



# Naval Submarines - Is Classification driving or hindering solutions for technical challenges?

COMBINED NAVAL EVENT  
at Farnborough International Exhibition and Conference Centre, UK

Christian von Oldershausen

23<sup>rd</sup> May 2024

1. Introduction to DNV Maritime Naval Services
2. Role of Class Societies
3. Relevance of analysis and testing
4. Collaborative engineering approach
5. Tailored rule development to suit a market need
6. Conclusion

# A global assurance and risk management company

~15,000

employees

100,000+

customers

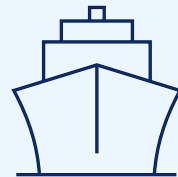
100+

countries

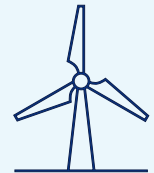
5%+

of revenue to R&D

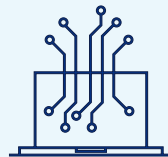
Ship and offshore  
classification and advisory



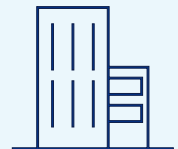
Energy advisory, certification,  
verification, inspection and  
monitoring



Software, cyber security,  
platforms and  
digital solutions



Management system  
certification, supply chain and  
product assurance



# Naval Safety Assurance



Navies are driven by their respective national defence interests and requirements that define and control the building and operation of naval vessels. The regulation of naval vessels is significantly different from merchant vessels – by statute, by need and by practices.



# Comprehensive Naval DNV support



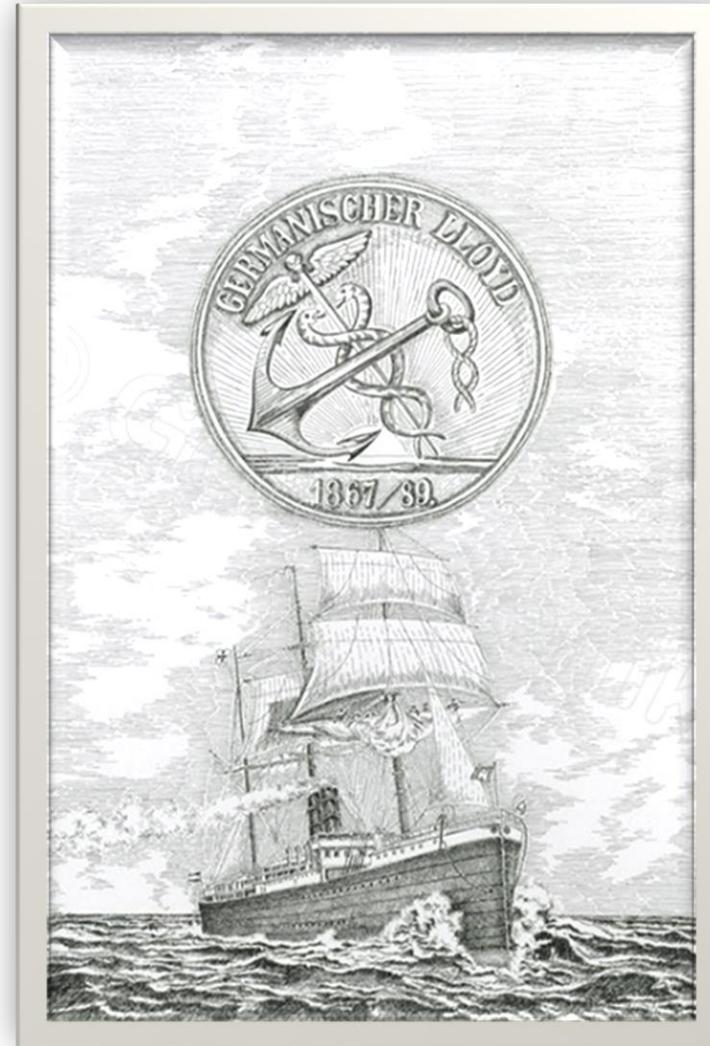
# Naval Assurance & DNV Class

- **Classification**, in the conventional understanding, is an important contributor to the assurance process of naval vessels. However, the assurance process often needs to be adapted to navy specific needs and the environment within which they are operating. This calls for assurance processes that are more diversified and have a wider scope.
- Therefore, DNV's **Naval Technical Assurance** is provided indicating an alternative and generic approach to the assurance process.
- Both **DNV Naval Technical Assurance** and **DNV Class** are powerful tools for naval vessels, the preferred use of which depends on the Navy's own regulatory system and the nature of the vessel in question.



