

Operational Analysis on Torpedo Defence

Surface vessels and submarines must be able to defend themselves against a torpedo attack. Self-defence can be approached as a modular concept. The first module involves 'Detection, Classification and Localisation (DCL)'. DCL triggers the second module: the 'evaluator'. This module starts the last module: 'reactor or effector'. This module launches countermeasures which may consist of soft-kill measures (evasive manoeuvring, decoys and/or jammers) or hard-kill measures (a weapon system designed to take out the threat physically e.g. an anti-torpedo torpedo).

The Netherlands Ministry of Defence (NL-MOD) has recognised the operational need for an effective torpedo defence

system, especially in complex environments e.g. shallow water. This is an operational shortfall, given the still persistent levels of submarine proliferation. Recent technology advances enable NLMOD procurement and/or development of an effective torpedo defence system.

At present, the RNLN uses two types of torpedoes (MK46 and MK48). In the near future, these torpedoes need to be replaced by new torpedoes that are designed for shallow and deep water operations. The programme aims to develop the knowledge to support the future procurement of new torpedoes and torpedo defence systems. This will enable the RNLN to act as smart buyer, user and, in some cases, smart specifier.

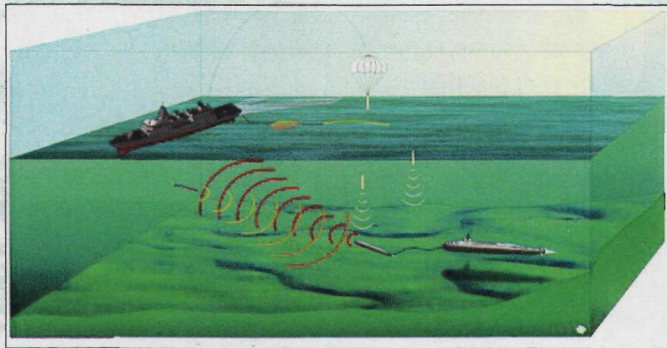


Figure 1: Surface ship torpedo defence systems

system (see Figure 1). The Royal Netherlands Navy (RNLN) uses torpedoes in a self-defence role and these torpedoes need to be replaced in the near future. This validates further research regarding the procurement, operational introduction and evaluation of torpedoes and torpedo defence systems.

Objectives of the TDS 'Torpedoes, DCL and CM' (V503) research programme

At the start of the programme, RNLN ships were not equipped with systems to effectively protect

Projects, studies and application

As part of the torpedoes and torpedo defence systems programme, knowledge and systematic descriptions will be developed on:

- Relevant characteristics of platforms, torpedoes and soft-kill countermeasures
- Torpedo and decoy logic of new and existing systems
- Interaction between various torpedo defence system components
- Acoustic detection, classification and localisation (DCL) techniques used by platforms and torpedoes using passive and active sensors

Since 1998, TNO Defence, Security and Safety has performed operational analysis with the Underwater Warfare Testbed, which provides an environment for the evaluation and validation of systems, concepts and tactics. The Torpedo Defence System TestBed has also been built to simulate torpedoes, torpedo detection systems and torpedo countermeasures.

- Relevant characteristics and behaviour of the wake of the platform
- Influence of a vessel's wake on DCL of the torpedo and its own sensor system

The studies that will be performed in the programme are:

- Analysis of the deployment of TDS for area torpedo defence (ATD)
- Analysis of decoy and/or jammer deployment against torpedo attacks
- Analysis of the degradation of the DCL (by ship and torpedo) due to the effects of wake

The resulting data will be used to support the RNLN in the procurement and use of new torpedoes and torpedo defence systems.

Underwater Warfare Testbed

To provide the RNLN in the future with the required support for acquisition, integration, operational assessment and

tactical systems deployment, TNO has designed an Underwater Warfare Testbed (UWT). On top of the UWT, a TDS model has been developed. The testbed, including the TDS model, is dubbed the Torpedo Defence System TestBed (TDSTB). The TDSTB is not only suited for single ship / single torpedo simulations but also has the potential to analyse TDS concepts for multi-ship / multi-torpedo scenarios. Besides these applications, the testbed can also be used to compare the performances of different torpedoes.

TDSTB

The TDSTB uses the acoustic model ALMOST (Acoustic Loss Model for Operational Studies and Tasks) and contains models for surface ships, torpedoes, decoys and jammers. The set-up is very modular, so new platforms (submarines, helicopters) can easily be added (see Figure 2). The sub-modules (e.g. sonar, launcher, motion etc.) can be exchanged between platforms, so new platforms can be built using

Figure 2: TDS Testbed - model structure Model structure within TDSTB

