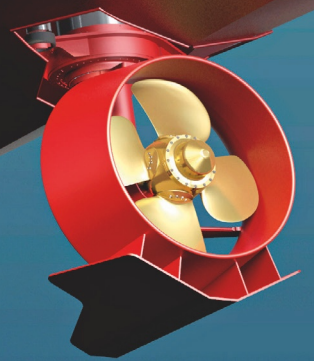


# NAVY

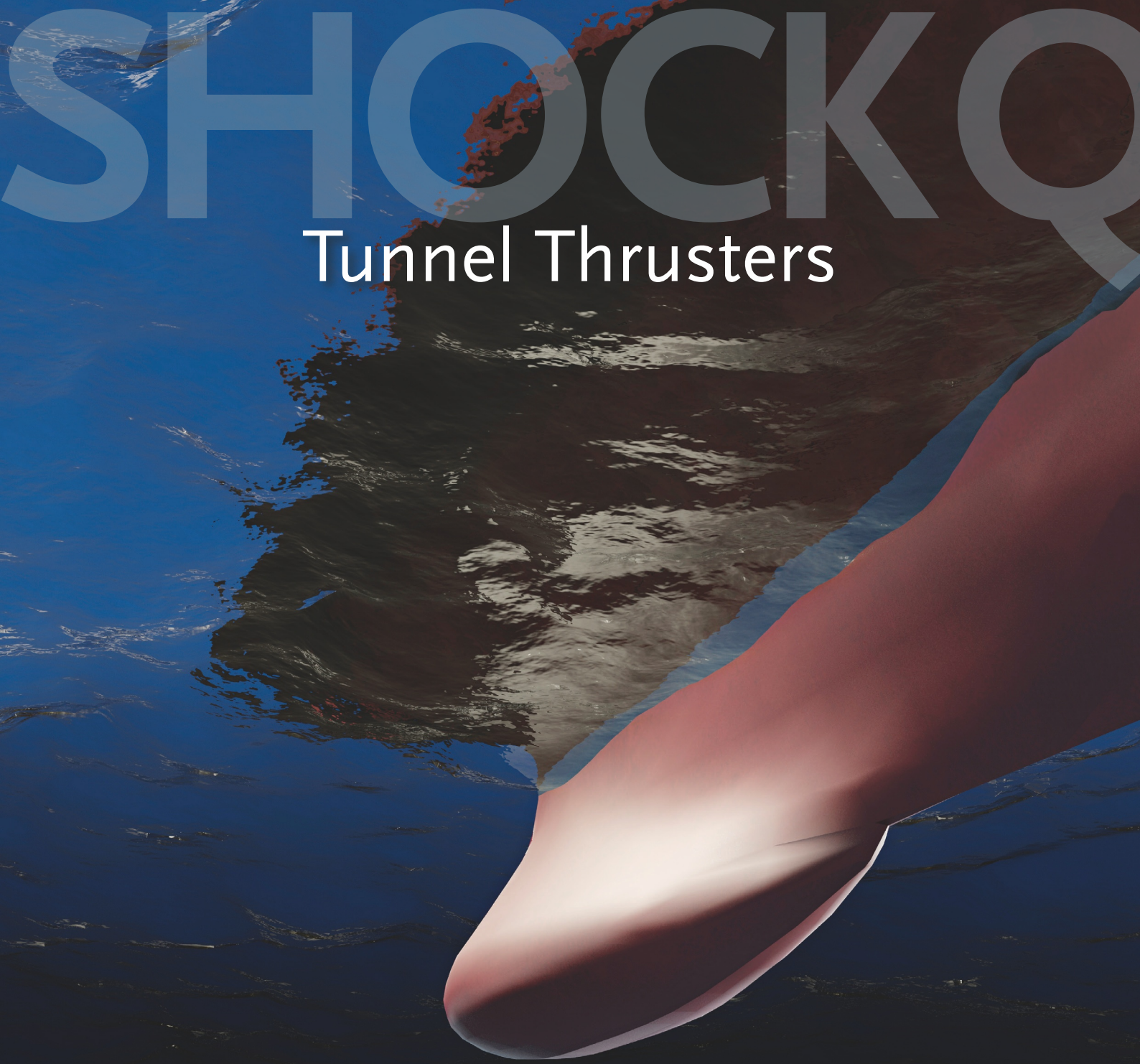


Trusted for  
shock qualified  
naval thruster solutions  
worldwide



# SHOCKQ

## Tunnel Thrusters

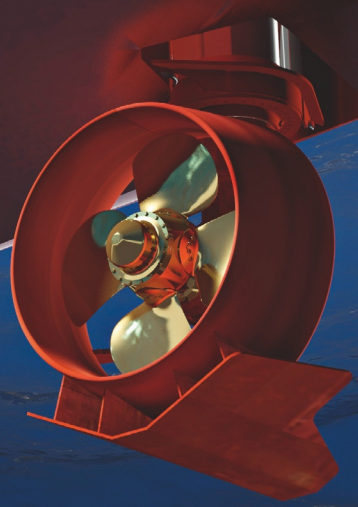


Brunvoll solutions are  
Australia, Denmark, France, Germany,



# QUALIFIED

## Retractable Azimuth Thrusters



| Contents                    |    |
|-----------------------------|----|
| Systems                     | 4  |
| Thrusters                   | 6  |
| Solutions                   | 8  |
| Shock Qualified             | 10 |
| Norwegian Frigates          | 12 |
| FREMM Frigates              | 16 |
| Spanish/Australian Frigates | 18 |
| German Frigates             | 20 |
| French/Russian LHDs         | 22 |
| Spanish/Australian LHDs     | 24 |
| Coast Guard favourite       | 26 |
| Ocean Patrol Vessels        | 28 |
| Navy Support Vessels        | 30 |

trusted by navies in  
Norway, Spain, the UK, the USA, and others



# SYSTEM

## Why is Brunvoll preferred for advanced



### Ever more challenging tasks and areas of operation require ever more trustworthy equipment

Brunvoll technology provides power and precision in challenging operating conditions:

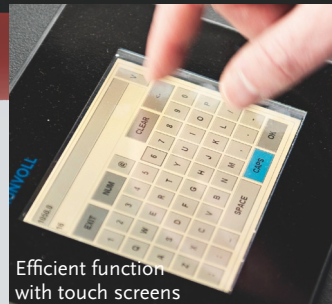
- Improved operational efficiency in and out of port
- Creep mode capability
- Manoeuvrability in coastal waters
- Take-home capability

