QinetiQ
People Who Know How

Paramarine®

ADVANCED MARINE DESIGN SOFTWARE

Paramarine®

Fully Integrated Tool

Paramarine is a fully integrated Naval Architecture tool, where all design and analysis work takes place within one common graphical user interface, eliminating the need for data exports to other packages.

Integration of multiple analytical tools within one software package

- Concept Design
- Stability Assessment, both damaged and intact
- Manoeuvring performance
- Powering and Endurance
- Seakeeping
- Structural Analysis

Customisable reports including general arrangements, stability books and Probabilistic Damage can be easily generated using Paramarine's advanced reporting functionality. These can be opened directly within Microsoft Word for further customisation if required.

Parametric Design Approach

Paramarine's object orientated design approach allows designs to be generated and controlled with ease through input characteristics. These can be used to parametrically define the hull, which can be assessed for stability, structure and manoeuvring performance. The resulting values are always up to date, eliminating the need for the user to manually recalculate any part of the design.

Siemens Parasolid™ Technology

Based on Siemens Parasolid, Paramarine integrates seamlessly with NX and also provides comprehensive interfacing through STL, STEP, DXF and IGES file types.

Paramarine uses the principles of facet geometry rather than curve groups to perform calculations, providing the user with results of greater accuracy. The 3D geometry allows the user to easily visualise their design and compartment definition.

Using powerful and flexible surface generation functionality allows the rapid generation of complex hull forms and subsequent compartment subdivision. This approach prevents double accounting of volume and the hierarchical nature of the subdivision ensures the consistency and integrity of the design.

Embedded Excel and Team Paramarine

Through an embedded Microsoft Excel functionality within Paramarine, users are able to easily control and define the flow of data to and from a design as well as utilising the inherent VBA macro language to undertake optimisation routines.

Multiple users are able to co work on a single design through the Team Paramarine functionality. This provides user access control, design auditing and the ability to check in and check out areas of the design.

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"Paramarine is our submarine software design tool of choice. Paramarine is easy to use, intuitive, has a good graphical user interface and is extremely flexible and powerful. I think Paramarine is probably the most powerful tool available for submarine design"

Rob Ritchie, Engineering Manager - Naval Architecture, BAE Systems - Submarine Solutions

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> "Paramarine allows us to push the limits of ship design, enabling naval architects to explore design possibilities fast at the crucial early stages"
>
> **David Andrews, Professor of Engineering Design, UCL**

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◢ FLEXIBLE CONCEPT DESIGN

Building Block Methodology

Available within Paramarine is the extremely flexible concept design module. This provides the ability to represent the make-up of a vessel using the building block methodology.

Each component within a design can be represented as a block, to which any number of individual characteristics are applied, such as weight, power requirement or volume demand.

Integrated Approach to a Balanced Design

In search of a balanced design, infringements will be reported where supply does not meet the demand and clash detection reports any occurrences. Each building block may be moved freely allowing complete flexibility of an evolving design. The effects this has on stability, powering and manoeuvring can be seen immediately through the integrated nature of Paramarine.

Benefits include:

◗ Flexibility
◗ Weight breakdown
◗ System definition
◗ Allows design to develop from coarse to fine detail level
◗ De-risking of design at concept stage

◢ STABILITY

Utilising the 3D visual representation of a vessel, Paramarine's Stability toolset enables the user to define intact and damaged cases with clarity.

The broad scope of stability criteria provides pass/fail checks which are generated quickly for the user to see.

With all analysis contained within the one design file, vessel definition can sit alongside the stability analysis allowing for the geometry to be modified and the impact to be immediately assessed. A vast array of tools are provided to allow detailed analysis of such areas as intact and damaged states, docking, grounding and emergency response.

©MIT

©UCL

SeaWeigh™ has been selected as the on-board loading computer for the Queen Elizabeth Class Aircraft Carriers. Integrated directly with the Platform Management System, SeaWeigh™ provides ship staff an immediate indication of stability and longitudinal strength compliance.