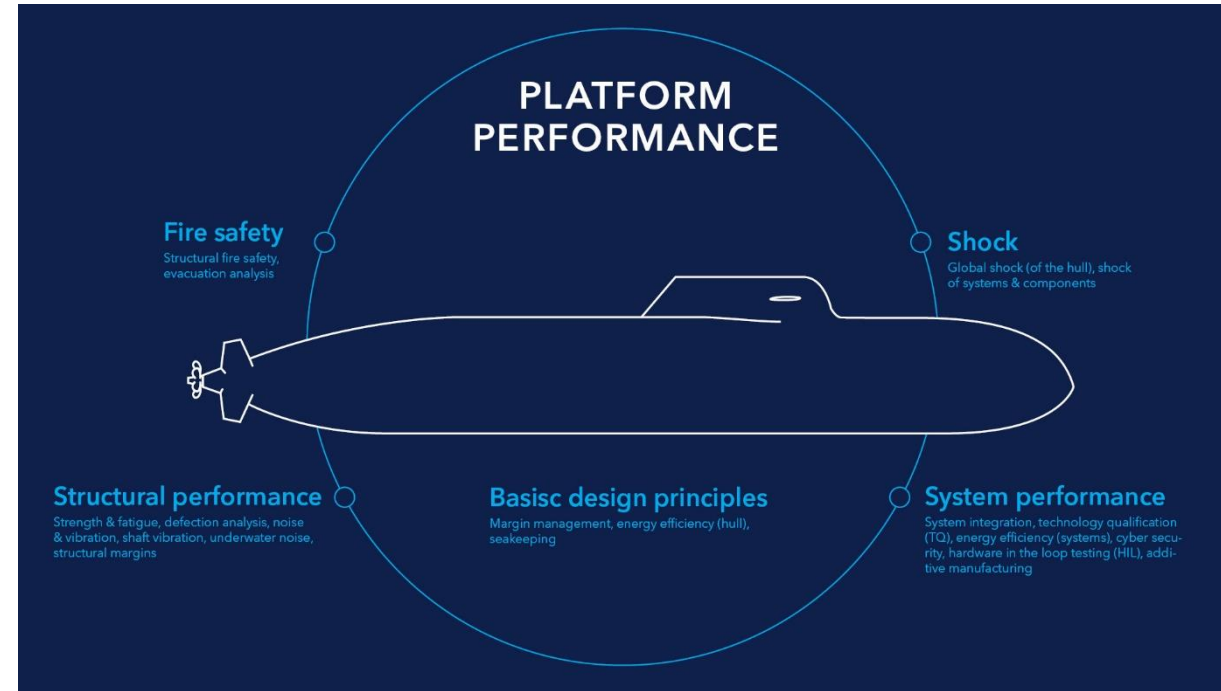
# Role of Classification Societies

Is Class driving or hindering solutions for “technical challenges” and “innovation”?



# Navies are faced with challenges, which are drivers for changes and innovation

- Cost & time pressure
- Fast developing technology
- Increasing complexity of systems
- Limited availability of components and materials
- Defense standards are often outdated and not consistent
- Efficiency of design and manufacturing processes
- Know-how and availability of key resources





# Collaborative engineering approach

DNV Underwater Technology developed a dedicated approach for Submersible & Naval Submarine projects:

