



RESEARCH VESSELS

— Design & Consultancy —



Excellence

Award winning ship design recognised by leading industry bodies.



Experience

Over 750 vessels built and more than 350 conversions successfully completed.



Technology

Developing and using best-of-breed technology to design better ships.



Solutions

Comprehensive experience covering design, contracting, construction, delivery and through-life services.



Guidance

Independent advice covering contract negotiations, planning, cost-evaluation and review of drawings and specifications.



Dedication

Our consultancy services ensure support throughout the entire lifetime of a vessel.

"We began to work with KNUD E. HANSEN, when we needed an HVAC specialist for the Queen Elizabeth Class. They performed very well for us and we've gone on to work with them on other projects as a result. In particular, KNUD E. HANSEN showed themselves to be incredibly flexible, willing to mobilise as many people as we needed, wherever we needed them to be. I attribute this adaptability to the close-knit, trusting relationships between personnel. The culture at KNUD E. HANSEN ensures total efficiency."

SHANKAR RASHIA, AERIUS

"KNUD E. HANSEN showed themselves to be very professional and totally dedicated to our project. Our cooperation could not have been better. We started out with one A4 page of specifications and, from this, KNUD E. HANSEN quickly developed the entire yacht."

PER BLINKENBERG-THRANE, 24 M EXPLORER TYPE MOTOR YACHTS

"KNUD E. HANSEN designed a total of 18 ships for my family's company. We spent countless days discussing our dreams, aspirations and passions. The relationships we developed became so personal that design decisions became automatic. The creativity and talent in KNUD E. HANSEN is boundless. KNUD E. HANSEN provided us with precision, accuracy and consistent quality. We knew we had a reliable design to work on. And, of course, the personal attention was outstanding – we felt we were one big family."

ALEX PANAGOPOLOUS

RESEARCH VESSELS, DESIGN & CONSULTANCY

Research vessels are in a class of their own when it comes to complexity and operational flexibility as they must be capable of adapting to a wide variety of challenging mission requirements. They have become increasingly important for scientific operations as well as surveillance of climatic changes and commercial exploitation of resources in the world's oceans.

Research vessels are often required to operate in the most extreme conditions on earth, thousands of nautical miles from refuge and emergency support.

Long-duration missions require these vessels to be entirely self-sustaining for extended periods of time.

The design of research vessels requires an inherent understanding of these requirements, along with the rules and regulations of the relevant flag authority and classification society, which aim to ensure the highest

standard of safety for the vessel, its crew, and the surrounding environment.

KNUD E. HANSEN places a great deal of emphasis on taking additional measures to validate and optimize the design from the early, conceptual stage right through to completion.

Our design phases involve thorough research and development, gathering of technical and empirical data, and feasibility studies to be able to develop an optimized design. As the design is developed further, it involves optimization through Finite Element Analysis (FEA), Computational Fluid Dynamics (CFD) and model testing. KNUD E. HANSEN has achieved a high level of precision when comparing design criteria and parameters to actual vessel performance, validated through sea trials and actual operation.