### Thruster applications in naval ships can be quite different from other vessels

- Tailored Brunvoll solutions for advanced navy and coast guard vessels
- Shock qualifications
- EMI / EMC tested
- Materials selected for fire resistance and hazard control
- Product and manufacturing qualification
- Integrated logistics support
- Spare parts with NATO codification
- Usability

# FEMS

## Navy and Coast Guard vessels?



### Complete Naval Thruster Systems from a single-source supplier

- Thrusters from 100 kW to 3,500 kW
- Consistent Brunvoll quality and design
- Fully integrated thruster solutions complete with automation systems, electronic cabinets, drive systems and hydraulic power units
- Multidisciplinary expertise focused on thrusters – more than 7,000 thruster deliveries
- Unmatched reputation for fast, knowledgeable service worldwide

### BruCon from Bridge to Blade

BruCon is Brunvoll's modular control, monitoring and alarm system for manoeuvring, positioning and propulsion – enabling:

- Precise control of manoeuvring, positioning and propulsion
- Optimized performance
- Reduced wear
- Smarter preventive maintenance
- Reliable service
- Access to Brunvoll support 24/7

# THRU

Consistent Brunvoll design

## Tunnel

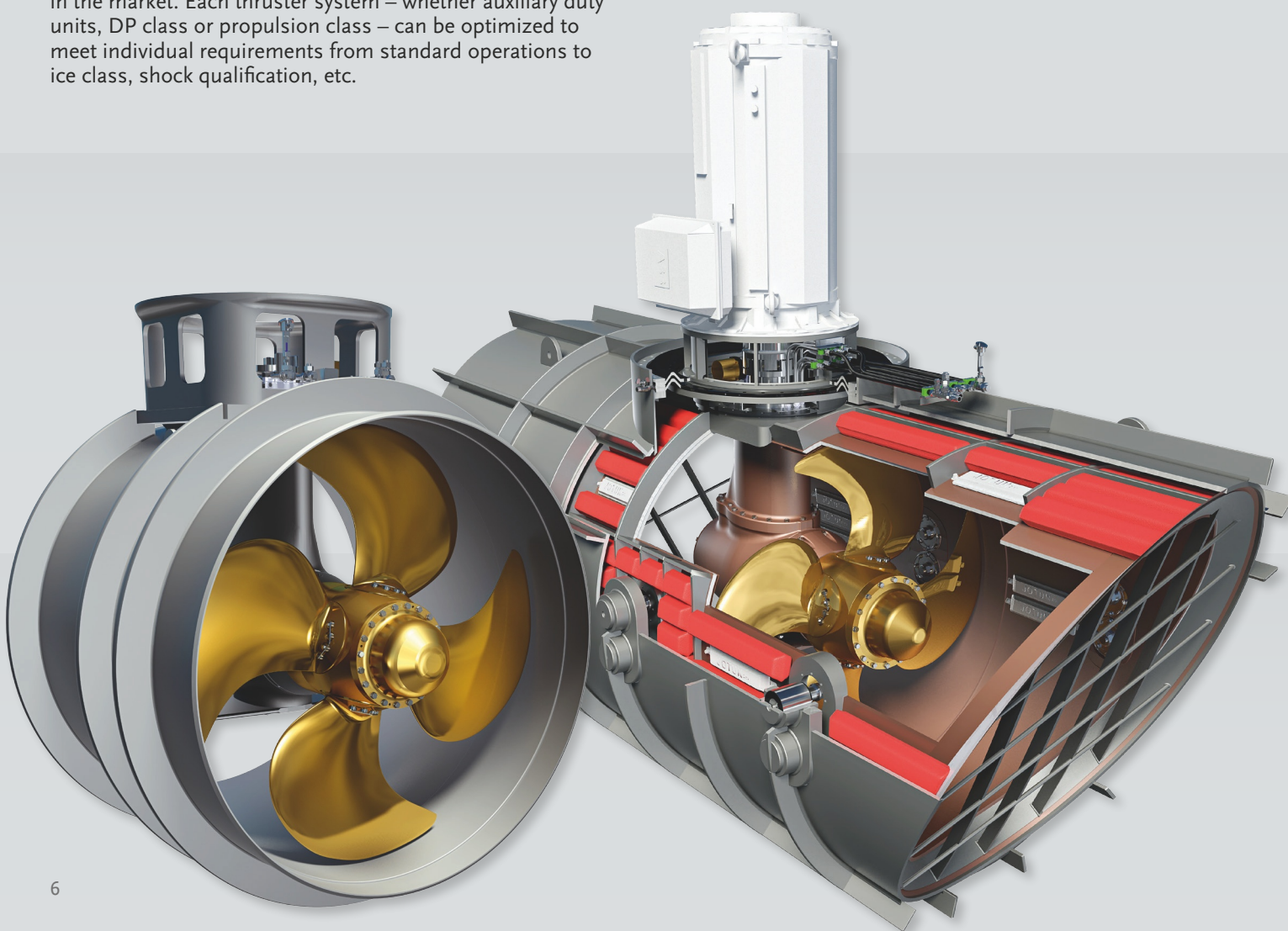
### Tunnel Thrusters from 100 to 3,500 kW

Brunvoll tunnel thrusters have been a success throughout the maritime sector. In the challenges presented by a wide variety of marine industries, they have proved their reliability with thousands of operating hours each year. Our thrusters have undergone constant refinement since the first unit was delivered in 1965, and are now state of the art in the market. Each thruster system – whether auxiliary duty units, DP class or propulsion class – can be optimized to meet individual requirements from standard operations to ice class, shock qualification, etc.

## Tunnel LowNoise

### Brunvoll pioneered LowNoise Thrusters

Brunvoll's LowNoise solutions cut noise levels by up to 15 dB(A) compared with conventional tunnel thrusters. Statistics show that lower noise and vibration levels improve crew alertness and reduce stress, promoting safety and operational efficiency. Brunvoll has been delivering LowNoise thrusters since 1984.



# THRUSTERS

and quality in a versatile range

## Retractable Azimuth

Retractable Azimuth Thrusters can be lowered in a minute to provide a new level of manoeuvrability

Brunvoll's retractable azimuth thrusters increase flexibility and stability for demanding operations and challenging waters.

- Take-home propulsion capacity (6-9 knots)
- At low speed, the ultimate in precision and reliability for station keeping, search, surveillance and tracking.
- Of growing interest for a variety of naval applications.