## Team of experts

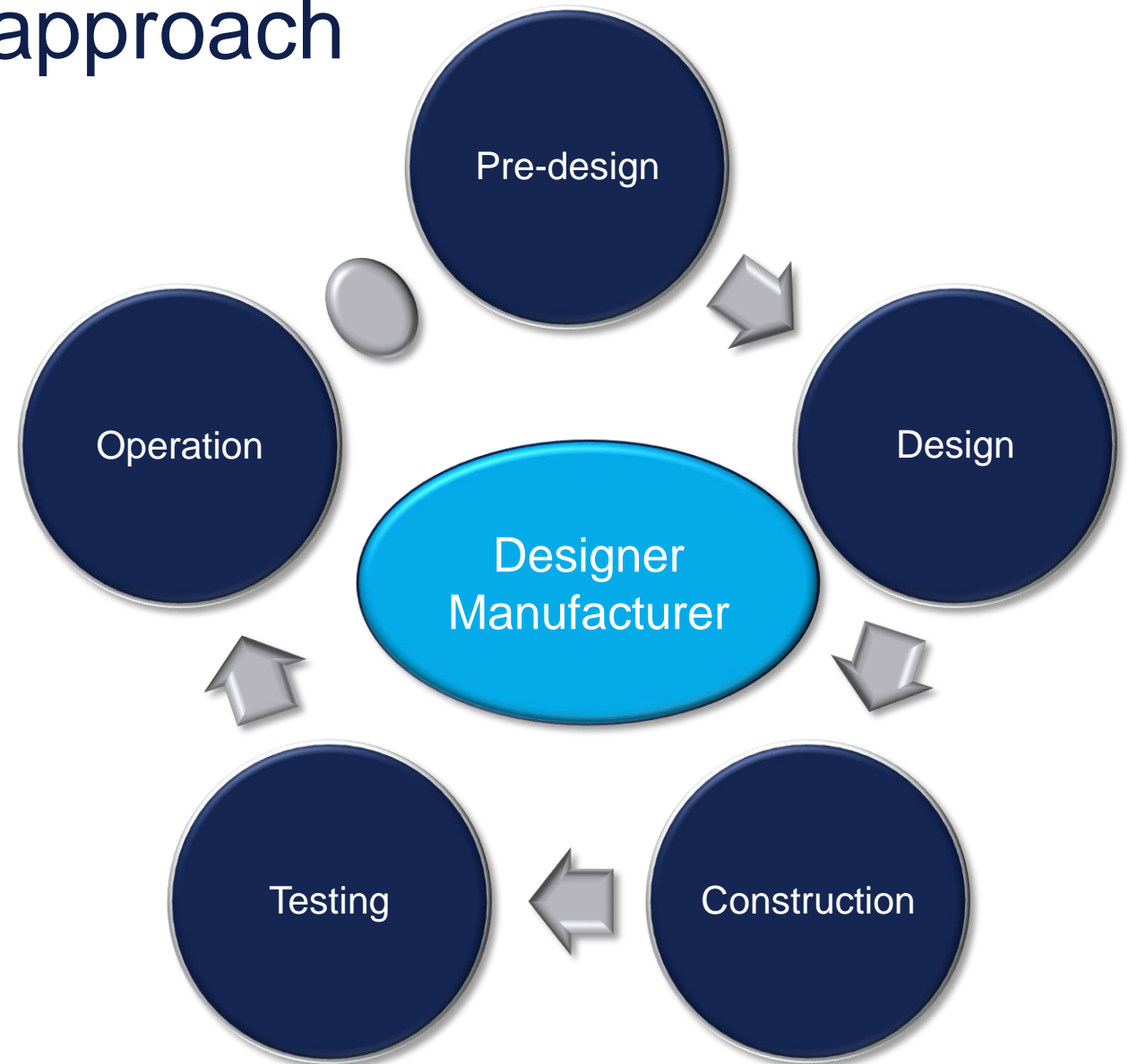
- DNV's collaborative engineering approach ensures a direct access to technical experts during the design, manufacturing, and testing phase.

## Technical Know-How

- Engineering Approach for designs which are currently not covered under existing rules.
- DNV's technical experts are qualified to perform detailed assessments and analysis of all kinds of engineering challenges including non-linear FE analysis of pressure hulls and load-bearing elements.
- Support in any kind of modification or alteration projects by providing engineering concepts including FMEA.

