Nevesbu

NAVAL ARCHITECTS & MARINE ENGINEERS

Submarine & naval platform design and engineering

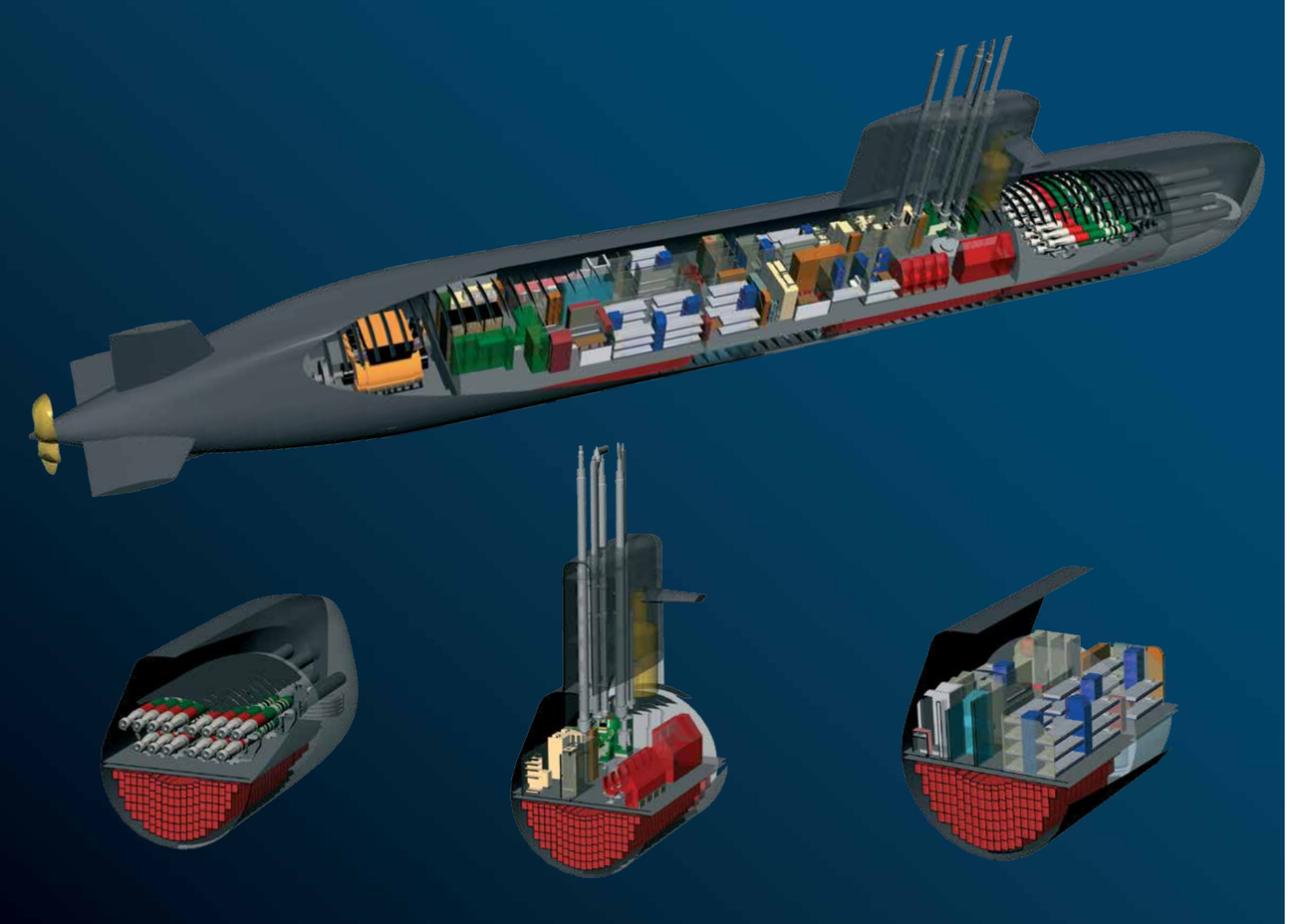
80 years engineering experience

"Good men learn from experience.
Wise men learn from the experience of others."
Otto von Bismarck

Introducing Nevesbu

Established in 1935, Nevesbu is an independent Naval Architecture and Marine Engineering company based in the Netherlands. Nevesbu offers design and engineering services to the maritime, naval and offshore industries worldwide. Thanks to our years of experience and our specialist knowledge of shipbuilding, complex maritime constructions and maritime systems, we are able to manage large multi-disciplinary projects and fully support our clients from program definition and the complete design & engineering of the ship and its systems up to production support and support during operation.