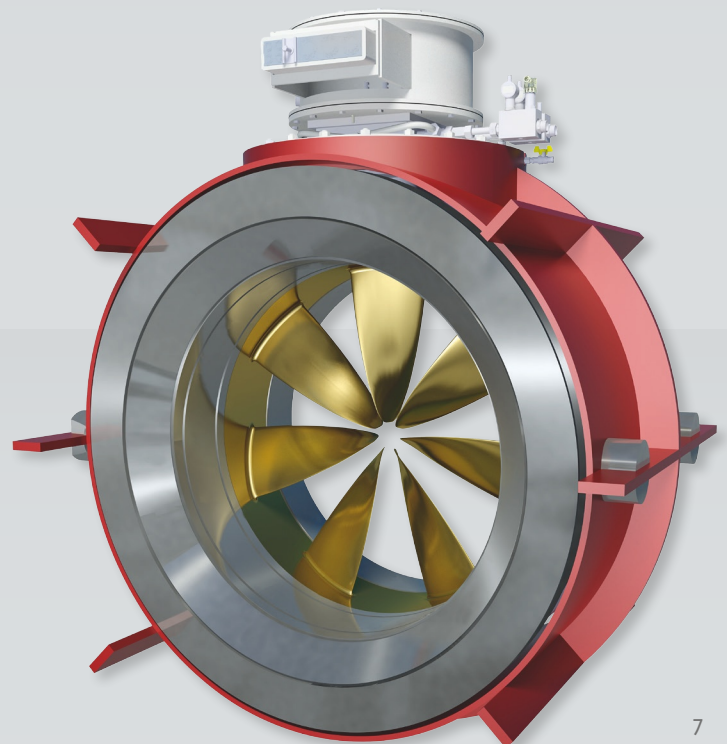
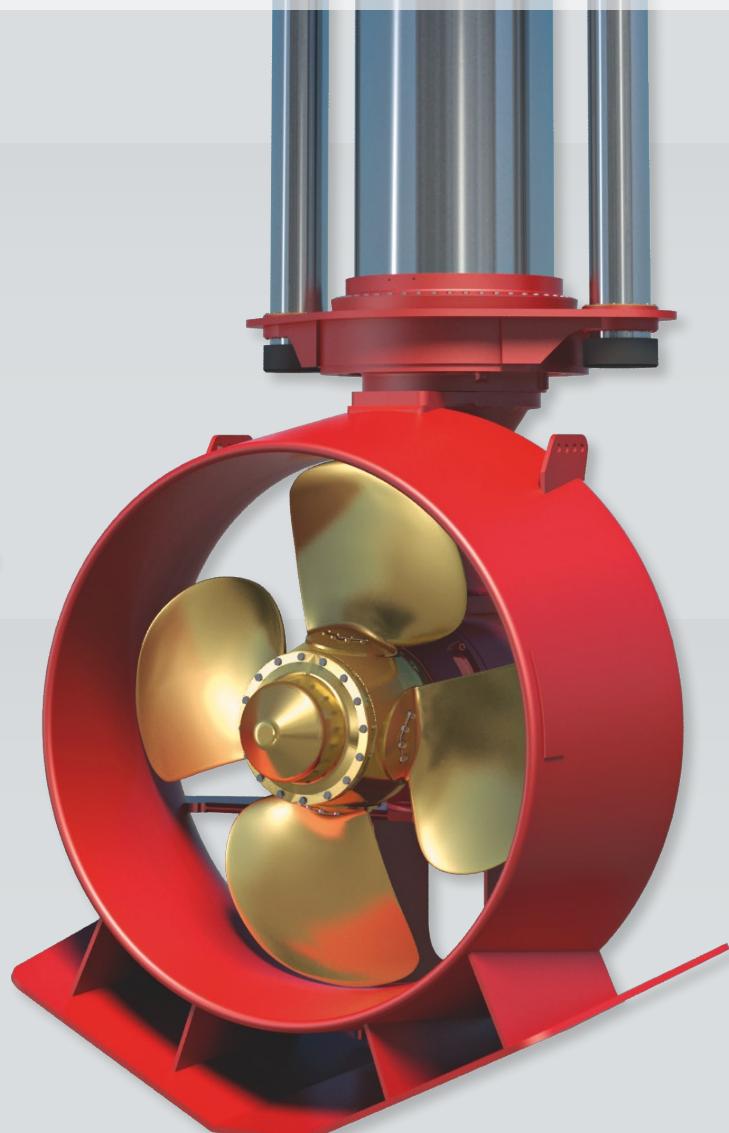
## Rim Driven

Rim Driven Thrusters (RDT) – lowest noise and vibration – space-saving design

Rim-driven thrusters enable quieter performance than ever along with space-saving design and flexibility – an advantage for installation in a narrow skeg or a slender bow.

