



**Dutch Underwater
Knowledge Centre
(DUKC)**



Introduction

Could Dutch industries design and build the replacement for the Walrus class submarines for the Royal Netherlands Navy (RNLN)? The answer is: 'Yes, we can'. Yet this answer merits two further questions: 'why' and 'how'.

Why?

- It is an essential industrial contribution to the Dutch 'Submarine Enterprise', which comprises the vital knowledge infrastructure, and both human and other resources. There has been investment in this infrastructure and these resources for lifetime support of the new class at affordable and competitive cost.
- It effectively achieves the aims underlying the economic interests of Dutch industry and research institutes in supporting the Dutch MoD. This is also set down in the Netherlands Defence Industry Strategy (DIS) paper.

How?

- There is adequate knowledge and experience available in the Netherlands to enable Dutch industries to play a major role in designing and building submarines. Dutch industries (including the research institutes TNO and MARIN, which have specific maritime and submarine knowledge) are united in the Dutch Underwater Knowledge Center (DUKC), a collaboration platform under the NIDV (Netherlands Industry for Defence and Security) association.
- Pressure hulls can be manufactured more efficiently in collaboration with European submarine builders rather than by investing in new facilities. Co-designing reduces risks and will result in synergy during design, engineering and qualification. This supports the political desire for more collaboration in Europe and should be regarded as one of the requirements.
- The 'proof of the pudding' of the Dutch knowledge base is provided by involvement in the current Life Extension Programme (LEP) of the Walrus Class. The first boat has successfully been commissioned, and the aim of the programme has been achieved within the constraints of time and budget.

Dutch industrial knowledge base

A letter from the Ministry of Defence to Parliament dated 11 June 2015 states: “The research institutes and DUKC already fulfil an important role in the upkeep programme of the Walrus Class”.

DUKC members represent a broad knowledge base, and expertise that includes integration capability at ship-system level. As far as non-recurring labour is concerned, DUKC members are confident in their ambition to fulfil the tasks required for all key knowledge areas. The Netherlands has a mature infrastructure of integrators and suppliers of systems, sub-systems and components for the national and international maritime market, as represented in the DUKC. Together, they have up-to-date, relevant knowledge on submarine-specific areas such as composites, shock mounts, chilled water plants, hydraulic systems, and specific cabling such as umbilicals, optics, etc. Their knowledge and experience enable an in-depth approach to specifications, selection and application. This is a result of the design-and-build experience obtained with the Walrus Class, but also of the professional support performed over the last decades, covering maintenance, modifications, and the upgrade under the LEP. The ambition of the DUKC members is to contribute to the replacement of the Walrus class with their current products and on-going developments. They are keen to enter emerging areas of interest in order to further expand their fields of expertise, these being manning, automation, and launch and recovery systems for manned and unmanned systems.

In the Netherlands, the following expert capabilities have already been identified and acknowledged in recent maritime programmes and R&D projects:

- Pressure hull design
- Hydrodynamic resistance and powering
- Platform system architecture (integration and design)
- Combat management systems integration
- Design to human factors
- Signature management
- Battery and energy management systems

Naval shipbuilding in the Netherlands is of a high standard with regard to design, construction and integration.



European Collaboration

European collaboration is necessary for solving challenges concerning the production of the all-important pressure hull.

Substantial Dutch design input and co-operation is required in order to design the submarine and produce a specification. More specifically, this concerns system design in accordance with the unique RNLN context, and requirements during the design phase.

At present, military-off-the-shelf submarines do not always comply with the expected operational requirements. This is why the experienced input of Dutch industry is of vital importance. Also, it will be necessary to ope-

rate cost-effectively. Adequate participation in the design phase and support in knowledge build-up are required to extend the life-cycle of the submarines, so it is essential that the final assembly, setting-to-work and test phases of the submarine take place in the Netherlands.

Under a European collaborative programme, resources can be shared and risks can be reduced by sharing facilities, scarce capacities, and knowledge. Furthermore, the Dutch industries have unique and





proven experience in setting up and implementing complex maritime programmes for merchant ships, off-shore vessels, and naval ships. This experience is invaluable and has shown its relevance in several challenging programmes, including those in the national and international submarine communities. DUKC's ambition is not only to have this added value embedded in the Submarine programme but also in the structured cooperation. This so-called triple-helix innovation model refers to a set of interactions between research institutes, industry and government with the purpose of fostering economic and industrial development.

