DEFENCE

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‘There seems a clear need for real-time simulations of complex naval operations’

The defence sector is one of MARIN’s most important markets, and while we have a long-established relationship with the Royal Netherlands Navy, we also work very closely with trusted partners from all over the world.

This includes the group that forms the Cooperative Research Navies – CRN (the ministries of defence from Australia, Canada, France, the Netherlands, the United Kingdom and the US Coast Guard), but also many other ministries of defence, related research organisations and naval shipyards. Our main knowledge partner is the Dutch Ministry of Defence which invests in many background research projects to widen and deepen the sector’s expertise. Internationally MARIN cooperates together with the Dutch defence cluster in newly formed European projects about sea defence and we expect this involvement to grow over the next couple of years. Besides this, we work together with our partners and clients in CRS (Cooperative Research Ships), CRN and in Joint Industry Projects, as well as for many individual clients.

Defence team MARIN’s Defence team, led by Pepijn de Jong, often works together with our Special Ships team, as some naval vessels have similar characteristics, especially with regard to auxiliary support vessels. As defence is one of the largest markets for MARIN currently, many of our experts from other sectors work together during defence projects, Pepijn explains. “An advantage is that this strengthens cooperation within MARIN and leads to fresh, innovative ideas.”

Interesting projects in the defence market include MARIN’s involvement in the Royal Netherlands Navy replacement programmes and the further development of our Fast Small Ship Simulator to increase its fidelity level and to allow the simulation of boat operations in close proximity to other vessels and the beach.

Ageing naval fleets The reason the Defence market is so strong is related to a number of developments, both domestically and internationally, he points out. “Unfortunately safety and security at sea in general along all of the major shipping routes have seen a deterioration, related to both piracy and larger-scale geopolitical conflicts. Many Western Navies are also in the process of replacing their ageing fleets after a time of cost-cutting ushered in by the end of the Cold War. Many of the vessels in their current fleet were actually designed during the Cold War!”

In the Netherlands this trend is certainly visible, he adds. “The Royal Netherlands

Navy is replacing the minehunters, acquiring a new replenishment vessel (the future Hr.Ms. Den Helder), and is in the process of replacing the Walrus submarine and a multipurpose frigate. In addition, the ambitions of governments with improving economies is leading to further investments in defence."

Flexible modular platforms

"Conflicts are very diverse and range from potential full-scale naval conflicts to asymmetric threats from drone swarms, small boats and missiles. Modern navies are also looking towards effective, flexible, and the safe deployment of unmanned vehicles (USVs, UAVs and UUVs). This seems to require flexible modular platforms that can adapt to new mission requirements and are capable of defending themselves against a wide range of threats. Multi-role frigates seem to be a trend as well, where large, flexible mission bays and the launch and recovery of a wide range of vehicles are important aspects of the design."

A 'system of systems' There are several major challenges in the defence sector, Pepijn stresses. "Naval operations are getting increasingly complex with more platforms, which range in size and the technologies used, having to operate in close cooperation. And some of these platforms are unmanned. This means that a navy vessel has to be studied in this wider context, and optimising a single design in isolation is not sufficient anymore. Naval platforms are becoming a 'system of systems' to an increasing extent. This also means that hydromechanics design optimisation needs to incorporate this idea. The operation of the naval platform needs to be optimised in its operational context and account for the operability and safety of the entire operation and the platforms that are part of the operation. This is already evident in the number of launch and recovery studies of small craft on board of larger platforms, but in my opinion this focus will widen to the broader operation."

Therefore, it is necessary to prepare the crew for these operations and to study the effect of them early in the design process, he says. "There seems a clear need for real-time simulations of complex naval operations. Our challenge is to ensure that we have the knowledge and tools ready to apply in this new context and this is something we work very hard on."

Beaching tests for amphibious landing craft

Sailing through the surf zone near a beach during an amphibious landing can be a dangerous operation, particularly because sailing with a landing craft through following breaking waves can pose challenges to the course keeping ability and/or surf riding that can lead to large uncontrolled roll and/or pitch motions.

Model tests are the only viable option to assess the safety of an amphibious operation for now. At the same time, a model test of an amphibious operation is very different from an ordinary seakeeping test, due to the changing bathymetry and changing waves over the run and the influence of the operator during each approach.

Navies are currently modernising their amphibious forces, leading to high performance landing craft, which have much higher speeds than traditional landing craft. These more advanced vessels may have different behaviour while travelling through the surf zone. This potentially leads to a higher need for model testing these operations.

Given their specifics, MARIN has never developed a standard for these tests. To enable MARIN to offer technically sound and cost-effective amphibious testing capabilities to its clients, we decided to perform a testing campaign to develop a new approach. The objectives of these tests were to:

- Develop a cost-effective, removable beach structure that could be built in either the Offshore Basin or the Shallow Water Basin.
- Get a better understanding of the relevant aspects of sailing through the surf near a beach.
- Develop a standard approach for amphibious tests.

A removable beach was designed and constructed in the Offshore Basin at MARIN. A large beach structure is needed to obtain a beach slope that is still somewhat steeper than many beaches around the North Sea. With this beach, we tested different aspects to assess the safety of these operations. The results form the basis of a new standard that is being developed. This standard will be fine-tuned, based on the experiences of future test campaigns.

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▸ Operation Blue Beach: testing amphibious operations