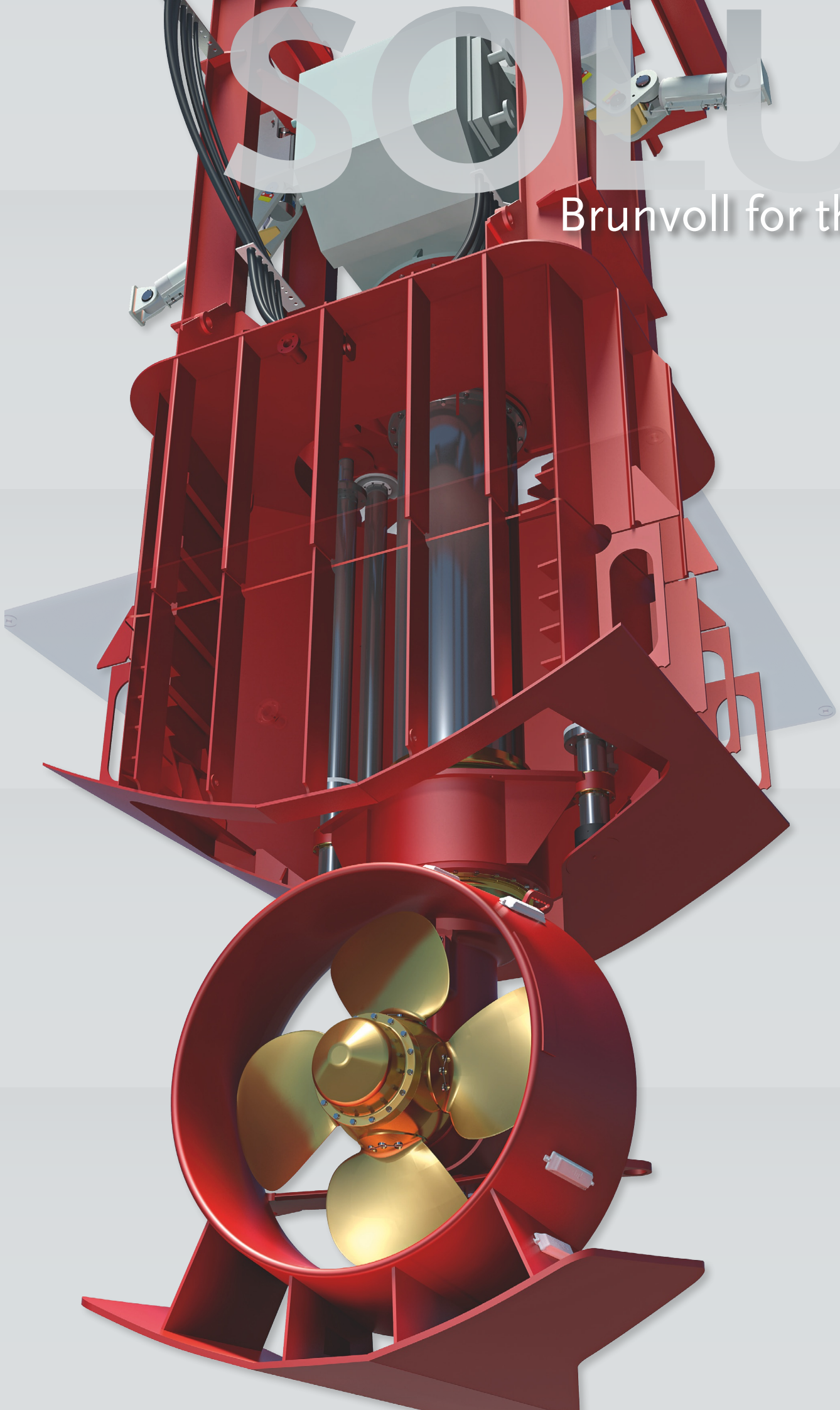
With no central shaft, water inflow to the propeller is undisturbed – improving thruster efficiency.

The electric motor is integrated. Environmental impact and maintenance costs are minimized because the RDTs have no gears and bearings that need oil lubrication.



SOLU

Brunvoll for the





# OLUTIONS

## life of the vessel

### Customized solutions – easy hull integration

- Assistance in selection of thruster type/size and location
- Advice on drive system type as well as type and extent of control system
- Integration and interface engineering and documentation

### Brunvoll documentation includes

- Installation instructions
- Set to work instructions
- Operating instructions
- Maintenance and Overhaul instructions
- Integrated Logistic Support documentation
- Spare parts recommendations

### We also offer

- Technical assistance for installation, start up and lifetime support
- Training of crew and personnel

### Consistent Brunvoll quality and precision

Robust design, generous dimensions, and attention to details support trouble-free performance. Excellent technical solutions enable our thruster systems to handle the challenges of naval operations. Brunvoll's in-house process combines cost efficiency with high quality. Full control of our production enables unique flexibility.

### Lifetime service and support

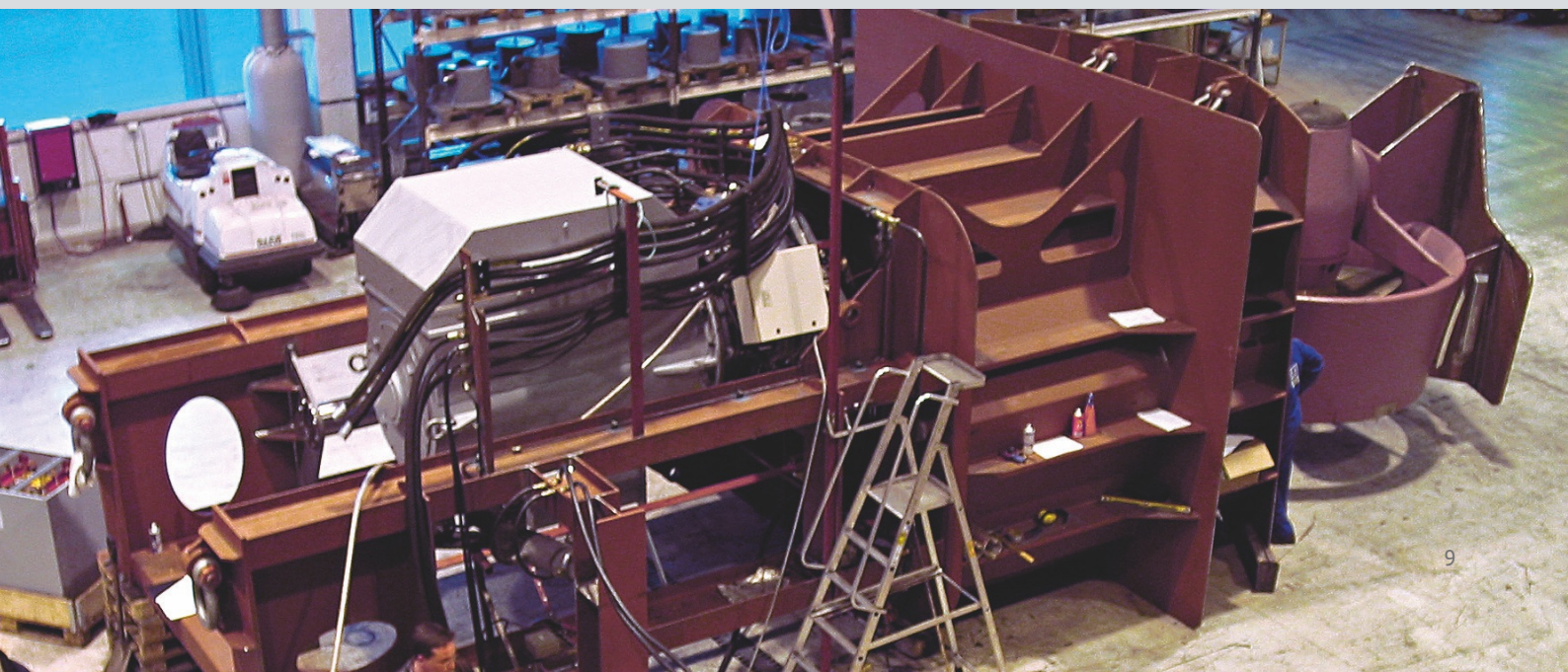
- Our streamlined organization focuses on thruster systems only.
- All our thruster systems are Brunvoll design – our service personnel know them inside out.
- Brunvoll's experienced teams of in-house service engineers have multidisciplinary skills.
- Fast and knowledgeable response to service calls is available 24/7.
- For short delivery times, we keep extensive stocks of spare parts for all Brunvoll thrusters in service.

