

Return address: P.O. Box 96864 2509 JG The Hague, The Netherlands;

International Association of Marine Aids to Navigation and  
Lighthouse Authorities (IALA)  
c/o The Secretary General  
20ter rue Schnapper  
F-78100 ST GERMAINE-EN-LAYE  
FRANCE

**Subject**  
CARPET software

Dear Sir,

First of all I would like to thank you very much for your letter dated 28 September 2010.

TNO is very honoured by the fact that the CARPET software plays a prominent role in IALA documentation in which the performance of VTS radar systems is considered.

TNO also recognizes the fact that recent developments in VTS and navigational radar systems are not conveniently covered by the present release of the software (version 2). A list of required additions according to one of our radar experts, Mr. A. Theil, is given in an appendix to this letter. TNO would appreciate a dialogue with IALA to discuss the required additions and their urgency.

TNO is currently investigating the possibility to raise funds in order to implement the proposed additions into a new version of CARPET. We would appreciate if IALA could support the 'business case' and we therefore kindly ask IALA to express their views in this matter.

Yours faithfully,



Dr. Henri Werij  
Director of Research  
Technical Sciences

**TNO**  
Oude Waalsdorperweg 63  
2597 AK The Hague  
The Netherlands

P.O. Box 96864  
2509 JG The Hague  
The Netherlands

[www.tno.nl](http://www.tno.nl)

T +31 88 866 10 00  
F +31 70 328 09 61  
Info-DenV@tno.nl

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1 February 2011

**Our reference**  
TNO-060-DHW-2011-00278

**Contact**  
A. Theil

**E-mail**  
[Arne.theil@tno.nl](mailto:Arne.theil@tno.nl)

**Direct dialling**  
+31 88 866 40 70

**Direct fax**  
+31 88 866 65 75

**Your reference**  
Your letter  
dated 28 September 2010

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Trade register number 27376655.

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**Appendix****Proposal for additions to CARPET version 2****Arne Theil****31-1-2011****Coherency**

Though CARPET version 2 supports coherent waveforms and signal processing (Doppler processing), transmit schemes with burst-to-burst pulse length agility cannot be simulated in a straightforward manner. The new release of CARPET must provide flexibility with respect to agile waveforms (pulse length, PRF and RF agility). Frequency diversity in combination with proper processing will lead to a decrease in clutter level and hence an increase in sensitivity.

**FMCW (Frequency Modulation Continuous Wave)**

Nowadays, affordable FMCW navigation radars have entered the market. The new version of CARPET must support FMCW waveforms.

**Sensitivity Time Control (STC)**

STC can have impact on the detection capability, as the receiver noise floor will vary over time (range).

**Beam squinting**

The effect of the frequency diversity concept (squinted beams) must be modeled.

**Extended target**

Apart from point targets, CARPET must be able to consider extended targets as well. VTS radar systems generally have good resolving properties in both range and azimuth angle. Typical targets (ships) are therefore extended.

**Tracking**

CARPET should be able to determine the probability to establish a firm track.

**'In situ' radar performance assessment**

Effects of terrain screening and of land clutter can be considered by consulting terrain altitude and terrain type data bases. Public releases of such data are nowadays available, such as SRTM (Shuttle Radar Topography Mission). Related to this subject, the new release of CARPET must be capable of providing maps that reveal detection capability and resolving properties (spatial resolution). Sustaining multiple radars and different approaches to combine radar output (e.g., plot or track level fusion) is also required.

**Integration with display software**

It might be worthwhile to integrate CARPET with the display software that is used by the operators. Thus, operators get the ability to view 'predicted radar coverage.'