Naval vessels are used for crucial missions. Reliability of the ship and its systems, as well as the comfort of the crew, are essential factors which contribute to optimal performance at sea. This requires an integrated ship design with an exact balance between requirements, costs, risks and technology. Risks must be tightly controlled when constructing or converting complex vessels. Using a pragmatic engineering approach, Nevesbu helps defence organisations and shipyards in realising complex projects cost-effectively and on time, and we help mission system suppliers and knowledge institutes to integrate their mission systems and innovations into the vessel successfully.



Our services for new-build submarines & naval platforms

Naval vessels are outfitted with various mission systems and pieces of equipment to suit the needs of the end suit the needs of the end-user and make the intended tasks possible. The design of such vessels with unique capabilities requires specialist know-how and an integrated design approach. Nevesbu has over 80 years of experience in designing naval vessels. We understand that the complexity in respect to the vessel's purpose has a direct relation to the total new building costs as well as total life cycle costs. As an independent knowledge center, Nevesbu can take care of the total design and engineering. Our services for new-build submarines & naval platforms include consultancy (technical & project management), technical support to acquisition, concept studies, system integration, design & documentation, on-site building supervision, procurement of marine systems and class approval.

Concept studies

We offer support in defining the design of new naval platforms. We assist in the election of requirements and wishes, and translate these into concept design solutions to evaluate performance, benefits and operational costs. Nevesbu clarifies the relationship between requirements and design consequences to gain insight into the design-driving requirements.