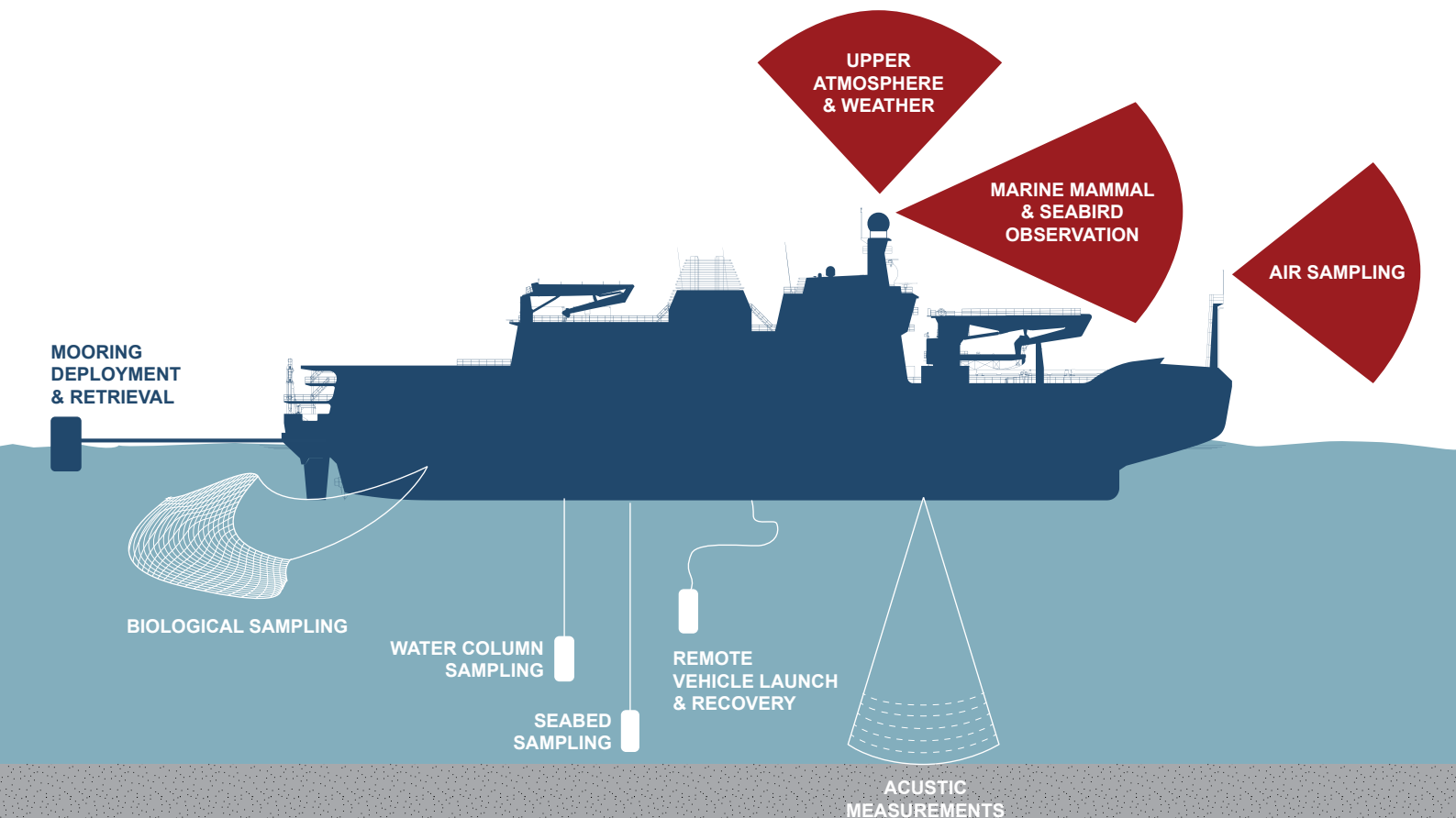
ABOUT KNUD E. HANSEN

We are a leading independent consultancy providing a comprehensive range of design, engineering and project management services to shipyards and ship owners around the world.

Our innovative, customised solutions cover areas ranging from concept, tender/contract & basic design, to supporting the building and conversion process of

all types of maritime vessels and offshore structures, to energy optimisation and services for the offshore wind industry. Since 1937, over 750 vessels have been built and over 350 conversions carried out to our designs.

In addition, more than 450 hull lines have been developed and thousands of surveys, feasibility studies and other projects undertaken.



RSV NUYINA, ICEBREAKER RESEARCH & SUPPLY VESSEL

The most prominent example is the 160-metre icebreaking research and supply vessel 'RSV Nuyina' for the Australian Antarctic Division. KNUD E. HANSEN is responsible for the original concept right through to tender design, including HVAC system design and winterization. The keel for this groundbreaking vessel was laid in 2017 with operations commencing in 2020.

The number of challenges overcome in the design of a vessel with such complex technical requirements is a testament to the highly-skilled staff of engineers at KNUD E. HANSEN.

Nuyina is classified as a Polar Class 3 (PC3) icebreaker, meaning it can operate year-round in second-year ice as well as multi-year ice inclusions.