This could be described as the cornerstone for strategic programme development for Dutch Defence, including involvement

and industrial responsibilities in the in-service support phase.

Knowledge-sharing in the areas of risk avoidance, procedures and programme management will contribute to overall submarine safety. Submarine safety is a non-negotiable and overarching requirement. This safety approach cannot be underestimated and impacts most, if not all submarine-related activities.

The replacement programme is strongly linked with European international collaboration. The DUKC and other industrial and non-industrial stakeholders are eager to play a crucial role in the replacement programme. Potential international partners will benefit from the Dutch contribution.



Proof of the pudding: the Walrus Life Extension Project (LEP)

The proof of the pudding lies in the experience stored in knowledge databases from well-regarded submarine projects for the RNLN such as the Zwaardvis class, the Walrus class, export projects (Hai Lung class) and recent designs and deliveries for foreign submarine programmes.

DUKC members created the concept and detailed design, and delivered production data packages to the naval dockyard implementing the LEP. The components and sub-systems were supplied internationally and domestically.

One of the main achievements was the interactive design study, in which representatives of the submarine service determined the new arrangement of the operating consoles for the new **Combat Management System** (CMS) in the modified Operations Room.

Major improvements were achieved by producing a domestically designed and produced update to the CMS (the acoustic sensor package), implementing the Optronic mast, and introducing a SHF SATCOM capability. This makes the LEP a preview of the future capabilities of submarines replacing the Walrus class.

In the same period, **the steering console and algorithms** were updated, and the **chilled water plants** replaced. Currently, the Integrated Platform Management System has been modified to extend the technical and operational lifespan.

At the same time, the torpedoes improved capability has been implemented and successfully tested.

DUKC members have played a major role in all areas. After conducting the successful Walrus class LEP programme, we are now ready for the current Walrus class replacement programme.

The submarine enterprise – The industrial knowledge base

Entering the replacement programme for the Walrus class means entering a complex and challenging phase. Procuring the hardware seems to be relatively straightforward. However, building the military platform means developing a skilled work force in order to guarantee maintenance, sustainability and operability.

An important and often underestimated aspect is the availability of well-trained staff with sufficient operational experience. “This is a significant asset that, once lost, would prove to be highly costly, if not impossible, to recover”. This statement, issued during a recent hearing of the Defence Commission, stresses the importance of the so-called ‘Submarine Enterprise’. Thorough understanding of the submarine operational output, maintenance practices, related R&D and engineering are vital contributions by Dutch industry and research institutes in this Submarine Enterprise.

A successful programme based on a European alliance with an experienced submarine designer/builder may enhance export opportunities for the parties involved, including Dutch companies.



Economic interests

According to a letter from the Minister of Defence addressed to the Dutch parliament, "Collaboration with national industry and research centres is to be conducted within the scope of the 'Defence Industry Strategy (DIS)'".

Combining submarine design and production technologies in the challenging Dutch context and within the scope of the above-mentioned DIS will require an innovative design and production process. It will also involve a much wider spread of industrial contributions than the DUKC community.

The replacement programme will consolidate and boost the national knowledge infrastructure needed to extend the effective and efficient output of all aspects of the Submarine Enterprise. No doubt, the Royal Netherlands Navy (RNLN) will benefit from this knowledge in future maritime programmes.

Other recent and successful programmes for the RNLN have been the air defence frigates, patrol vessels, and the Joint Support Ship. Again, these are examples of the unique Dutch co-operation involved. Its technology and programme management are also highly regarded in the international arena.

All relevant Dutch content will contribute to the 'Submarine Enterprise' as an important cornerstone for both initial implementation and life-cycle support for the new class of submarines. Important input will be provided in the design, production engineering and integration phases.

Furthermore, the relevant, specific areas for a submarine programme, such as integrated system design, sensors, automation, advanced materials and components, electronic and information protection, are all part of the priority areas mentioned in the DIS.

Dutch Underwater Knowledge Centre (DUKC):

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