

WHITEPAPER

Cross-fertilisation to drive the future of naval engineering

How Expleo's cross sector engineering expertise is helping clients unlock value and accelerate innovation within naval engineering



About Expleo

Expleo is a trusted partner for end-to-end, integrated engineering, quality services and management consulting for digital transformation. We help businesses harness unrelenting technological change to successfully deliver innovations that will help them gain a competitive advantage and improve the everyday lives of people around the globe. We operate in 30 countries.

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Introduction

Increasingly, marine customers' expectations for their product solutions are becoming more demanding.

Market pressures such as environmental performance, adoption of new technologies, reduced cost of ownership, future proofing and overall time to market are becoming increasingly significant factors in sourcing decisions throughout the product lifecycle. This paper presents how Expleo utilise a strategy of cross fertilisation to assist Prime Contractors and Original Equipment Manufacturers (OEMs) rise to these challenges by augmenting scarce resources with personnel, strategies, processes and philosophies from adjacent sectors such as Aerospace, Automotive and Rail to enhance the design and manufacture of naval vessels while remaining compliant with classification society rules and regulations.

Creating value from cross fertilisation cannot be considered a simple "lift and shift" of technologies and best practices from other sectors into marine sector. In order to successfully implement the strategy, it is essential the intricacies and complexities of the naval industry are understood at every level of the engineering lifecycle and wider supply chain. Innovative operational management and leadership are crucial to ensure knowledge transfer from these adjacent sectors adds value to the OEM, end user and supply chain creating an integrated culture of innovation and collaboration by removing constraints to adoption.



Managing a skills shortage

While the Naval sector has continued to experience strong growth, research presented in the [EU's USWE report](#) has highlighted the scarcity of suitably qualified and experienced personnel (SQEP) for a modern marine sector, noting the EU's focus on upskilling the shipbuilding workforce in Europe.

These two aspects of scarcity and upskilling can directly benefit from implementation of a cross fertilisation strategy in the following ways.

The scarcity of skilled resource can be offset by considering the fundamental skills required for a given role and existing teams composition, rather than exclusively focussing on years of experience within the sector. Removing these constraints allows employers to widen searches challenging the selection and interview process and ultimately upon successful appointment, disrupting teams with new ways of thinking leading to innovations. Particularly when combined with new approaches in delivering accredited training through a mix of online platforms and bespoke "in house" courses delivered by training partners (such as universities and professional institutions) focussed on the mid to long term market trends and their underlying technologies. In this regard, Expleo has engaged Lloyd's Maritime Academy to deliver a programme of training that takes our professional mechanical engineers and provides them with the Marine Engineering domain knowledge they need to work alongside our experience marine engineers in a blended team.



In addition to focussing on key "Industry 4.0" digital enabling technologies (such as Robotics, Artificial Intelligence, Data Analytics and Cyber security) and embedding these in all engineering functions it is equally important this training program develops the operational management and leadership function to ensure business models, recruitment and retention policies and the overall culture of the organisation can adapt and continuously improve ensuring the voice of the customer is embedded in its daily operations.

Although the approaches outlined previously ultimately bring benefits to the organisation, they tend to be external endeavours which take time to implement. A key element of any training and development program is the internal aspect which sees the organisation's in house experienced naval engineers engage as mentors, to guide and develop engineers in the intricacies and nuances of naval engineering.

Agile efficiency

In comparison to other sectors, naval new product introduction (NPI) tends to be a much longer endeavour (between 5 and 10 years) which can reduce an organisation's ability to implement new technologies during manufacturing operations. Additionally, with vessels remaining in service for as long as 40 years obsolescence management is another practical consideration in vessel design.

An essential ingredient of the future naval engineering function will therefore be the adoption of Agile practices to reduce time to market, while improving vessel design and robustness.

This approach uses cross-functional teams to execute processes in short sprints within the overall project lifecycle, facilitating problem-solving incrementally. This approach allows for new systems and practices to be tested in a controlled manner.

Mature agile testing approaches can ensure the fast delivery of working solutions, which is particularly relevant when considering the introduction of new processes. Furthermore, the embedding of cross-functional teams is pivotal to optimising the use of SQEP, because experienced individuals can be introduced to provide the context needed for a specific task.