This has several design implications with respect to hull form, structural scantlings, propulsion and steering, as well as crew safety and survivability of the vessel.

Nuyina has a range of sixteen thousand nautical miles with an endurance period of 90 days and a capacity of about 150 persons.

OUR PROJECTS KNUD E. HANSEN's involvement in the design of research vessels includes newbuilds, conversions, refits/refurbishments, life extensions, as well as a variety of other engineering and non-engineering tasks such as owner representation, market analysis and feasibility studies. KNUD E. HANSEN has also provided design and engineering for the following vessels:

- 65M ICES209 Research Vessel (PC6)
- 54M DNV SilentR Research Vessel

- 35M Marine Research Vessel
- 68M Fishery Inspection Vessel
- 90M Southern Ocean Patrol Vessel
- 80M Oil Recovery Icebreaker (DNV 1A1/ ICE 10)
- 64M Multi-Purpose Offshore Support Vessel
- 160M Antarctic Resupply and Research Icebreaker (PC3)
- 140M Heavy Icebreaker (PC2)

OUR TEAM KNUD E. HANSEN employs a team of highly skilled naval architects devoted to the challenges presented by these complex designs. They are joined by experienced marine engineers, designers, project managers, HVAC specialists, and lead engineers from all relevant disciplines in order to provide a comprehensive design solution.

This includes technical evaluations on such issues as:

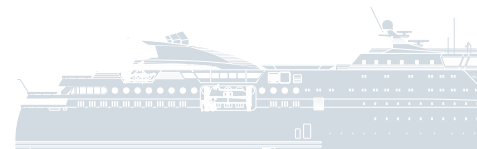
- Flag and Class notation
- Polar Code and winterization
- Good seakeeping

- Icebreaking capability
- Underwater radiated noise
- Mounting of sensor suites
- Hull lines and buoyancy
- Bubble sweep down
- Arrangements for silent propulsion
- Interior design and layout of laboratories
- Deck arrangements and flexibility for different scientific operations
- Fishing gear and work flow on deck



OUR TECHNOLOGY KNUD E. HANSEN has always been at the forefront of ship design. We use the latest technology that enables our team to be more creative and efficient.

- ShipSpace™ virtual reality tool, allows close technical collaboration everywhere in the world.
- SAMBA project, extensive use of Finite Element Analysis (FEA) and computational Fluid Dynamics (CFD) all contribute to better designs.

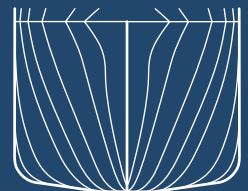
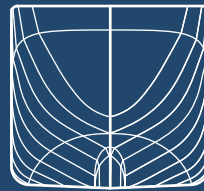




PROPULSION AND PROPELLERS

Choice of propulsion is one of the most costly and crucial decisions to be made when designing a research vessel. A number of different types of propulsors are installed in contemporary research vessels.

When designing the RSV Nuyina for Australian Antarctic Division KNUD E. HANSEN chose a traditional twin shaft solution with controllable pitch propellers and triple bow and stern thrusters in a weighted balance of ice conditions in the Antarctic, level of underwater radiated noise, operational distance in open water among other design requirements.



SEAKEEPING AND ICEBREAKING

The hull form of a research vessel must be carefully considered for the geographical area of operations and scientific purpose. Environmental conditions including wave heights and water depth must be taken into consideration.

Hulls designed for icebreaking generally use a ramped hull form that allows the vessel to ride up and break the ice by using its own weight.



DROP KEEL, MOUNTING OF SENSOR SUITE

It takes a suite of highly advanced bio-acoustic transducers and multibeam echosounders to perform acoustic mapping and research in the water column below the vessel when sailing.

The bio-acoustic transducers and multibeam echosounders are affected negatively by the bubble sweep down from the moving vessel. RSV Nuyina has been designed with twin drop keels to keep the sensor suite below the bubble sweep down from the icebreaking bow.



UNDER WATER RADIATED NOISE



Often research vessels are required to be designed for compliance to a high standard for noise reduction and low noise radiation to surrounding waters during marine research and scientific operations up to speed of 10-12 knots.



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