## Quality assurance

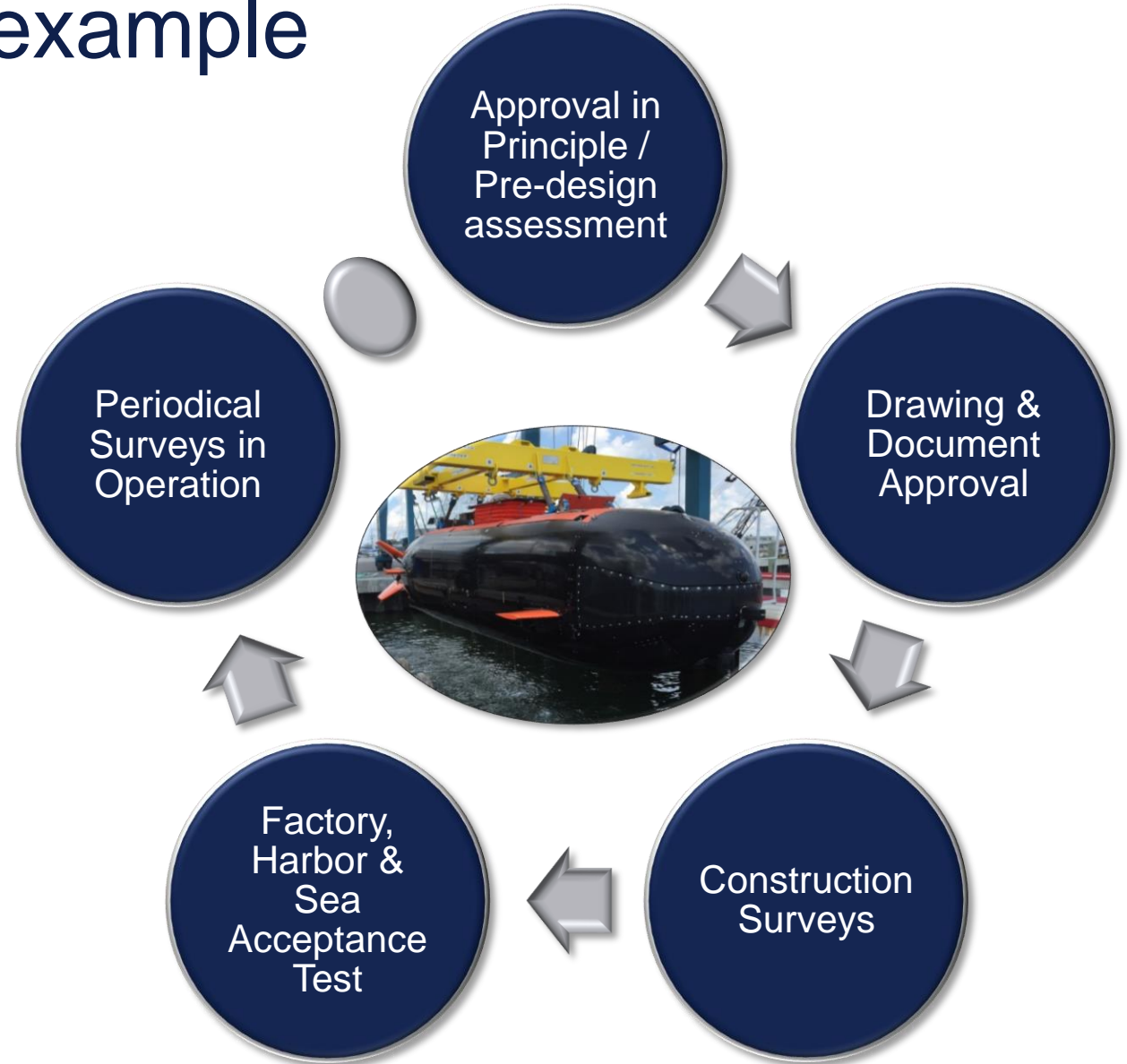
- Development of quality assurance processes and hold points for the individual project requirements.



# Collaborative engineering example

The following technical challenges have been assessed collaboratively during the design and manufacturing phase of a tactical diver delivery vehicle:

- Pressure Hull
  - Non-linear analysis of all pressure load bearing elements
  - Definition of manufacturing, inspection and testing criteria
  - Non-conformity assessments
- Load bearing elements
  - Non-linear lifting and collision analysis
  - Non-standard material qualifications
  - Fatigue assessment
- Assessment of performance criteria



# Tailored rule development to suit a market need

- Changing market needs require a continuous development of rules and regulations
- New market trends and technologies not covered by existing requirements need to find their way into formal rules without breaching non-disclosure agreements
- Examples:
  - XXL Unmanned Underwater Vehicles
  - Underwater habitats
  - Power supply systems
  - Advanced material grades
  - Non-standard pressure hull designs



# Continuous Standard & Rule development

## Manned Submersible Rules

DNV-RU-UWT  
Edition July 2023



## Naval Submarine Rules

DNV-RU-NAV SUBMARINES  
Edition October 2022



Over the years, DNV has continuously developed the rules and maximizes synergies from the experience with both rule sets in the Naval Submarine and Manned Submersible Sector.

