

# NAVAL PLAT- FORMS

THE INTEGRAL TNO APPROACH TO NAVY R&D

**TNO** innovation  
for life

**KEY ELEMENTS TO TNO'S INTEGRAL APPROACH IN SUPPORT OF NAVAL PLATFORM DEVELOPMENT ARE OPERATIONAL EFFECTIVENESS, SENSOR SYSTEMS, FIREPOWER, COMMAND & CONTROL, HUMAN FACTORS AND SURVIVABILITY**

**FIREPOWER**

At TNO, we cover all aspects of firepower. We offer professional, specialist advice when it comes to the selection, integration, use and maintenance of guns and missiles. From small calibre weapons to 30 mm mounted remote controlled weapon stations to 127 mm naval guns to exoatmospheric ballistic missile interceptors. We develop, simulate and evaluate firing doctrines, threat and target definitions and (special) munitions. We look at coordinated firepower, including all types and sorts of platforms and systems, like naval fire support for an integrated, simultaneous attack on ground, and defence against sea and air targets. To ensure that our crews remain safe, we also continually research active protection systems such as air defence missiles and close-in weapon systems.

TNO was involved in the First of Class Live Firings of the AAW missile systems in 2003, for the integration, evaluation and continuous improvement of the AAW system. We also developed the Missile Performance Data Set (MPDS) of the Standard Missile 2 Block IIIa (SM2) and Evolved Sea Sparrow Missile (ESSM). The MPDS provides performance data for the weapon scheduler of the Combat Management System aboard the Air Defence Command Frigates to determine the engagement times that optimise the probability of raid annihilation.

**COMMAND & CONTROL**

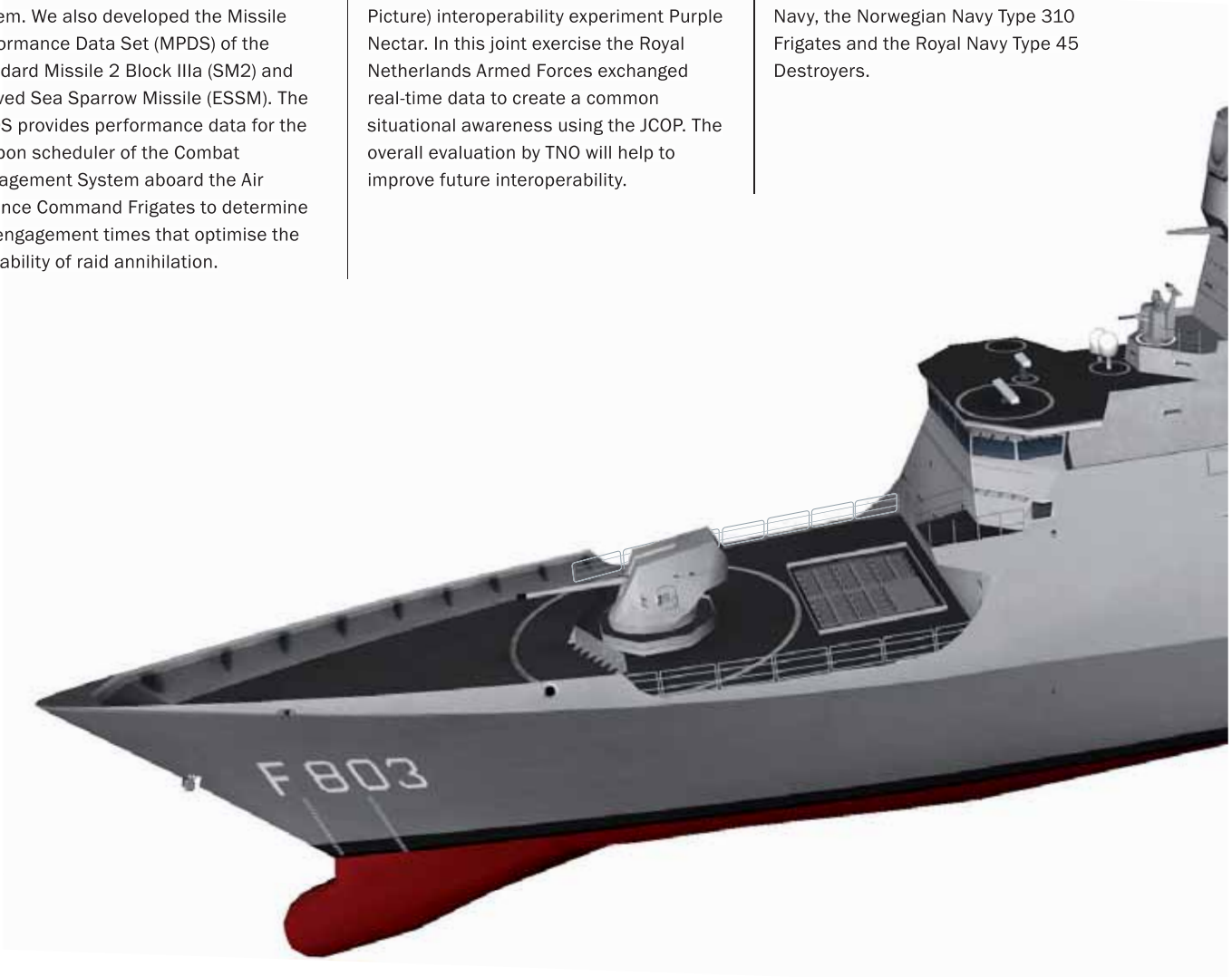
The design of future naval platforms depends on many new technological and conceptual trends like autonomous vehicles, the All Electric Ship and Network Enabled Capabilities. In addition to this, after decades of blue water operations Navies are also focusing their attention on littoral and expeditionary operations (e.g. Sea Basing). At the same time, budgets keep shrinking and crews will inevitably keep becoming smaller. Any mistake in the chain of command may cost the lives of men, and endanger the ship. That is why it is essential to have optimal Command & Control and common shared situational awareness. At TNO, we have worked with many C2 and C4I systems available today and tomorrow, on the ground, in the air and at sea. We can help you improve your system. So that you can use it in the most effective way.