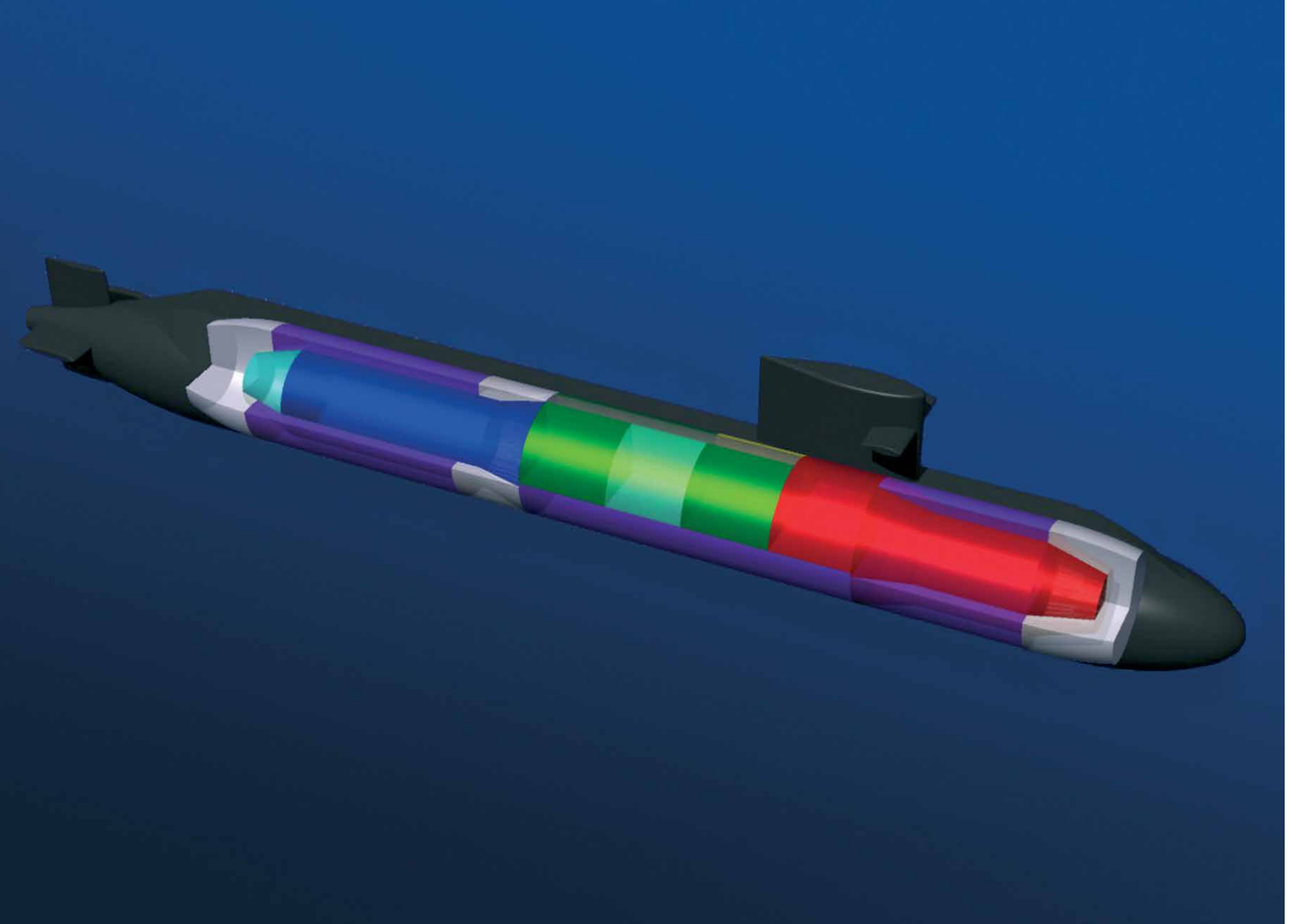
System integration

Nevesbu acts as a platform system integrator for both new-build and refit projects, bringing together new and existing systems into one platform, and ensuring that all subsystems function as a whole. We monitor all vital ship systems, such as available electrical power, heat load, ship weight as well as stability and strength. Furthermore we provide technical support on site.

Design & documentation

Nevesbu supports its customers with design and documentation of naval platforms or parts thereof based on know-how and experience. We provide design and analysis of mechanical equipment and transport and handling systems. We also design mounting and integration of weapons and command systems provided by a third party. Nevesbu establishes procedures for design reviews, tests, installations, alignment et cetera, as well as requirement management. Additionally we provide detailed design and engineering for both new-build and refit projects.

Nevesbu brings added value to projects with a practical and structured design process. We manage meeting of pre-set requirements and, more-over, to achieve and maintain the target mission philosophy of the project.



Tool development to improve the submarine design process

It is well-known that the design of new naval platforms is a complex and time consuming task. To improve and simplify the submarine design process, Nevesbu continually develops its working processes and tools. Recent developments are the SUBmarine Supporting Design Tool (SUBSIDE), the Volumetric Estimation Tool and PHAReB (Pressure Hull Analysis on a Reliability Basis) all part of the SUBCEM toolbox.

Submarine Supporting Design Tool

Due to the great complexity of modern submarines, the process of selecting a design philosophy requires iterative developments and comparison of multiple design strategies to assess technical and performance characteristics, cost implications and risks. To break down this process, Nevesbu has designed a tool which has been incorporated into the naval architectural software package (NAPA), developed by Napa Group. This tool, named SUBSIDE, assesses the performance of submarines in the early stages of the concept design as well as in the later stages of the design process.

SUBSIDE is used for modelling submarines, balancing and evaluating their stability. Some of the main capabilities developed within the tool include modelling of the pressure hull, parametric modelling of the outer hull (including appendages), main internal structure for tankage, bulkheads and main decks, contribution to buoyancy, weight distribution and balance, size and location of typical tanks in submarines like main ballast tanks and trim and compensation tanks, hydrostatics, transition analysis, stability check, operational conditions checked, and equilibrium polygon.

Volume Estimation Tool

One of the most important design requirements when designing a submarine is the attainment of neutral buoyancy. To evaluate the buoyancy of a submarine design, it is extremely important to make a reliable estimate of the weight and volume of a design. Nevesbu developed the Volume Estimation Tool (VET) in order to determine quickly at an early stage of the design process a suitable starting point for the main dimensions, volume and sub-volumes of a diesel-electric submarine. Thanks to the limited quantity of input data and the short time needed to use the VET, it is possible in a matter of minutes to make an estimate of a submarine's volume and dimensions that are appropriate to a selected mission profile. The tool is modular and flexibly structured, meaning it is expandable by adding new functionalities. These may include a section with a multi-mission portal, a section with atmosphere independent propulsion or alternative energy storage systems.

Pressure Hull Analysis on a Reliability Base

The submarine's commander must have sufficient information at his disposal to take a well-considered risk as he passes his ship beyond operational depth. A designer can calculate these risks using probabilistic analysis. But since these analyses are performed with numerical simulations, they are time consuming. Nevesbu is developing a new, compact formula that can accurately portray failure behaviour in a shorter calculation time. This tool is named PHAReB. The study focuses on the application of numerical simulation using the Response Surface Method or Monte-Carlo simulation. But in contrast to the present situation, it is limited only by computer power.

Our services for life extension programmes

To ensure overall operational availability, an upgrade is sometimes necessary. Nevesbu's history record consists of a wide range of experience in life extension programmes of various naval platforms. We can take care of the complete design and engineering and assist our clients in all project phases. Our services for life extension programmes include consultancy (technical & project management), technical support during acquisition, concept studies, system integration and design & documentation. In addition to engineering and design, we offer assistance on-site during the construction phase and implementation and we can take care of the procurement of marine systems and class approval.