### Northern Europe – a marine leader

Washed by the world's wildest oceans, Northern Europe has been driven to become a leader in the marine area. An attitude of innovation and superb workmanship has been hammered into a maritime tradition that dates back to Viking times.

Brunvoll is inspired by the dynamic and innovative maritime cluster of Western Norway, and we contribute to it. Brunvoll has made a substantial investment in naval applications over the years and was first with shock-qualified retractable azimuth thrusters.

Brunvoll solutions are found in navy vessels ranging from aircraft carriers to frigates, destroyers, patrol vessels, coast guard vessels and naval support.



# SHOCKO

Brunvoll's thruster solutions meet the dema



# QUALIFIED

## Meeting requirements for naval applications

### Shock Qualification of Thruster Systems

Elastic deformation, resilient mounting and rubber isolation provide shock absorption in compliance with naval specifications. Mechanical reinforcement and the choice of materials are key factors in the design.

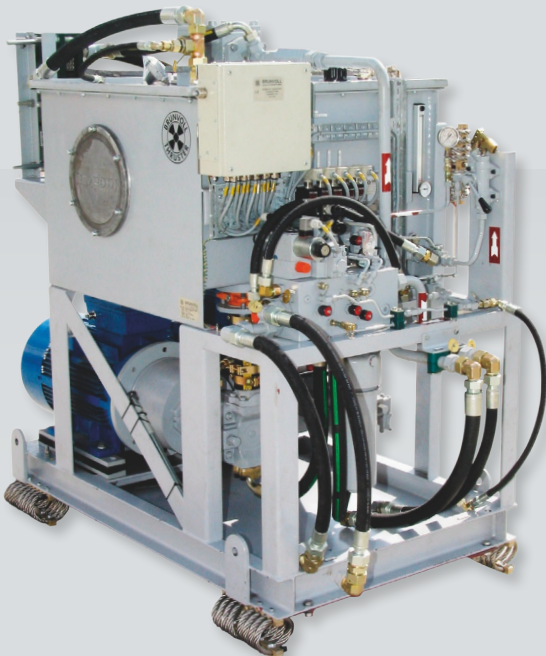
Brunvoll has a wealth of experience in developing shock-qualified solutions for

- Retractable azimuth thrusters
- Tunnel thrusters
- Combined retractable azimuth and tunnel thrusters

### Advanced FEM analysis minimizes weight, materials and costs

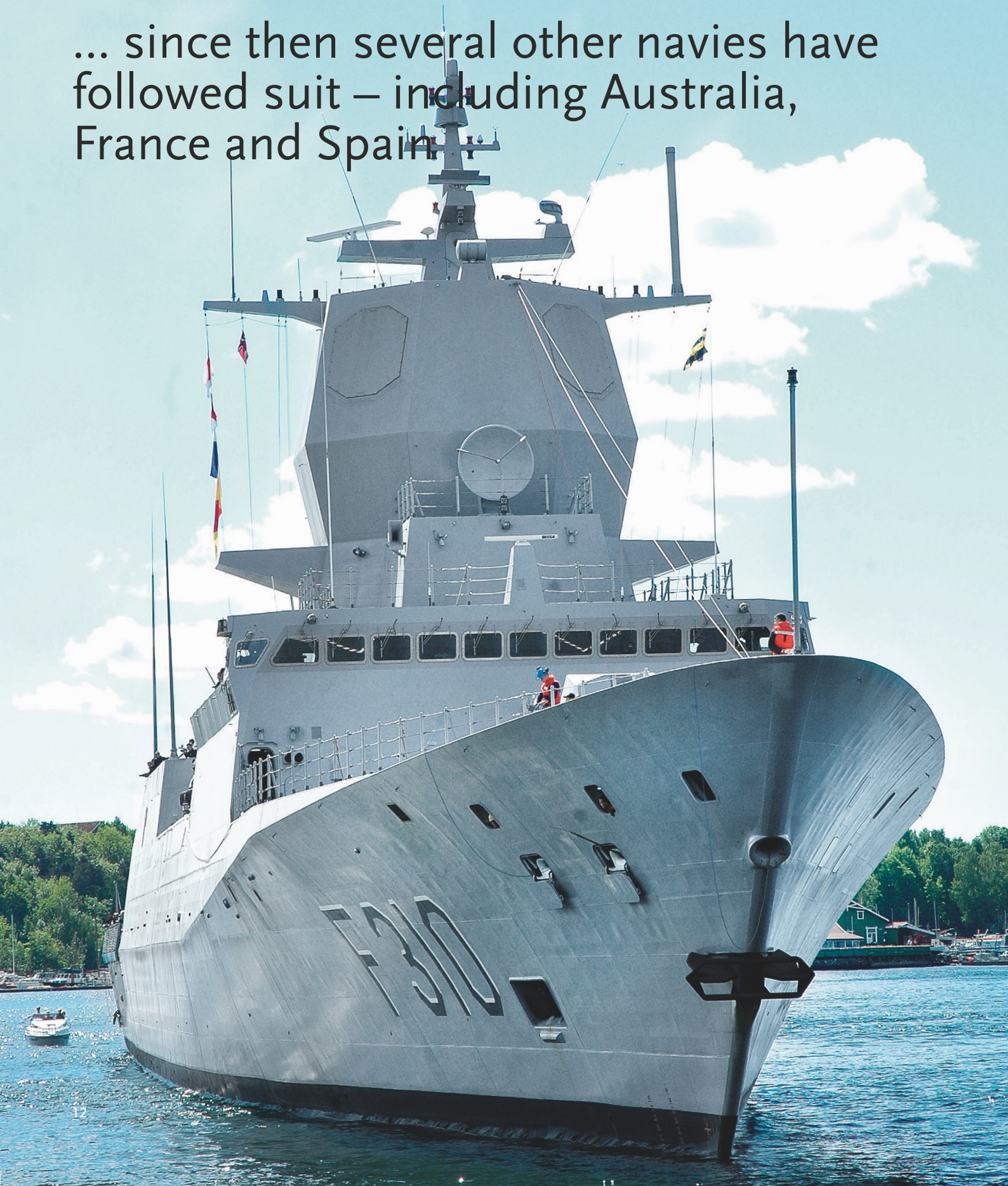
For improved design and virtual prototyping, the finite element method provides advanced visualization of stiffness, strength, distribution of stresses and displacement.

