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## **Carriage and Use of Radar Reflectors on Small Vessels**

**Notice to all Owners, Operators, Masters and Skippers of small vessels under 150 tons including Pleasure craft**

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### **PLEASE NOTE:-**

Where this document provides guidance on the law it should not be regarded as definitive. The way the law applies to any particular case can vary according to circumstances - for example, from vessel to vessel and you should consider seeking independent legal advice if you are unsure of your own legal position.

### **Summary**

- The recent loss of the yacht 'Ouzo' and her crew highlighted the potentially fatal consequences of poor radar visibility of small vessels.
- SOLAS Chapter V Regulation 19.2.1.7 states that a ship shall have:  
*'if less than 150 gross tonnage and if practicable, a radar reflector, or other means, to enable detection by ships navigating by radar at both 9 and 3 GHz'.*
- All small craft should correctly and permanently install a radar reflector, either passive or active (powered), that meets the standards laid down in British Standard BS EN ISO 8729:1998 (ISO standard 8729: 1997).
- Vessels under 15m overall length should be fitted with the most efficient reflector that the vessel can accommodate.

### **1. Introduction/ Background**

1.1 The loss of the yacht 'Ouzo' in August 2006 was investigated by the Marine Accident Investigation Branch (MAIB). Their report, published in April 2007 (report 7/2007), raised several issues including the characteristics of the vessel as a good radar target. The MAIB commissioned a study by QinetiQ designed to inform yachtsmen of the most appropriate choice of radar reflector for their craft. They further tasked the Maritime and Coastguard Agency (MCA) together with the Royal Yachting Association (RYA) to promulgate guidance on the carriage of radar reflectors to all seafarers but specifically owners and skippers of small recreational craft.

1.2 The physics of radar detection is a complex subject which depends primarily on the quality and height of the interrogating radar, and the range, size, shape and aspect of the vessel involved (target). Target detection is also affected by other external factors including sea state, wave shape and direction, multipath cancellations and rain. Commercial shipping uses radar equipment that operates in the 'X' band (9GHz) and the 'S' band (3GHz), which each present their own problems and advantages. The probability of detecting small craft, particularly those not fitted with a radar reflector, may be degraded by any or all of the environmental factors and this has always presented a challenge to mariners and equipment manufacturers.

1.3 Although it cannot be overemphasised that there is no guarantee that a small vessel will consistently show on radar screens, a correctly fitted reflector with a consistent echoing area or Radar Cross Section (RCS) is a crucial factor in increasing the overall probability of detection. Owners and skippers of small craft are strongly urged to fit the most effective and appropriate radar reflector for their circumstances.

## **2. Requirements for carriage**

2.1 SOLAS Chapter V Regulation 19 2.1.7 states that a ship shall have:

*'if less than 150 gross tonnage and if practicable, a radar reflector, or other means, to enable detection by ships navigating by radar at both 9 and 3 GHz'*

2.2 MCA guidance to SOLAS Chapter V Regulation 19 2.1.7 is published in *'Implementing SOLAS Chapter V Annex 15.'*

## **3. Notes on selection and installation**

The following notes give further guidance on the choice of a radar reflector for small vessels.

3.1 Reflectors meeting the technical standards laid down in British Standards BS EN ISO 8729:1998 (ISO standard 8729:1997) may carry an EU 'Wheelmark' to Annex A.1 Item 4.39 signifying that they have been type-approved to this standard for general use as a radar reflector. In 2005, the IMO performance standard was revised (IMO Resolution MSC.164(78)). This will lead to a revised ISO technical standard based on the 2005 IMO revision and is likely to be published in 2008. Until the revised technical standard is published, ISO 8729:1997 will remain in force.

3.2 An important parameter of a radar reflector is the 'echoing area', or equivalent radar cross-section (RCS), as this determines the amount of radar energy that is reflected back. Reflectors that meet the above standards and have been type-approved will have the 'Wheelmark' applied. The following are the basic requirements of the ISO 8729:1997 test standard (currently under review to include the improved requirements of IMO Resolution MSC.164(78)):

- A peak RCS of at least 10 m<sup>2</sup>;
- An RCS of at least 2.5 m<sup>2</sup> over an azimuth angle of at least 240° when the reflector is vertical (i.e. not heeled over);
- An RCS of at least 0.625 m<sup>2</sup> over an azimuth angle of at least 240° for angles of heel up to +/- 15°.

3.3 The correct installation and orientation of the reflector must follow manufacturers' recommendations if it is to be effective.

3.4 SOLAS Chapter V Regulation 19 recognises that reflectors built to the above standards are relatively large and may not be practical for fitting to smaller vessels. The MCA considers that fitting reflectors meeting ISO standards to vessels of 15m or more in length should be practicable and in many cases vessels below 10m are able to mount a reflector meeting the current ISO standard safely.

3.5 Many operators of radar systems use automatic guard zones set at 3nm to 5nm, to warn of approaching vessels and a consistent radar target response is important to trigger this function. It is emphasised that the reflector must be mounted at a minimum height of 3m (preferably 4m) above sea level to take it out of any wave obscuration effects and give a potential detection range of 5nm, which was used in setting the ISO 8729 criteria.

3.6 A Radar Target Enhancer (RTE) is an active form of reflector requiring a power supply. It receives a radar pulse, amplifies and re-transmits the signal. An RTE has a larger equivalent RCS for a physically small size than passive radar reflectors and produces a response on an 'X' band radar display, which is stronger and more consistent. Mariners should note that radar enhancers currently available (2007) do not operate in the radar 'S' band.

#### **4. Recommendations**

##### **It is strongly recommended that:**

4.1 The requirements of SOLAS Chapter V Regulation 19 are complied with;

4.2 Yachtsmen **permanently install**, not just carry on-board, a radar reflector or RTE that offers the largest Radar Cross Section (RCS) practicable for their vessel;

4.3 Small craft owners and operators are strongly recommended to fit the best performing radar reflector possible. It is also essential for skippers to be aware that, notwithstanding the type of radar reflector fitted, in certain circumstances their craft may still not be readily visible on ships' radars. They should navigate with caution.

4.4 The following reports published by the Marine Accident Investigation Branch are considered during the process of selecting a radar reflector:

[http://www.maib.gov.uk/cms\\_resources.cfm?file=/Radar%20reflectors%20report.pdf](http://www.maib.gov.uk/cms_resources.cfm?file=/Radar%20reflectors%20report.pdf)

[http://www.maib.gov.uk/publications/investigation\\_reports/2007/ouzo.cfm](http://www.maib.gov.uk/publications/investigation_reports/2007/ouzo.cfm)

## More Information

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