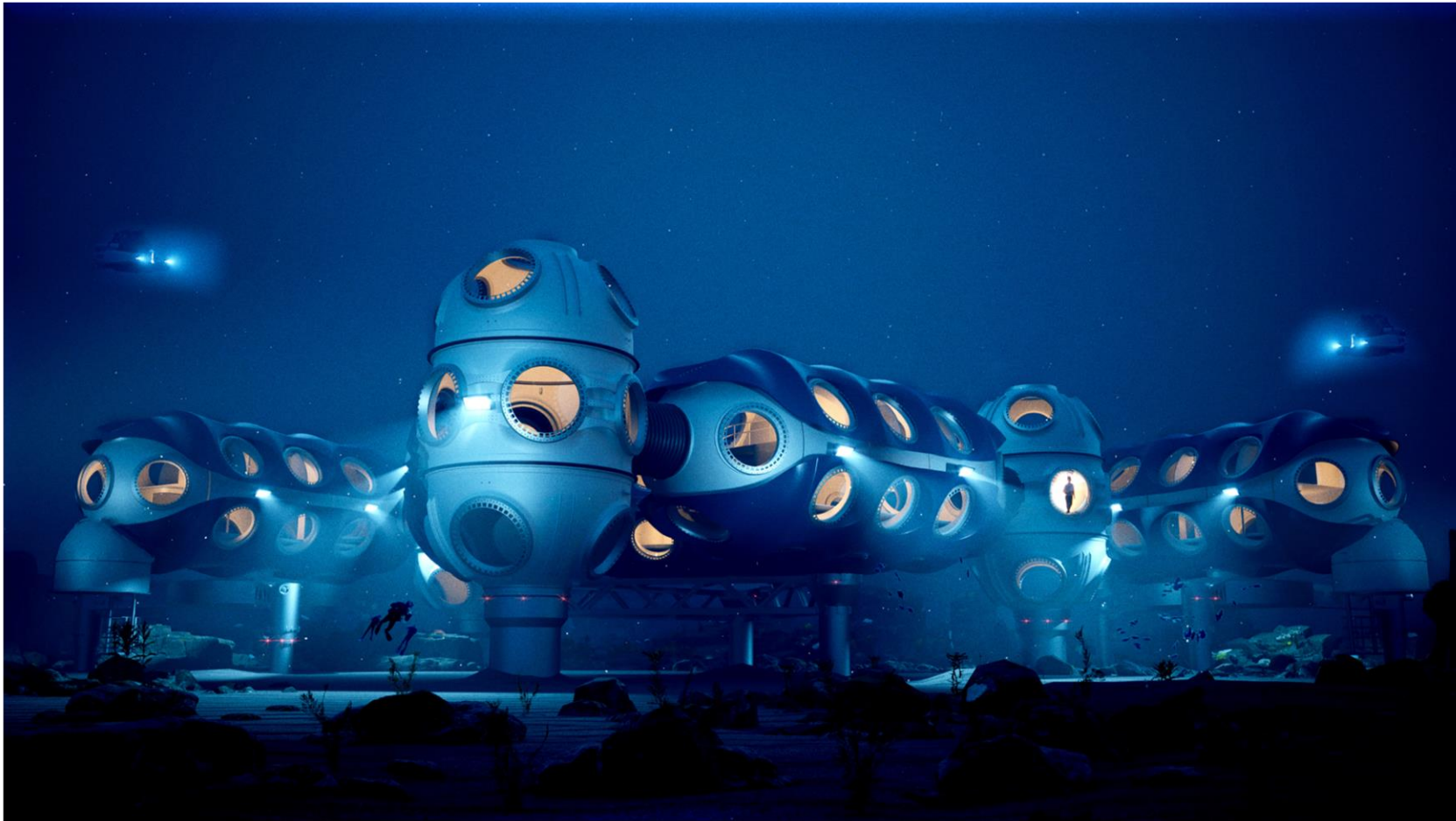
# Learning from commercial submersible innovations

- The procedures for qualification of novel design and materials are well established in the manned submersible industry
- Cutting edge technology, but conservative testing and qualification approach
- Innovative power supply solutions
- Non-standard acrylic viewport seats and geometries
- Novel types of materials for pressure vessels
- Non-standard trim- and ballast systems
- Advanced control and automation systems