But no matter how good the solution looks on the drawing board, it has to function under harsh real-life conditions at sea. Here, Brunvoll's vast portfolio of experience makes all the difference – when it counts most.



In 2001 the Norwegian Navy decided to equip 5 new frigates with Brunvoll Retractable Azimuth thrusters ...

... since then several other navies have followed suit – including Australia, France and Spain.





# Each of the five Norwegian frigates has a Brunvoll Retractable Azimuth Thruster



KNM "Fridtjof Nansen" is equipped for anti-submarine warfare, anti-air warfare and anti-surface warfare as well as non-combatant tasks in peacetime. Built by Navantia in Spain, "Fridtjof Nansen" is the first of five frigates delivered to the Royal Norwegian Navy. The shock-qualified Brunvoll Retractable Azimuth Thruster has become a favourite. As a consequence of positive experience with the Norwegian solution, the thruster has been chosen by several navies in their programme for new naval vessels.



Packed with measurement instruments and specialized equipment, the vessels were tested extensively during underwater explosions





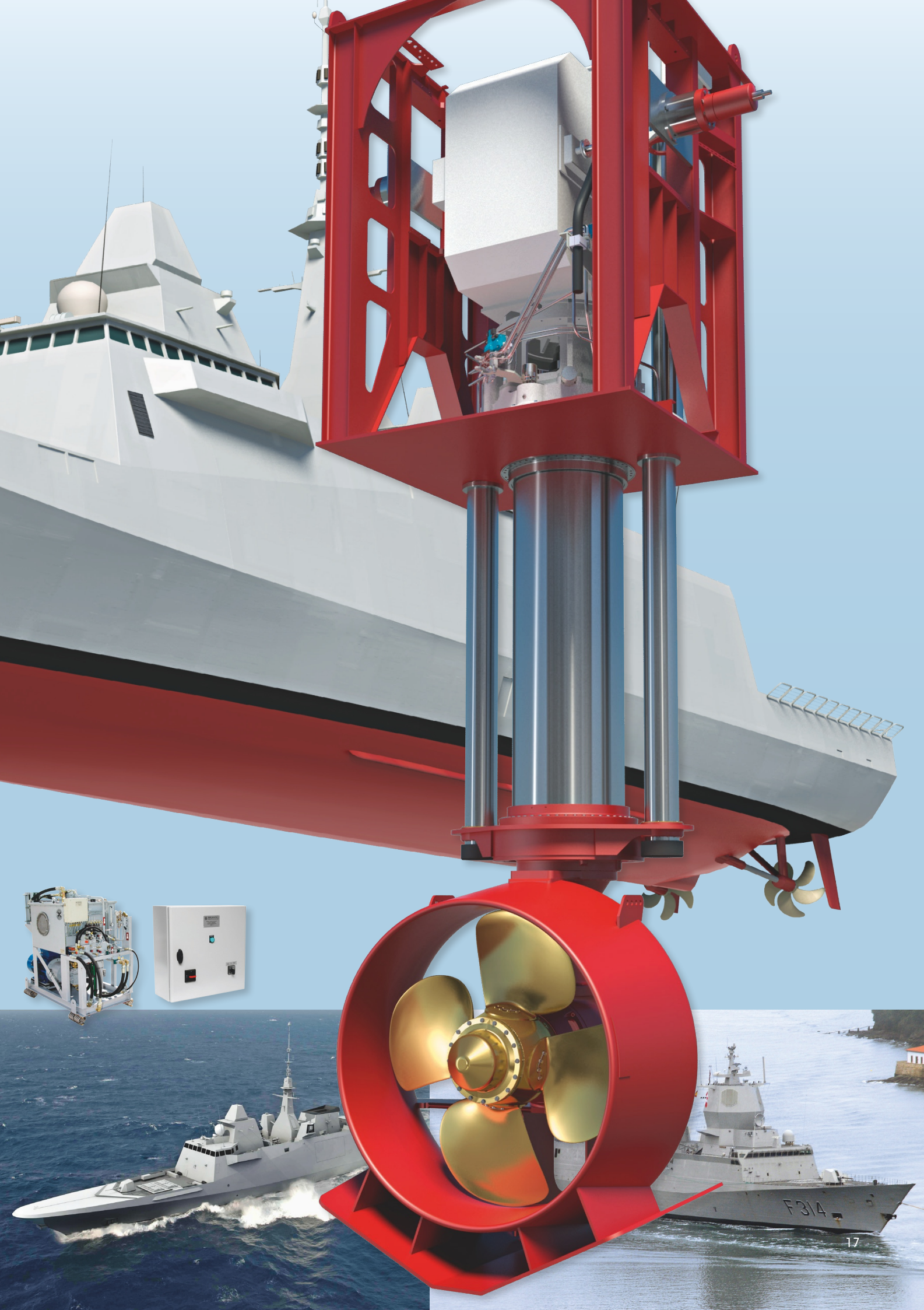
# Brunvoll Retractable Azimuth Thruster systems in the FREMM frigates for the French Navy



The FREMM (Frégate multi-mission) is a front-line warship that will form the operational backbone of major navies. Combining stealth and muscle, the multipurpose frigates are potentially the most modern warships in the French navy. They can operate in anti-air, anti-submarine and anti-ship warfare. The ships are being built in France by DCNS. "FNS Aquitaine" is the first of class. Brunvoll thruster systems were chosen for all the frigates.







# The Spanish Navy chose Brunvoll for the new F105 frigate ...

The F105 multi-role frigate "Cristóbal Colón" is the most advanced of the Spanish Navy's F100 class vessels. The frigate, capable of cruising at up to 28.5 kt, has the flexibility to operate in coastal waters or high seas. "Cristóbal Colón" is the first vessel in the Spanish Navy to be equipped with a retractable azimuth thruster. Brunvoll was chosen for the delivery.