HMS QUEEN ELIZABETH

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Key Stability Functionality

- Standard hydrostatics and tank calibrations
- Comprehensive intact and damaged analysis
- Damage templates to expedite damage case generation

Advanced Emergency Response toolkit

- Multi point grounding analysis
- Time stepped flood simulations
- Powerful visual representations
- Docking and launching calculations
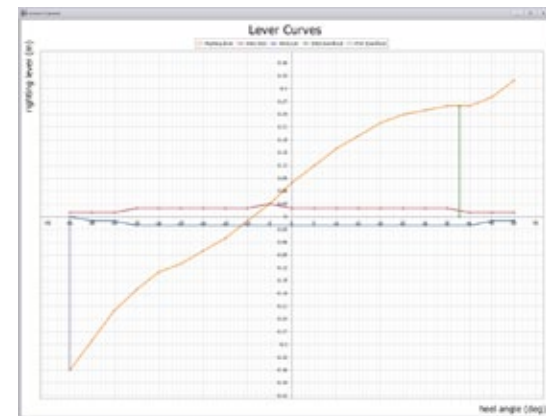
Extensive criteria coverage

- Commercial regulations
- UK, RAN, US warship and submarine
- Latest SOLAS 2009 regulations
- User friendly interface
- Clear pass/fail

Specific interrogation tools to allow the user to modify the design to improve the result. With the inclusion of finger printing theories, re-calculation times are reduced allowing for the impact of localised changes to be realised quickly.

Submarine specific features include

- Fully balanced submerged calculations
- Surfacing under ice analysis
- Trim polygon generation

Warship specific features include

- Carpet plot generation tool
- V-Lines and Red Risk Zone assessment
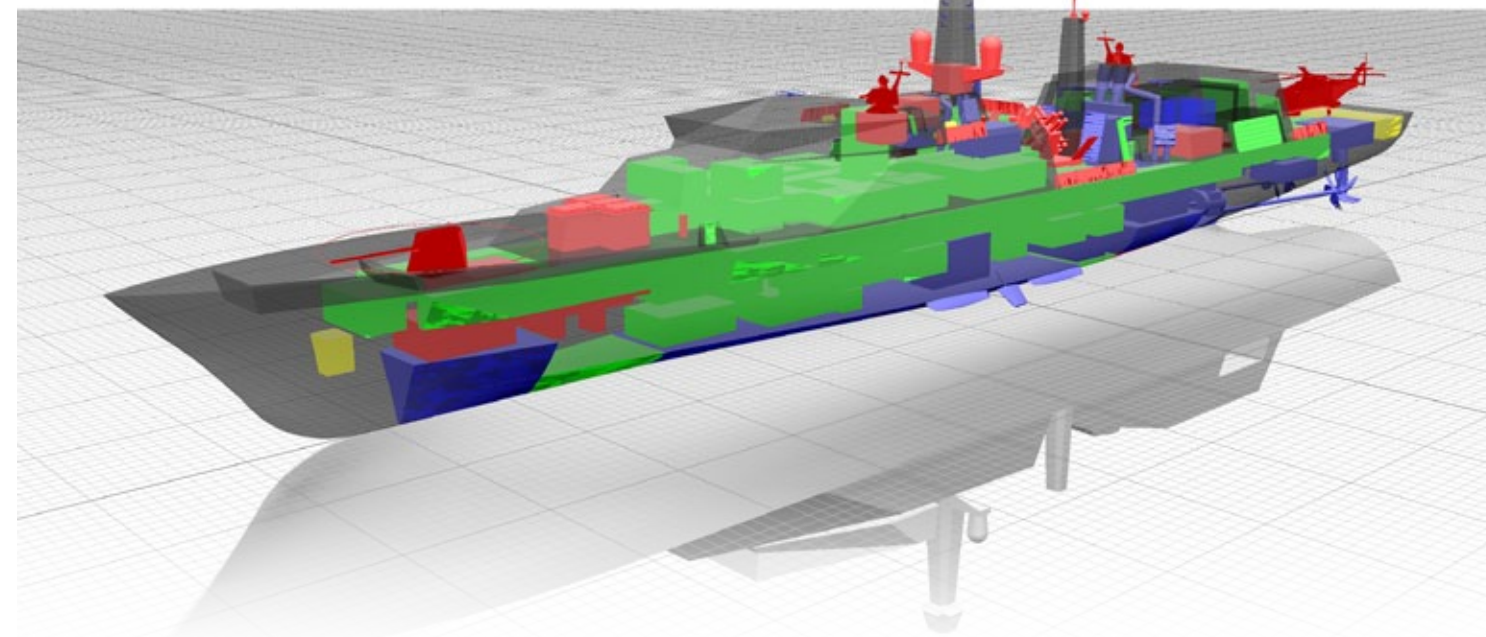
◢ MANOEUVRING