Source: tritonsubs.com

# Brand-new DNV Rules for Underwater Habitats to suit a market need

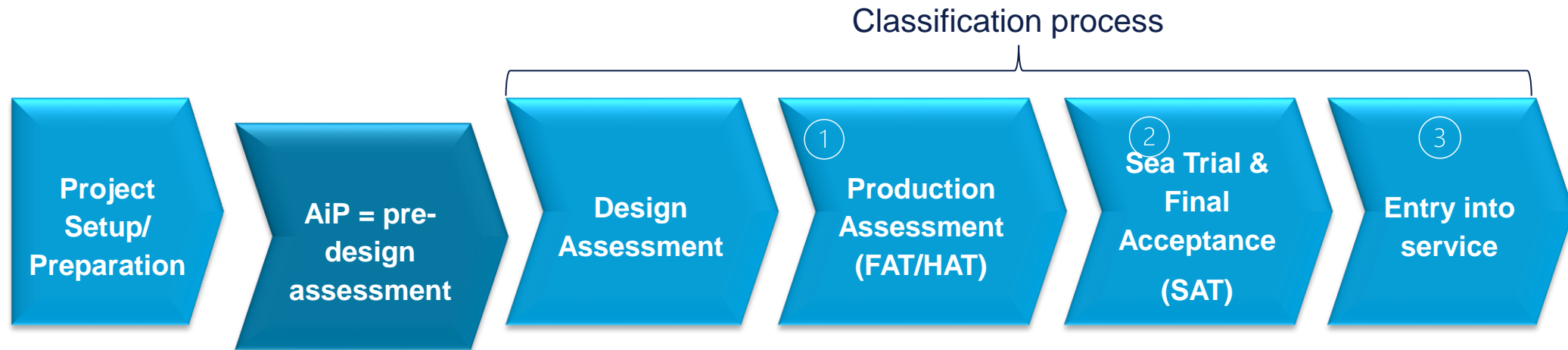


Depth: 200 msw

**Manufacturer:**  
DEEP Research Labs  
Ltd. (UK)

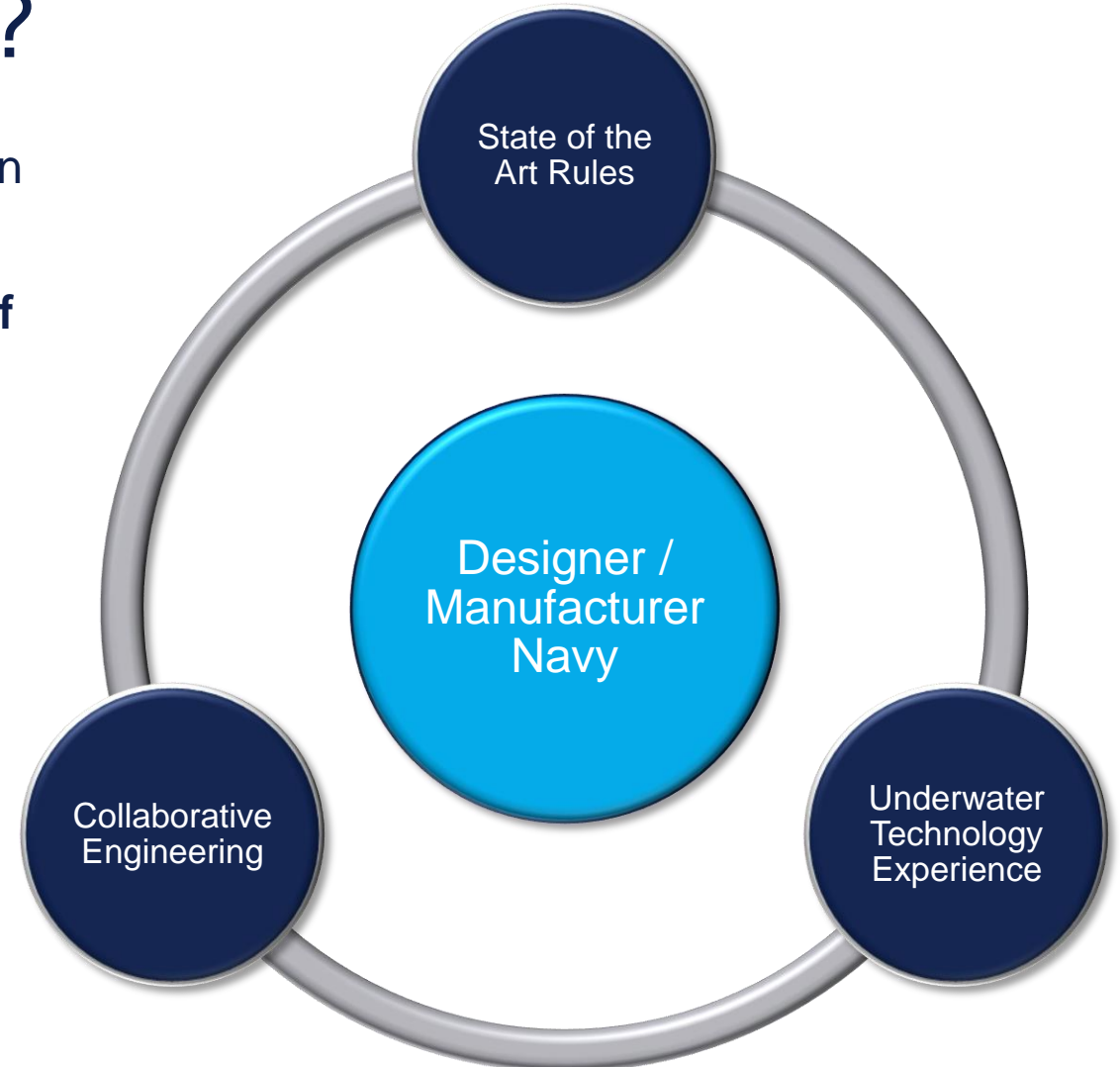
# Approval in Principle (AiP) drives efficient and effective design processes