# ... so did the Australian navy for the SEA 4000 Air Warfare Destroyers

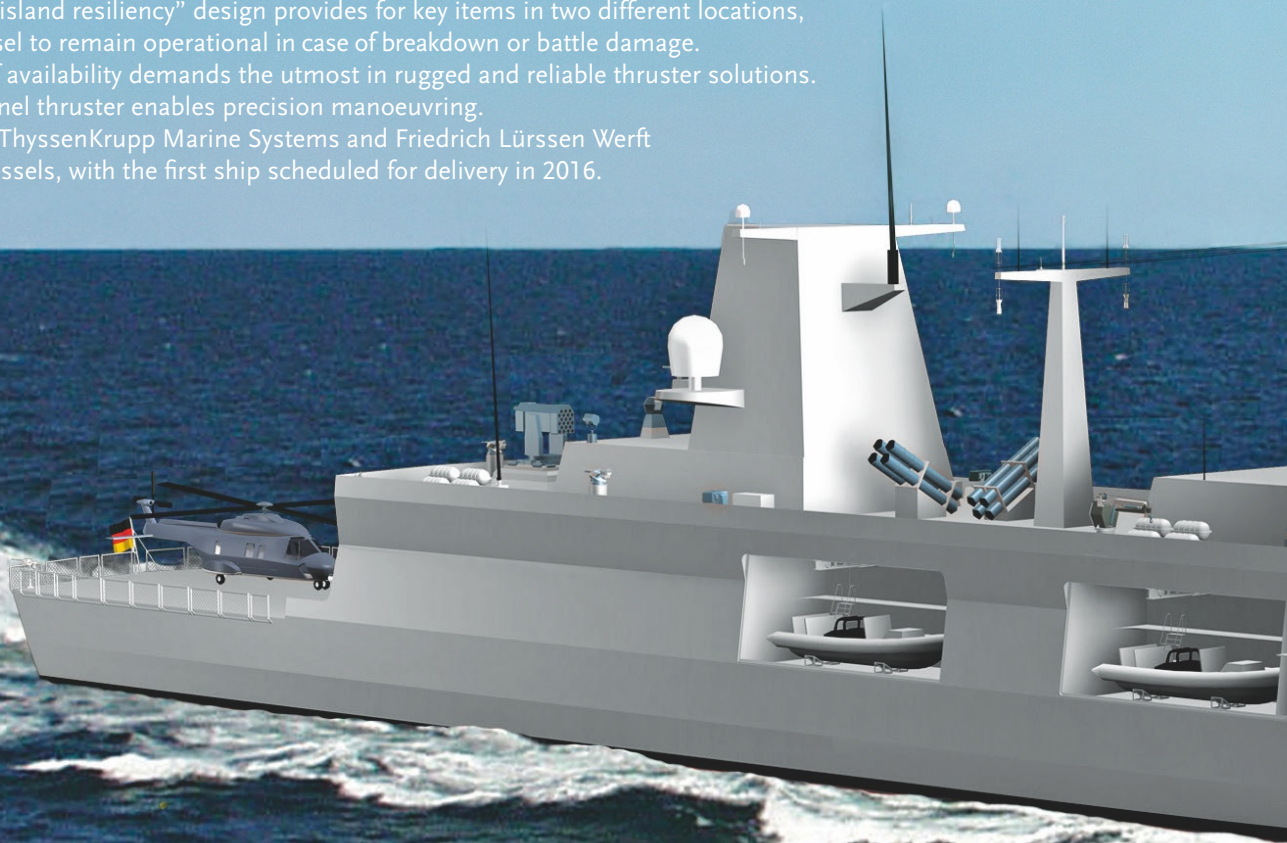
The three new Hobart Class destroyers, based on the Spanish F100 class, are to be named HMAS "Hobart", HMAS "Brisbane" and HMAS "Sydney". These vessels will be among the world's most capable all-purpose warships. They will each be equipped with a Brunvoll retractable azimuth thruster.

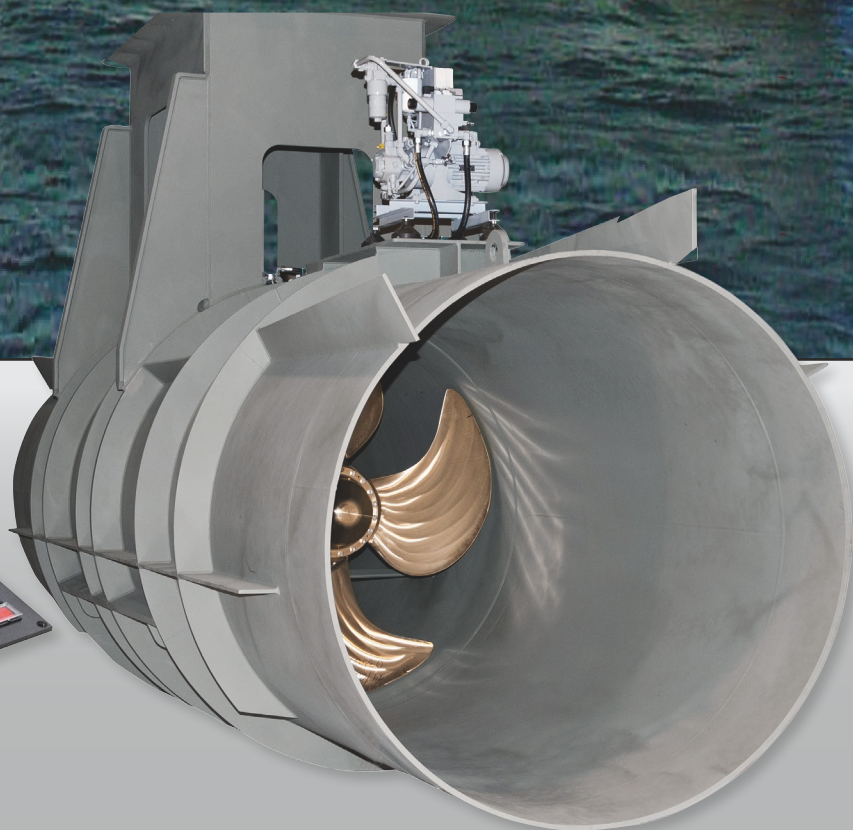




# Brunvoll in next generation German frigates

The F125 class represents the navy's future vision of long missions and littoral operations. The frigate will have land attack capabilities tailored to the needs of peacekeeping missions. The ship's "dual island resiliency" design provides for key items in two different locations, enabling the vessel to remain operational in case of breakdown or battle damage. This high level of availability demands the utmost in rugged and reliable thruster solutions. The Brunvoll tunnel thruster enables precision manoeuvring. A consortium of ThyssenKrupp Marine Systems and Friedrich Lürssen Werft is building the vessels, with the first ship scheduled for delivery in 2016.