Paramarine allows for a range of vessel types to be examined, including mono hulls, trimarans and submarines. In addition, the manoeuvring performance can be assessed for a range of vessel propulsion and appendage types.

For submarines, the in-built derivative predictor can be utilised at a concept design level, or where towing tank data is available the full coefficient set can be used.

Fully Customisable Manoeuvres

- Turning circles
- Zig zags
- Spirals
- User defined

Submarine specific functionality includes:

- Linear derivative predictor based on geometry
- Unclassified non-linear set provided (can be overwritten)
- Non-linear 6 degree of freedom simulation

Detailed graphical outputs allow representations for the manoeuvres to be displayed for the user to interrogate further.
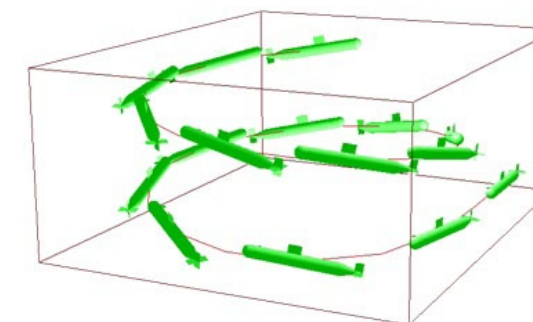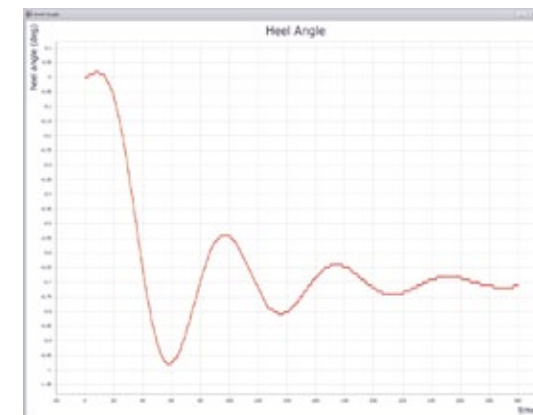
◢ POWERING AND ENDURANCE

Integrated within the one program, the powering estimation uses common algorithms to calculate the effective power requirements of a design based on:

- Naked hull from Paramarine geometry
- Appendages
- Fouling
- Air resistance
- Shallow water effects
- Powerful propeller finder
- Both surfaced and submerged resistance can be calculated.

The endurance calculations allow surfaced or submerged mission profiles to be defined allowing investigation of the energy store levels throughout each mission.

◢ SEAKEEPING

Paramarine offers a 2D Rankine source approach for calculating the frequency domain seakeeping response of a vessel in a seaway. The use of this approach allows for a rapid, robust solution without problems of irregular frequencies found in alternative solutions.

Analyses of motions at specified locations in the vessel in order to assess the lateral and vertical motions (displacement, velocity and accelerations) can be undertaken.

Operability assessments can be performed which will identify the proportion of time that the vessel may be restricted in operations due to ship motions related impairment of systems or human behaviour.

◢ STRUCTURES

The detailed structural definition and analysis functionality within Paramarine allows for hull scantlings to be applied to shell, decks and bulkheads. The 3D environment allows for extensive interrogation of individual structural elements. Detailed weight distributions can be generated and where appropriate linked directly to the concept design analysis.

The inherent parametric nature of Paramarine allows for the structural definition to be applied to a scalable hullform, allowing the immediate effect on weight and structural performance to be examined.