- Early-stage design review and definition of qualification procedures increasing efficiency throughout the design and manufacturing process
- **AiP can be considered as a preparatory part of a classification.** Means, the AiP can be carried out well before the actual class process and is therefore ideal for business development
- **Focus on:**
  - Safety concept / ConOps
  - Structural integrity of the pressure hull and structures
  - Design of key systems
  - Innovative designs and materials



# Is Class driving or hindering solutions for “technical challenges” and “innovation”?

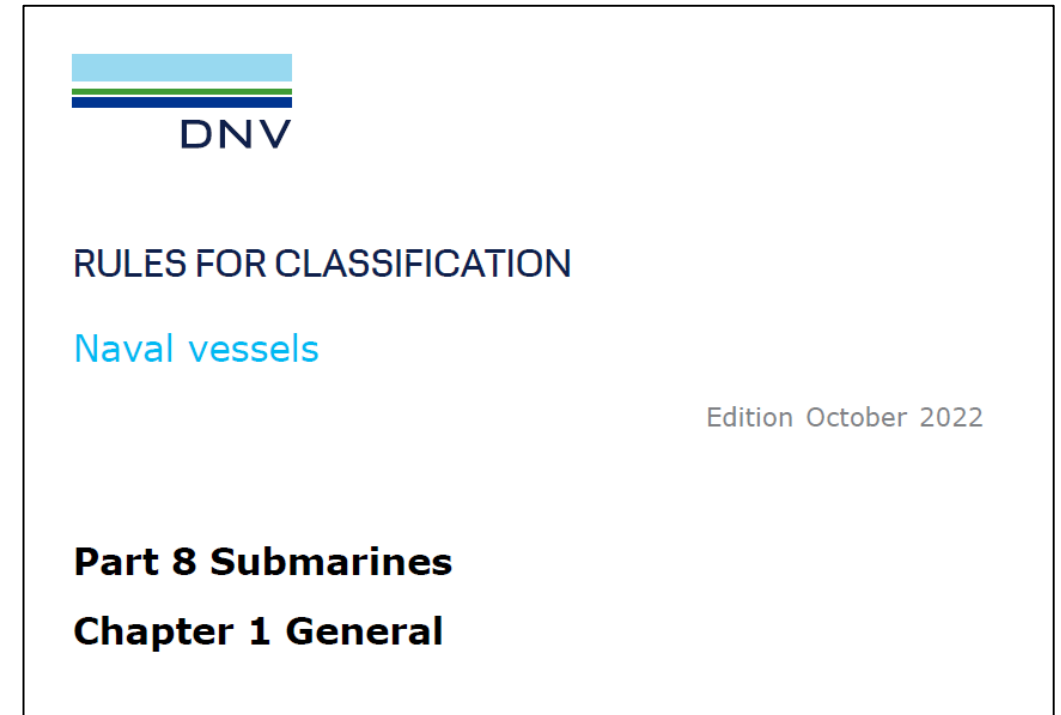
- Classification Rules for manned submersibles have often been perceived as obstacles on the way to innovation
  - Reality is that **class societies support development of innovative, advanced underwater systems through technology qualification**, testing and design assessment
  - Classification Rules are being updated regularly with state-of-the-art design principles and the dust from historical requirements has been lifted steadily
  - Class Rules form the foundation for technology qualification of innovative and advanced underwater systems
- ➔ Class is supporting and driving innovation