Nevesbu acts as a platform system integrator for upkeep and Life Extension Programmes. As the platform engineering partner, Nevesbu carries out the engineering necessary to allow embedding of all modifications (including new systems) on board the platforms. Nevesbu ensures that all systems are able to operate as an integrated whole, and makes an inventory of systems to be decommissioned. Further steps in the process include, among others, designing the new arrangement, allocating space for new hardware, and as an architect giving all new and existing equipment a place in the ship or submarine. Furthermore, Nevesbu provides technical support and advice.

With a multidisciplinary approach and expert team, Nevesbu is capable of developing multiple platform configurations. For example, maintaining the capability to withstand high water pressures and shock (e.g. from explosions) in submarines while satisfying other requirements in areas like electromagnetic separation and radiated noise, or drawing a transport plan to find out how all components (structural elements as well as equipment) can be brought on board. It is a complex puzzle to find room for all systems and to ensure that they work according to plan. With Nevesbu as a partner, this can be accomplished.

Due to the specific kind of knowledge required for naval platforms, we aim to bring together knowledge and expertise in the field of naval platforms and achieve synergy through cooperation with other parties. Combining these strengths gives our clients added value.




An example of a project executed by Nevesbu: Life Extension Programme for the Walrus class submarines

The four Walrus class submarines of the Royal Netherlands Navy went into service back in 1990. The submarines were originally designed for a service life of 25 years, with an upkeep planned for halfway through their life cycle. To ensure overall operational availability, in 2007 the Dutch government agreed to an upgrade of the four submarines and the Navy Command decided to recruit extra personnel. The objective of the Walrus class submarines Life Extension Programme (LEP) is to prolong their service life to at least 2025 and to increase their operability in coastal waters. To meet the new technical standards and requirements, the command center of the Walrus class submarines have to be completely stripped and provided with new equipment, cable ducts, piping and technology. The LEP integrates all the work needed for this. A puzzle which asks for efficient use of the available space and effective implementation of state-of-the-art engineering.

Platform system integrator

As the platform system integrator, Nevesbu was tasked with carrying out the engineering necessary to allow embedding of all modifications (including the new systems) on-board the submarines. Nevesbu ensured that all systems are able to operate as an integrated whole, and was responsible for making an inventory of systems for decommissioning. Further steps in the process included designing the new arrangement, allocating space for new hardware, and as an architect give all new and existing equipment a place in the submarine. Nevesbu was further responsible for designing the foundations for equipment, cable ducts, piping and furniture. The scope of the work also included designing connections for piping, electrical systems, controls and cooling systems, and monitor essential aspects like the power distribution, the heat load, and the vessel's weight, volume, stability and strength. Furthermore, we provided technical support and advice.

The life extention includes modernising the present torpedoes, rearranging the command centre, integrating satellite communication systems, modernising the Combat Management System, replacing a number of obsolete primary sensors (sonar systems and replacement of navigation periscopes by optronic mast), as well as modifications to several platform systems.

DUKC

Due to the specific kind of knowledge required for the Walrus class submarines, the programme manager at the Defence Material Organisation (DMO) of the Ministry of Defence enlisted the assistance of the Dutch Underwater Knowledge Centre (DUKC). DUKC is a working party dedicated to maintaining submarine know-how in the Dutch industry. It initiated a collaborative venture to support the conceptual and platform engineering activities in the LEP. The aim is to bring together knowledge and expertise in the field of submarines, and to achieve synergy through cooperation. A number of basic principles were defined for the maintenance engineering work.

Design philosophy

To adhere to the Walrus class design philosophy, Nevesbu's designs are based on the new-build requirements and design rules. The systems are integrally designed to produce a single design that functions harmoniously. Nevesbu started with high level designs and worked its way down to the detailed level in order to comply to the general design philosophy. The engineering part of the maintenance programme has been divided into two phases. Nevesbu kicked off with a conceptual phase that zoomed in on the changes with the largest impact during the detailed design. The consequences for the LEP platform were worked out in detail.

Conceptual phase

During the conceptual phase, the consequences of integrating new systems were assessed, to produce an initial design of the required modifications and space reservations, and to translate the design requirements into procedures. The aim was to quantify and reduce technical risks, identify interfaces and questions (also for suppliers), validate the choice of suppliers, and act as a SMART Buyer in the procurement process. This has been accomplished by monitoring ergonomic aspects and ensuring a comfortable living and working environment on board of the submarines. Other work included monitoring the heat balance (cooling capacity), the available power, and the seaworthiness of the vessel. Factors like the available space, the electrical power and the cooling capacity cannot be changed. This makes it essential to keep the entire modification within the constraints of the current submarine design.