Other features available within the structural definition and analysis include:

- Flexible plate and stiffener definition
- Powerful holes and inserts definition
- Blast and Fragmentation analysis
- Cost estimation
- Ultimate strength assessment
- Critical Section generation
- Inclusion of wave loadings

Further submarine specific features include:

- Pressure hull collapse calculations
- Pressure hull scantling optimisation
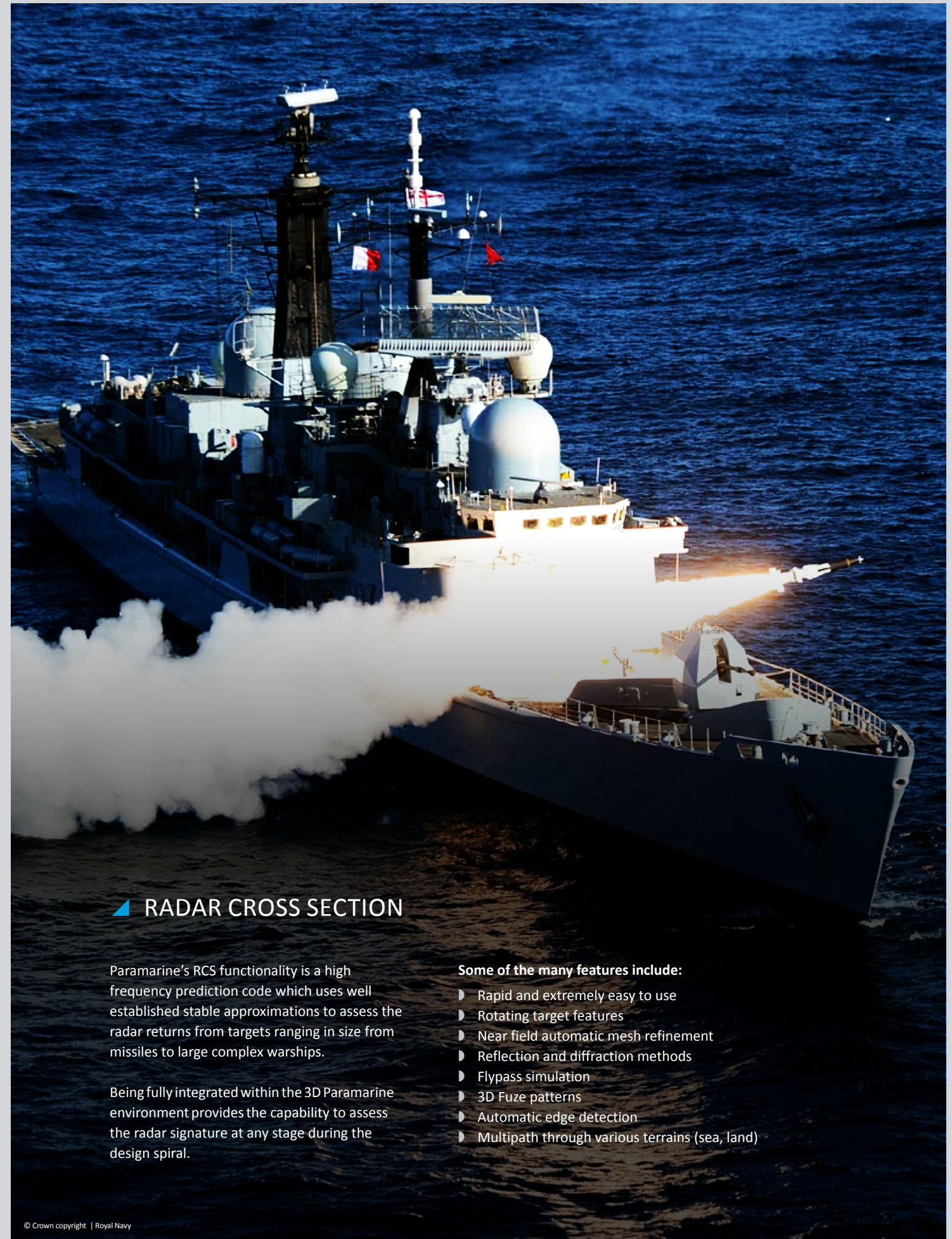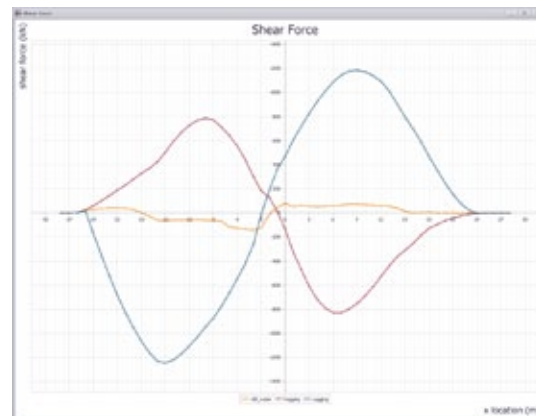
◢ RADAR CROSS SECTION