Agility enhances adaptability, increases the pace of innovation, and allows for changes to be implemented at short notice.

Improving design quality



While the naval sector has already adopted tools and methods such as CAD, FEA, CFD for particular aspects of the design process, the automotive and aerospace industries are increasingly benefitting from integrating engineering functions' data into these tools to create a "graphical database" which stores information on manufacturing process times, tolerances, material data, suppliers and costs.

With this data integrated into the CAD model, a product (such as a vessel) can be decomposed into a series of sub-systems and developed to express functionality in terms of key performance parameters. Design trade off studies can then be automated using Bayesian based Machine Learning principles to facilitate optimisation of the overall system design robustness without compromising performance.

When coupled with innovations in manufacturing such as 3D printing, and the use of innovative materials in design construction, efficiencies of up to 40% can be achieved in reduced part count and mass optimisation.

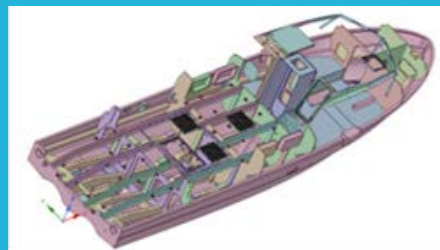


Learn more about some Expleo's work where innovative approaches have been applied from different sectors

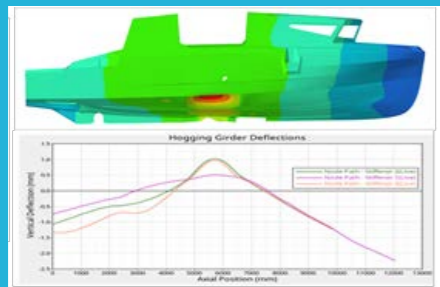
Expleo was tasked by a major defence client to secure process efficiencies across the engineering life cycle through innovative digital solutions. Expleo has implemented a Robot Process Automation solution on a major naval programme to reduce repetitive administrative tasks that take up to 30% of an engineer's time. The outcome has been that Expleo aims to achieve 50–60% improvement across the project in the form of reduced lead time and improved quality.



The detailed case study can be found here:
[How robotics and digitisation are pushing boundaries in defence engineering](#)



Expleo have undertaken a design study on behalf of a major technology OEM to investigate the feasibility of utilising Additive Layer Manufacturing (3d printing) and new materials in the production of a 12 metre x 3.5 metre draft hull. The study investigated a number of ALM processes and manufacturing techniques before selecting a modular build approach, utilising Fused Deposition modelling of random oriented carbon fibre reinforced polymers. By utilising this approach, it was concluded the overall manufacturing lead-time could be reduced by approximately 70%, with total lifecycle cost savings of approximately 40%, with only marginal (15%) increases to key overall Naval Architecture parameters.



The next stage of this study will be looking at maturing the Technology Readiness Level (TRL) in terms of Classification rules adaptation, material allowables data, repair methods and End of Life Disposal.

Revolutionising the manufacturing process

Given the similarities to the Aerospace regulatory environment, the naval industry can reasonably be expected to benefit from the core principles of enhanced manufacturing engineering practices such as automation, visualisation and process control to streamline manufacturing operations. Combined with techniques from the automotive sector such as the “Toyota Production System” (TPS), “Just in Time” (JIT) and “Lean Technologies” (LT) significant improvements to manufacturing workflow can be achieved, with corresponding benefits of improved quality, reduced inventory and optimised costs.

A key feature of the production facility of the future will be its flexibility, not just in terms of its ability to manufacture variations on a products lines, but fundamentally to be re-configured in response to customer change requests and in-service feedback.

Integration of the wider supply chain into digital design process and “Enterprise Resource Planning” (ERP) can help implement change and reduce lead times within material or part supply, allowing the organisation to flex resources, develop new solutions and optimise procurement strategies to the needs of the market.



Find out more about Expleo's smart digital solutions designed to quickly troubleshoot, streamline efficiencies and make improvements at all stages of production.

BuildSmart

Using HoloLens you can bring interactive 3D work instructions and rigorous process controls to your engineers' fingertips to reduce time, cost and non-conformances on your build line.



DataSmart

Using AI technology to power analytics and solve issues of non-conformance in engineering processes anywhere there is data. The smart dashboard visualises the data and checks against the latest compliance standards.



