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Note that this paper has also been submitted to ENG8 WG3 so liaison is recommended

LIAISON NOTE TO IALA

ON THE EFFECT OF RADARS ON RACONS IN BUSY HARBOURS

1. Introduction

In June 2017 the IALA Council issued a Liaison Note to CIRM, entitled “On the Effect of Radars on Racons in Busy Harbours” (document reference C64-11.4.14.1).

The subject of the note was a study on the poor performance of racons in busy harbours, which concluded that marine radar emissions seem to be concentrated around a small number of frequencies, and that there are many radars operating at the same frequency. The study proposes two techniques that radar manufacturers could use to lessen the effects described, namely to:

- a) use more of the frequencies within the band, and
- b) avoid repeatedly using the same frequency on a large number of units.

In the note CIRM is requested to:

- note the conclusions of the study described in this note and in IALA Paper ENAV20-13.11;
- consider the fact in appropriate CIRM work groups;
- advise on how IALA and CIRM can work together to alleviate this problem.

2. Discussion

CIRM has noted the conclusions of the study described in the Liaison Note and in IALA Paper ENAV20-13.11, and the matter has been discussed extensively within CIRM’s Radar Working Group.

2.1 Current situation

With respect to the conclusions of the study, it is indeed the case that ship radar emissions are concentrated around a small number of frequencies, and that many radars operate at the same frequency. There are reasons for this.

Magnetron radars operate on a fixed frequency; manufacturers do not have the ability to change the operating frequency of their radars. In order to operate effectively at frequencies other than their centre frequencies (typically 9375 MHz and 9410 MHz in the X-Band), radars would require antenna and receiver re-design/replacement, and new or updated products would need to be re-approved by authorities.

Radar magnetrons are fixed-frequency and engineered for specific frequencies. As such, magnetrons are produced in volume only for certain frequencies. CIRM consulted a major magnetron manufacturer as part of this exercise, who explained that costs would increase significantly if magnetron manufacturers were to produce multiple fixed-frequency magnetrons at specific separate frequencies; so that the radar manufacturer would face increased magnetron cost in addition to increased costs for antennae, receivers, spare parts, and training for service personnel.

For these reasons, CIRM's opinion is that it is not feasible for radar manufacturers to use more of the frequencies within the band, or to avoid repeatedly using the same frequency on a large number of units.

2.2 Discussion on solid-state radar

The Liaison Note states: *"Future solid state radars could potentially operate using fewer and more precisely defined frequencies than older radars, which could exacerbate the problem."*

Racon (and SARTs) are currently designed to operate with pulsed magnetron radars operating in the X-Band. A report by the GLA on a test of one solid-state radar showed that the range of the racon's operations was reduced, but improvement to racon receiver sensitivity could compensate for that (ref: *"New Technology Radars and the Future of radcons"*, Ward & Bransby (GLA 2010)).

Whilst there are solid-state S-Band radars in operation today, the availability of these devices is not of relevance to this discussion because, in 2008, IMO exempted all S-Band radars from the requirement to interoperate with radcons. Some radcons do remain in operation that respond to S-Band radars but that imposes no obligation on shipborne radars installed after June 2008 in compliance with MSC.192(79) *"Adoption of the Revised Performance Standards for Radar Equipment"*.

The availability of X-Band solid-state radars on the SOLAS market is currently limited, and CIRM members have suggested this is primarily due to the significantly higher cost of solid-state X-Band components at the power levels required for racon and SART triggering.

In the last couple of years, a number of low power solid-state X-Band radars have been introduced in markets with less stringent performance requirements (i.e. non-SOLAS recreation and workboat markets subject to national regulations). These radars are not required to operate with racon or SART, but in some cases that capability is important to workboats. Such vessels might prove suitable candidates for a study similar to the one undertaken by GLA in 2010.

3. Moving forwards

In CIRM's experience, solutions that rely on technical changes to shipborne radars will result in a significantly long transition period, bearing in mind the considerable length of time it takes for new navigation equipment to permeate across the global fleet (i.e. waiting until new equipment is installed on new ships, or until existing ships are ready to replace their old equipment). Such a change would also impact upon the entire SOLAS fleet, not just those vessels sailing in areas with radcons.

In contrast, solutions based on the upgrading of shore-side infrastructure can potentially be implemented by relevant authorities over a much shorter timeframe and would affect only racon sites / radcons sited at busy harbours. Furthermore, the design and production of radcons are subject to fewer regulations than shipborne radars.

CIRM poses the following questions to prompt further discussion of this matter:

- Could racon manufacturers design future products or upgrades to existing products to operate with solid-state X-Band radars, and if so, would doing so involve more than just increasing receiver sensitivity? (As part of this exercise we have found that at least one manufacturer is marketing a racon that is reportedly able to operate fully with X-Band solid-state radars);
- Could the benefit to navigational safety associated with racons – particularly in the highly congested areas where we see problems today – be provided more economically, and with less regulatory burden, through other means (e.g. shipborne AIS and AtoN services?);
- Could the GLA be approached to undertake a further trial of racon performance using non-SOLAS solid-state X-Band radars?

CIRM is prepared to collaborate further with IALA on this matter through both the continued exchange of liaison notes and through CIRM's direct participation in IALA's E-navigation Committee.

4. Action requested

IALA is requested to:

- note CIRM's response to the conclusions of the study;
- consider the questions posed by CIRM in this note, regarding a possible way forward on this matter;
- note that CIRM welcomes further collaboration with IALA in consideration of these matters.