SPL (stated performance level, or average RCS) of 7.5m² in X-band and 0.5m² in S-band when mounted a minimum of four metres above sea level.

This stated performance level must be maintained over at least 280° with no nulls below those levels of more than 10°, nor within 20° of each other. For sailing vessels the 7.5m² SPL should be maintained at ±20° of heel. No passive reflector meets the standard so COSS (the EU's Committee On Safe Seas) has reintroduced the previous standard until one does. ▲

*The array inside the EM230's tubing is made from a metalised fabric from DuPont*

# Mounting a passive radar reflector

**YM's test showed that heel badly affects a radar reflector's performance – passive or active – relative to the vertical. We also know that many radar reflectors are mast-mounted. However this creates a mast shadow, which means that radar waves can't be reflected if they are coming in from the opposite side of the mast.**

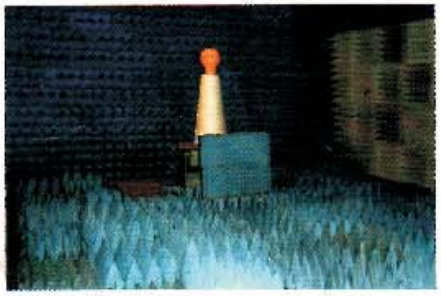
**A much better mounting position is on a flag halyard, hanging from a spreader, secured below by a bridle system of two lines, fastened to the shrouds and the mast, which allows you to adjust its angle. This significantly reduces mast shadow and allows you to keep it as close to vertical as possible. It will move about in the wind, more than a fixed passive radar reflector but, as a moving mirror will 'glint' more light, it is thought that this will enhance the chances of successful reflection. Anecdotal reports support this but we still have no evidence.**

**1** The EM230i folds up neatly for convenient stowage...

**2** ...and can be easily inflated when you need to use it

**3** Effectively positioned, hanging from a spreader

# Testing the Echomax EM230i



*Radar wave-absorbing foam pyramids were used to test the effectiveness of the EM230i at Qinetiq's hi-tech laboratory near Chichester*

**We went back to Qinetiq's Funtington lab to see Echomax's test of its new inflatable radar reflector, the EM230i. The array inside the tube is similar to the EM230 but it is made from a DuPont metalised fabric, which means it can be put inside an inflatable tube. It was designed for use in liferafts but the ability to stow it easily, deploy when required and keep the weight down to just 247g was, we thought, worth investigation.**

**The EM230i was mounted on the test plinth in Qinetiq's anechoic chamber, lined with radar wave-absorbing foam pyramids and tested at ±3°. It showed a maximum RCS of 25.6m² and an average RCS of 4.1 m². This compares very favourably with its rigid sister it and costs about a third less, at £100.36.**