Paramarine's RCS functionality is a high frequency prediction code which uses well established stable approximations to assess the radar returns from targets ranging in size from missiles to large complex warships.

Being fully integrated within the 3D Paramarine environment provides the capability to assess the radar signature at any stage during the design spiral.

Some of the many features include:

- Rapid and extremely easy to use
- Rotating target features
- Near field automatic mesh refinement
- Reflection and diffraction methods
- Flypass simulation
- 3D Fuze patterns
- Automatic edge detection
- Multipath through various terrains (sea, land)

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◢ ON-BOARD LOADING COMPUTER SeaWeigh™

SeaWeigh™ is a powerful onboard loading computer, providing accurate calculations on the stability of the vessel. These calculations are based on the Paramarine framework and are derived from the on-board version of the Paramarine model, allowing the advantage of a complete stability assessment which can be made available to salvage experts if needed.

The option is available to use direct damage assessment allowing for exact sailing conditions to be examined, providing a greater operational envelope compared to the traditional limiting KG curve comparison.
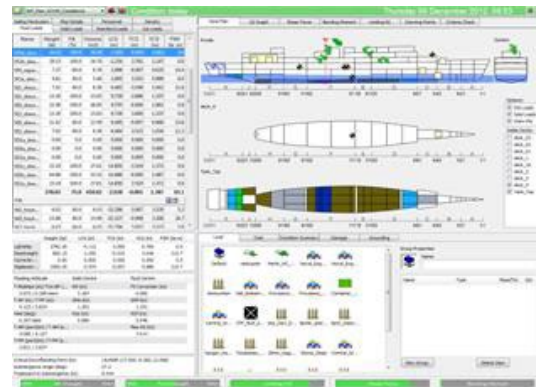
◢ TRAININGANDSUPPORTSERVICES

Training Courses Tailored to Customers Requirements

QinetiQ provide a range of Paramarine standard or bespoke training courses, either at their offices or customer sites worldwide. The standard three day course is structured in such a way that someone with no prior Paramarine experience will be able to:

▹ Understand the principles of Paramarine
▹ Develop a parametric hull, subdivided to a compartment level
▹ Undertake a full intact and damaged stability analysis
▹ Calculate the powering requirements
▹ Investigate the manoeuvring performance

Naval Architecture and Software Development

QinetiQ can provide bespoke services covering Naval Architecture consultancy work:

▹ Paramarine model generation
▹ Independent audits of existing designs
▹ Stability book and bespoke report generation

Software consultancy includes
▹ User specific developments within Paramarine
▹ Bespoke software generation, with experience in C++, C#, Java