To obtain a good baseline for the platform engineering, the existing documentation was examined on-board and the differences were highlighted. A three-dimensional model was produced of areas where complex changes are expected, based on the relevant two-dimensional drawings and diagrams. As part of the tender evaluation process a number of new systems, such as the optronic mast and the SHF satellite communication system, the integration consequences for the platform were analysed and compared.

The information obtained from the RFQ was used to produce a draft integration plan. The modifications were analysed and the plan was evaluated from an engineering point of view. This made it possible to produce a ranking, with quantification for all tenderers of the layout consequences (clashes with existing systems and routing), construction, platform systems (hull penetrations, heat load, hydraulics, et cetera), weight and volume.

Thanks to this work we were able to draw up modification recommendations for all potential suppliers. With this advice, suppliers had an opportunity to optimise their design and reduce its impact on the platform. Using the revised plan from the supplier, we again conducted a series of analysis. The ranking of the platform consequences served as input for the ultimate selection of suppliers. Examining all consequences for the submarine in the RFQ phase made it possible to establish clear confines for suppliers, and thus greatly mitigate the risks for the overall maintenance programme.

Analysis of design requirements

The original requirements for the Walrus class submarines were converted into concrete design solutions and verification procedures for the activities conducted as part of the LEP. This practical translation of the original requirements ensures adherence to the original design philosophy, so that all new elements will satisfy the original requirements.

Detailing phase

The detail design was worked out in the detailing phase. This started by defining the demolition work, the equipment, foundations, cables and pipes to be removed. This disassembly plan was followed by the design of the new layout and furnishings of the submarine. The new layout was used to determine the locations of all components, to design the foundations, cable ducts and piping, and to decide on the structural modifications. The design were then validated.

Submarines must meet stringent requirements. Among other things, a submarine must be capable of withstanding high water pressures and shocks (e.g. from explosions), and satisfy all other requirements in areas like electromagnetic separation and radiated noise. A transport plan also has to be drawn up to find out how all components (structural elements as well as equipment) can be brought on-board. Space on-board a submarine is at a premium. So it is a complex puzzle to find room for all systems and to ensure that they work according to plan. At the end of this phase, the design is translated into a manufacturing documentation package.

During the LEP, numerous changes are made to the submarine's systems. New weapons, sensors and communications systems are brought on board. Systems are modernised and obsolete systems are removed. Changes had to be made to the connections between all of these 'subsystems'.

All of these systems are still under development, so design and configuration management is extremely important. It involves questions like: Which information has or has not been incorporated into a particular part of the design? The relevant information is saved in the configuration management system. Nevesbu is also involved in the design reviews of all suppliers so as to monitor the platform interfaces. The relation between the platform and the suppliers' engineering interests is monitored by platform engineering units. It is important for DMO, supplier and platform engineer to agree and monitor interfaces between the different systems and the platform.

The concept phase started in 2008 and finished in 2011. In 2011 Nevesbu started the detailing phase and completed the engineering by the end of 2012. Work on the LEP went underway in early 2013 at the navy dock yard in Den Helder, the Netherlands. On Monday, 13 May 2013, the Life Extension Programme for Walrus class submarines officially started.

An example of a project executed by Nevesbu: Life Extension Program Dutch M-frigates

The Royal Netherlands Navy multipurpose (Karel Doorman) frigates have been operational since 1996. Recently, the four frigates owned by the Royal Netherlands Navy and Belgium Navy have been modernised in order to keep them fully deployable until 2020, both on the ocean and in coastal waters, and in the highest spectrum of violence. Installations that no longer met the environmental requirements or operational availability have been replaced.

One of the applications that the frigates have after the life extension program, is an innovative LFAS system, which allows them to detect submarines better than with other systems. As the platform system integrator, Nevesbu was responsible for defining the demolition work, producing the plans for the new layouts, designing the foundations and all the connections with the ship (such as the cables, pipes and controls) and monitoring the stability and energy balance of the ships.

Nevesbu b.v.

Kelvinring 48
2952 BG Alblasserdam
P.O. Box 278
2950 AG Alblasserdam
The Netherlands
Phone: +31 88 943 3400
Fax: +31 88 943 3401

sales@nevesbu.com
www.nevesbu.com

Nevesbu Sdn. Bhd.

No 29-4, Jalan SP 2/1
Taman Serdang Perdana - Seksyen 2
43300 Seri Kembangan, Selangor
Malaysia

Nevesbu
NAVAL ARCHITECTS & MARINE ENGINEERS