TNO provided the Royal Netherlands Navy with hands-on support and the evaluation of the JCOP (Joint Common Operational Picture) interoperability experiment Purple Nectar. In this joint exercise the Royal Netherlands Armed Forces exchanged real-time data to create a common situational awareness using the JCOP. The overall evaluation by TNO will help to improve future interoperability.

**SURVIVABILITY**

There are numerous conceivable threats to a ship in peacetime and wartime conditions. Conventional threats like sea mines, shellfire, torpedoes or missiles, for instance. Or terrorist attacks, small arms fire or accidents resulting in a fire or an explosion. Any damage to the ship will diminish its effectiveness, which is a condition that should be avoided at all times. TNO has decades of experience in improving ship survivability. From the use of water vapour to reduce the effects of an incoming shell to redundant power circuits, from effective damage control techniques to blastproof doors and bulkheads – TNO has been supporting Navies all over the world in saving human lives.

TNO researches, designs, develops and validates safety measures ranging from efficient damage control organisations to reinforced hull constructions. TNO survivability solutions have been implemented on the Air Defence Command Frigates (LCF) of the Royal Netherlands Navy, the Norwegian Navy Type 310 Frigates and the Royal Navy Type 45 Destroyers.



### OPERATIONAL EFFECTIVENESS

TNO supports the acquisition, operation and maintenance of all types of military systems. Buying a naval platform is one thing. Keeping it operational at an affordable cost is another. Apart from the life cycle cost, the operational effectiveness of a Navy ship depends on numerous other factors that we can quantify and optimise for you, using realistic threat scenarios, simulation environments, operational analysis tools and Operations Research. Our unique selling point is this: for any query you may have, we can tap the knowledge and experience of more than 1,000 experts in military research projects. They will know the answer.

Together with the Royal Netherlands Navy we are investigating how TNO modelling and simulation systems can support the current counter-piracy activities. By submerging the actual operators in a simulated environment TNO helps training their tactics, techniques and procedures, familiarising them with the area of operations and the way the pirates work.