◢ Paramarine® CUSTOMERS
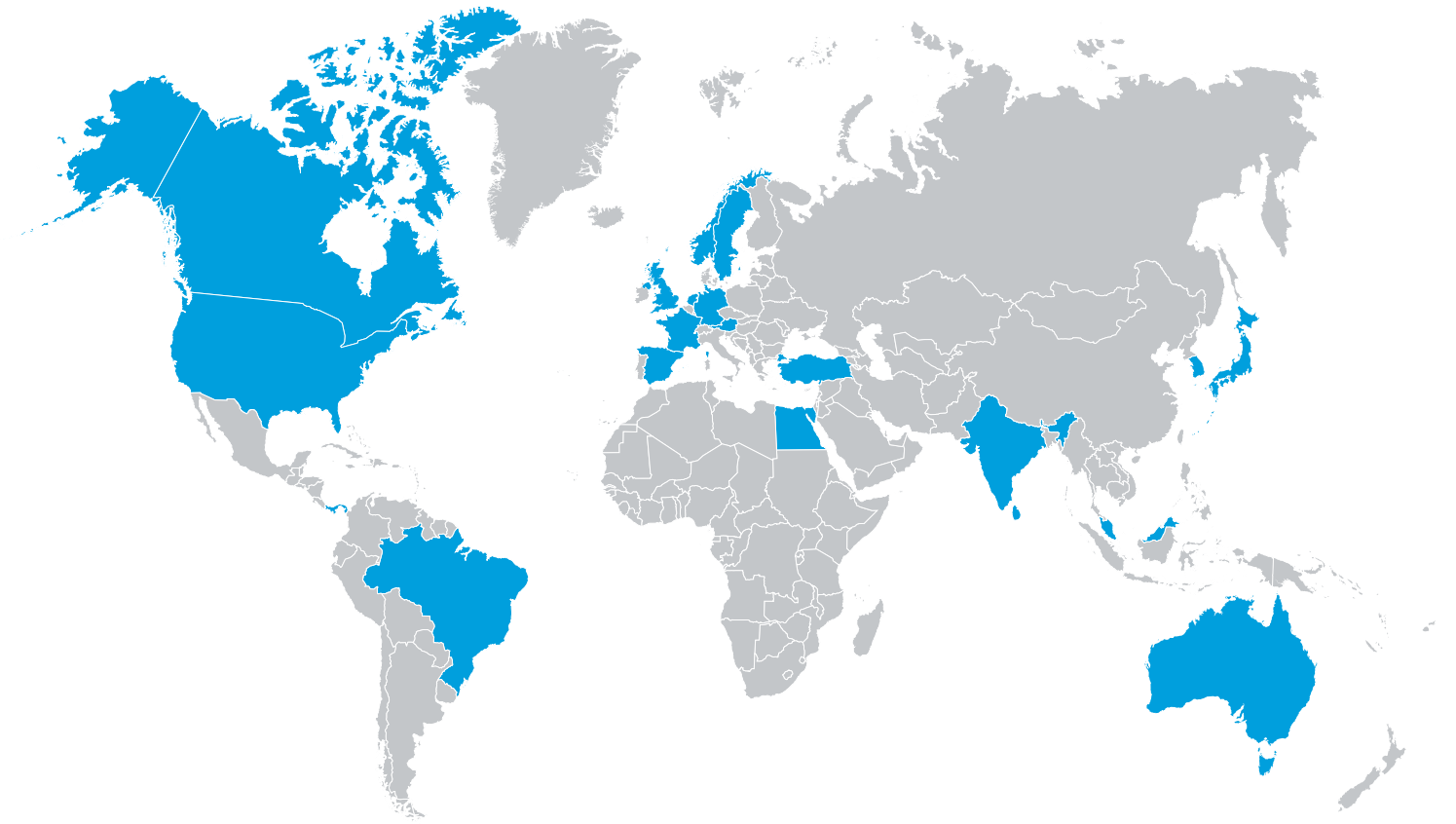
QinetiQ is a world leading provider of solutions for submarine, naval surface and commercial ship design, analysis and support.

QinetiQ has over 25 years in the market place, Paramarine has been used by ship builders, designers, operators and owners as well as academic institutions to model and analyse a broad range of designs.

With an experienced team of both Naval Architects and software developers, product development is at the core of the business' activities. Alongside this, both consultancy projects and training courses are delivered globally to a varied customer base. The highly knowledgeable team within QinetiQ provide direct user support drawing on years of experience of working with Paramarine.

"We wanted to extend our marine design capabilities through the acquisition of additional vessel design software. We selected Paramarine not only because of its functionality and track record but also its ability to handle both submarines and surface vessels particularly with regard to its early stage design capabilities."

Sebastian Abril, Head of Naval Platforms, Navantia

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