DesignSmart

Automate manual engineering processes in product development and design analysis and get your new products to market up to 50% faster.



RepairSmart

Expedite root cause analysis and implement corrective action. Using Robotic Process Automation it can automate the answering of concessions by proven solutions from a database of thousands, whether that be a replacement part, alignment adjustment or corrective actions.



Enhancing in-service customer experience

The availability of a wide range of miniaturised sensors, connectivity options and software applications are increasingly creating opportunities to collect and analyse data based on actual user experiences. The resulting "data lakes" can be interrogated through Artificial intelligence in combination with Data Analytics to create new services built around the user, making choices more convenient. Further, measurements of vibration, temperature, speed and more can be interrogated to improve design robustness based upon actual data, rather than empirical design rules (with their inherent conservatism) to reduce, not just the cost of acquisition by matching design to use cases, but also the overall cost of ownership. Aerospace engine health monitoring is one example that has delivered significant benefit to OEMs and operators.

As businesses become increasingly digital there is a rising need to ensure data is managed efficiently, most usually in the cloud utilising open architectures in combination with appropriate security safeguards such as blockchains to verify transactional integrity. Initiatives such as the Airbus "Skywise" and Rolls-Royce "Total Care" are integrating this data along their value chain to successfully anticipate and ultimately implement emergent technologies and design new services and products.

The marine industry can benefit from further adoption of data analytics tools for new capabilities encompassing engineering investigations, component reliability analyses, and enhancing maintenance operations.

Read our white paper '[Future-proofing your naval engineering](#)' to learn more about how new technologies are being applied to naval engineering.

Conclusion

It is evident that the naval industry can benefit from cross-fertilisation of skills, practices, and solutions from other engineering industries, to not only enhance and modernise systems, but more importantly to address the rising engineering demand within the naval sector.

To help address the engineering demand the naval sector could work together with other sectors, such as aerospace and automotive, to invest in creating a central pool of newly recruited engineers with expertise in key skills which can be adaptable across multiple industries. Training should introduce individuals to several industries to provide the high-level knowledge of key industries and be focused on broader manufacturing and digital skills for core systems. A general teaching approach will prepare individuals to develop transferable skills to take on several roles and work well within different teams. Engineers in the future will likely need to be highly versatile and able to work effectively within cross-functional teams.

At sea, speed is everything.

Your naval customers want you to deliver more for less, faster than ever. The answer? Expleo.

We're experts in engineering services with a difference. Not only can we offer you our extensive knowledge of the naval sector, we can also introduce you to tried-and-tested innovations, technology and best practices developed in other industries, such as aeronautics and automotive. You might say we can help you think outside the hull – a skill that will help you not only accelerate your power of delivery, but protect your margins too.

Navigating tomorrow, delivering today.

Meet the authors



SEAMUS BROGAN,
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Seamus is a Business Manager with over 25 years of experience working in the Marine and Defence sector for BAE Systems, SEA and BMT. Seamus has led numerous successful teams to deliver outstanding results, most notably was the Type 45 Power Improvement Project and Communication Coherency for Submarines. As Marine Operations Director for the UK business Seamus is responsible for delivering projects to time and cost whilst ensuring the customers' needs are being met.



JOSEPH LASANTE
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Joseph has 32 years' experience in building and managing technical teams to provide critical business solutions using innovative technologies, he's an expert in the Defence and Aerospace sectors with previous leadership roles at Thales and Steria. At Expleo he is responsible for identifying and implementing new digital offers and solutions for our clients globally.



SEAN SIMMONS
Solutions Architect

Leading the digital transformation of the Expleo Marine Division, supporting operational management develop and execute business strategy, developing strategic partnerships and governance of project delivery. A Chartered Mechanical and Certified Systems Engineer with a wide range of experience leading and executing high complexity and integrity projects and programs across the Marine, Aerospace, Automotive and Nuclear Defence Sectors.



JONATHAN WINES
Aerospace and Defence Capability Director

Jon is an Engineering Leader with over 22 years of experience working in the Aerospace and Defence sector for Manufacturers, System Suppliers and Engineering Service Providers. Jon's strengths are in leading multi-functional teams to deliver integrated solutions across the lifecycle from new product development to Inservice support.

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