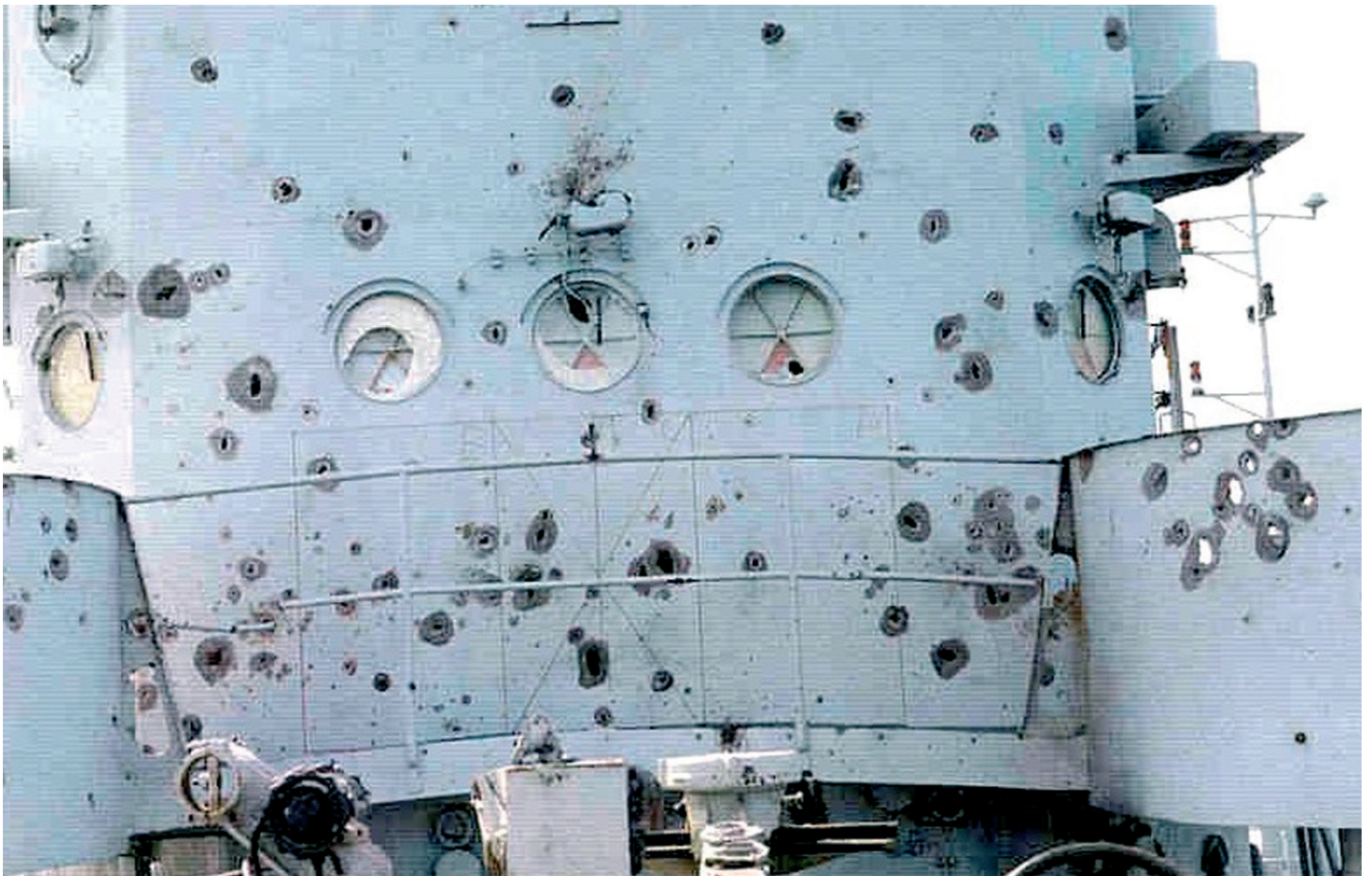


Ballistic protection for maritime platforms



Ballistic protection of ships becomes more eminent every day. Particularly when operating in the littoral, new threats come from terrorists, pirates and shore based artillery systems.

Threats

As far as terrorists, pirates and artillery are concerned, the following threats can be regarded as typical for the littoral:

- Small caliber fire up to 7.62 mm ball (AK-47 rifle)
- Hard steel AP ammunition with larger penetration capacity
- Fragments from typical ship-borne gun systems like the 76 mm and 127 mm shell
- Fragments from 155 mm artillery shells.
- Rocket Propelled Grenades (RPG-7) with a shaped charge.

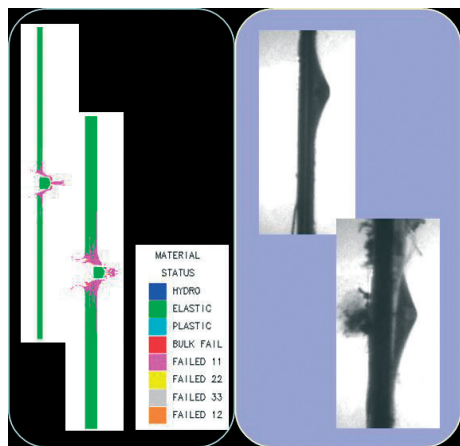
Spaces and parts to be protected

Depending on the design of the ship, spaces, compartments and equipment have to be selected as vital, such as:

- Operations room/CIC
- Communications room
- Ammo magazines
- Electronic equipment room
- Bridge
- Parts of the mast containing radar equipment
- Sensors, like radars.
- Missiles on the deck
- Power cables and cooling water circuits

Ballistic materials for maritime platforms

Ballistic materials range from metals, advanced composites to ceramics. For maritime application we focus on cost effective solutions given the relative large surfaces to be protected. We provide the customer with a practical solution dedicated for the ship environment, getting as much as possible benefit of the ship subdivision and existing steel structure. Our solutions are based on our validated and proven ballistic concepts taking into account the so-called 'behind the armour effect'. TNO has even developed an affordable solution for the heavy RPG7-threat. Simulations have shown that ballistic protection will reduce the number of casualties significantly in case of a shell explosion.



Simulations and experiments on composites.

TNO has been involved in the development of a Frequency Selective Surface radome, suitable to protect ship borne sensors. We performed the simulations, modelling and tests on this fragment and blast protective radomes (tasked by Thales Nederland).



TNO has one of the largest in house test facilities for experimental research on ballistic protection products.

TNO's competence

Vulnerability reduction by means of bullet and fragment resistant panels for a naval ship requires specific tools and knowledge beyond traditional ship design methods. TNO can perform studies, designs and tests on:

- The theoretical determination of the required thicknesses by simulations
- An optimum ballistic concept
- The empirical validation of the thicknesses by standardized ballistic testing
- Practical advices on how to apply the concept
- The probability of a hit for the components in a compartment
- Advice on the combination of blast and fragment effects



Effects of local ballistic protection (outer plates), compared with middle plate (without protection).

TNO Defence, Security and Safety

'TNO Defence, Security and Safety' is the title under which TNO operates as a strategic partner for the Dutch Ministry of Defence and makes innovative contributions to enhance the safety and security of the Netherlands both at home and abroad. We also use our accumulated knowledge for businesses, industries and foreign governments.

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