### SENSOR SYSTEMS

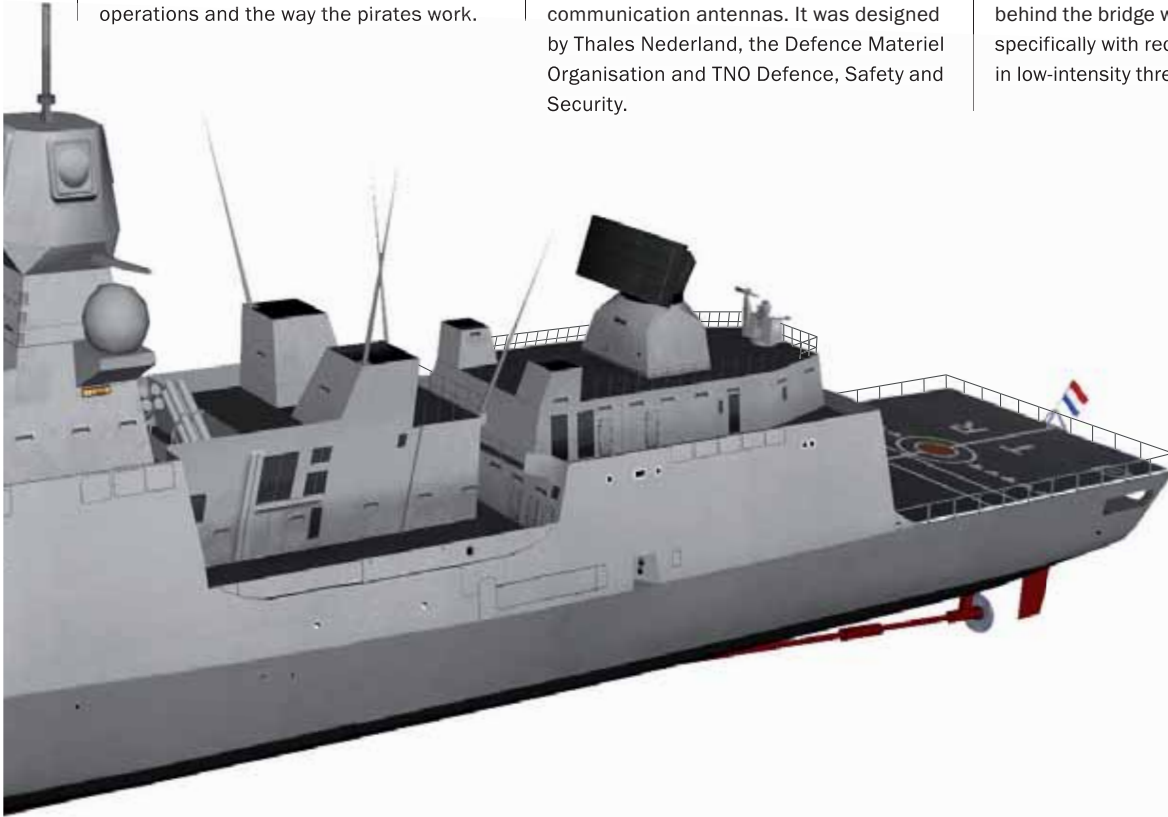
One day a Navy ship may combine maximum situational awareness with total surprise by becoming virtually undetectable outside a 10 mile radius. Not exactly easy. But it can be done, because it is all about radar, EO/IR, acoustics, data fusion, countermeasures and signature management. We know all about the latest in sensor systems, including automatic classification and identification of small targets that so easily escape detection. TNO has the knowledge and expertise to maximise the chance of seeing the enemy before he sees you. TNO will subject any measures you propose – e.g. system upgrades, coatings, decoys – to the most advanced radar and EO/IR simulations available today. And tell you whether these will actually improve your situational awareness and reduce your signature.

On the new Holland Class Patrol Vessel most of the sensor technology has been integrated in the MAST. This MAST concept consists of radars, optical, IR sensors and communication antennas. It was designed by Thales Nederland, the Defence Materiel Organisation and TNO Defence, Safety and Security.

### HUMAN FACTORS

A Navy ship is as good as the men that sail it. The crews manning the ships consist of highly skilled specialists able to perform under straining conditions. That is why TNO pays much attention to Human Factors (which in itself is a fairly broad concept). In the C2 and C4I environments, for instance, we keep looking for the best man-machine interfaces, enhanced situational awareness under poor visibility conditions, good ergonomics, optimal team effectiveness and streamlined procedures, while simultaneously reducing the crews in size. All are needed for optimal performance. But we also address e.g. motion sickness, customised foods, personal protection and effective damage control. Human Factors is all about people and their working environment.

TNO supported the Royal Netherlands Navy with the layout of the navigation bridge and command centre of the new Holland Class Patrol Vessel. The novel concept of the command centre being positioned directly behind the bridge was developed by TNO specifically with reduced manning concepts in low-intensity threat environments in mind.



**A CASE IN POINT – THE HOLLAND CLASS PATROL VESSELS**

At TNO, we are familiar with all the ins and outs of advanced military systems. Like the acquisition of a new system. This requires you to look ahead for 30 to 40 years. What will the world look like by then? Will the system still be able to perform as planned? If not, what will be the necessary upgrades? TNO has been acting as a strategic partner to the Netherlands Ministry of Defence for many years now. That is why we are confident that we will be able to help you solve a large variety of problems you may have with your naval platforms. As part of the fleet modernisation programme the Royal Netherlands Navy is introducing four new Holland Class Patrol Vessels. At 108 by 16 metres, the total displacement is approximately 3,750 tonnes. The armament includes a single 76 mm gun and a 30 mm automatic gun. The ship has a helideck and can accommodate a crew of 50. The Holland Class Patrol Vessels have been designed for operation in low-intensity conflicts, counter-piracy

and anti-drug operations. The reduced manning concept of the Holland Class, the decentralised system configuration and the integrated mast are just a few of the technologically advanced features of this ship. During the Holland Class development and acquisition phase, TNO supported the Netherlands Ministry of Defence in more than one way. A few examples of our work:

- Operational Effectiveness: speed requirements of the vessel and helicopter tactics for surface picture compilation
- Sensor Systems: concept, performance and architecture of integrated sensor mast
- Firepower: selection of calibre and gun positions
- Command & Control: wireless communication and personal information system for platform management
- Human Factors: reduced manning concepts and layout of combined command centre and bridge
- Survivability: protective blast doors and damage control systems



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**TNO**

TNO is an independent innovation organisation. TNO connects people and knowledge to create innovations that sustainably boost the competitive strength of industry and the welfare of society.

TNO focuses its efforts on seven themes including Defence, Safety and Security: TNO works on a safe and secure society by creating innovations for people working in defence organisations, the police, emergency services and industry.

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