# Do Class Rules allow alternative or innovative design?

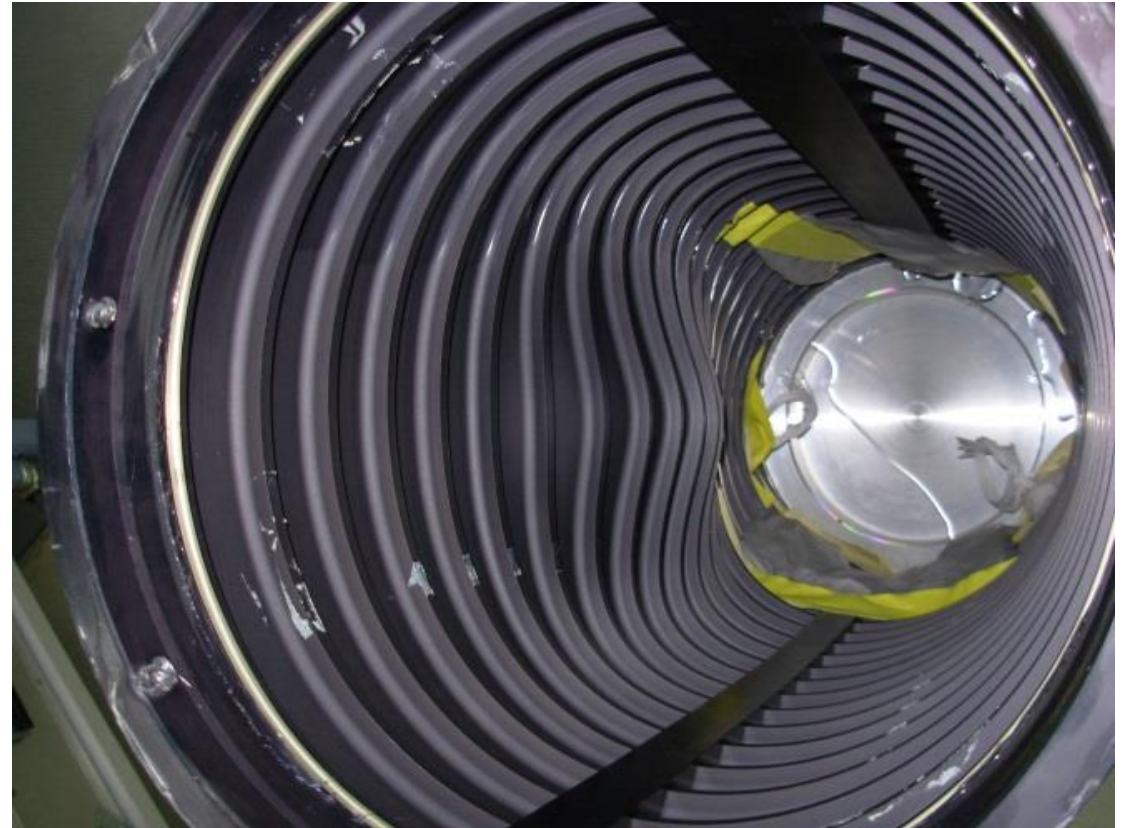
- Alternatives to detailed requirements in the rules may be accepted when the overall safety and reliability level is found to be equivalent or better than that of the rules.
- If detailed requirements are not prescribed in the rules, the Society may consider the safety and reliability level of a proposed solution...
- The design of arrangements, systems and individual components may alternatively or supplementary to the rules be based on recognized standards, codes, national regulations and other methods of safety and strength evaluation than specified in the rules. The basis shall be equivalent to the requirements given in these rules.



Other material grades may be acceptable after provided acceptance by the Society. In such cases, additional testing will be required and qualification procedures shall be reconsidered.

# Class is supporting solutions for “technical challenges” and “innovation” but not at all cost

- **Laws of physics cannot be changed** or neglected – there are limits
- **No room for overconfidence** in the world of naval submarines
- Class society acts as third party ensuring a minimum level of safety and redundancy – Naval Administrations may have further requirements w.r.t. innovative designs
- Innovation comes with the price of additional testing and analysis



TURN UNCERTAINTY



INTO CONFIDENCE



# Questions?

DNV Maritime – Underwater Technology

Christian von Oldershausen  
Segment Director Navy  
Christian.von-oldershausen@dnv.com  
+49 40 36149 7706

Jonathan Struwe  
Head of Section Underwater Technology  
jonathan.struwe@dnv.com  
+49 40 36149 8925

[www.dnv.com](http://www.dnv.com)