# Brunvoll in French and Russian Landing Helicopter Docks



2004 "Mistral"

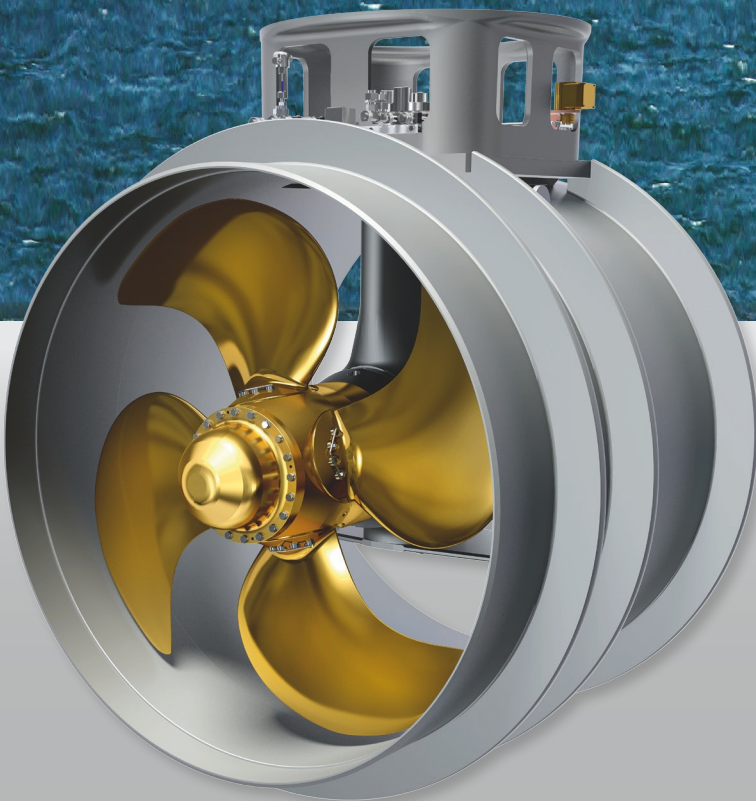


These LHD vessels are designed for crisis management and force projection missions. The three LHD vessels “Mistral”, “Tonnerre” and “Dixmude” were delivered to the French navy from 2004 to 2012. They provide sea-based air mobility capacity with great multi-role flexibility.

Russia has ordered two DCNS Mistral-class ships for construction at STX France. There is an option for two further ships to be constructed in Russia. The Brunvoll tunnel thrusters offer exceptional manoeuvrability – enabling the vessel to turn around its own length.



2005 “Tonnerre”



# Brunvoll in LHDs for Spain and Australia



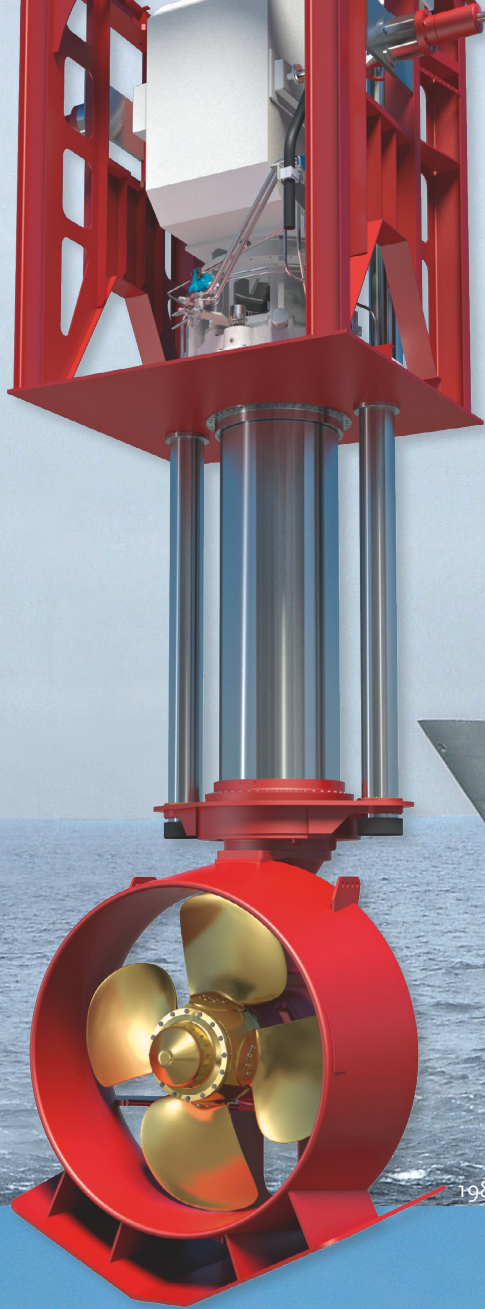


Built by Navantia and launched in 2008, the BPE “Juan Carlos I” is designed primarily for use as an aircraft carrier, playing an important role in the Spanish Navy. The BPE (Buque de Proyección Estratégica – Strategic Projection Vessel) concept reflects a new focus on expeditionary operations at extended range and endurance.

Navantia will also deliver two LHDs to Australia – HMAS “Canberra” and HMAS “Adelaide” in 2014 and 2016. The vessels will have air support, amphibious assault, transport and command centre roles. Every advantage counts in the extremely challenging sphere of operating aircraft at sea, Brunvoll was the thruster of choice.



# Brunvoll Thruster Systems – a Coast Guard favourite since the 1970s



1981 KV "Serja"

## Brunvoll Thrusters for Coast Guard Arctic operation

The Norwegian Coast Guard icebreaker and offshore patrol vessel KV "Svalbard" was launched in 2001. The vessel is designed to break ice both ahead and astern. The coast guard inspects fishing boats, performs zsearch and rescue missions as well as environmental monitoring.



Brunvoll has pioneered the development of retractable azimuth thruster technology for naval applications since 1979. Brunvoll developed and produced retractable azimuth thrusters for the Nordkapp class of ships delivered to the Norwegian Coast Guard early in the 1980s.

The Nordkapp class consists of “KV Nordkapp”, “KV Senja” and “KV Andenes”. These ice-strengthened vessels are designed for Arctic waters. They are used for rescue, fishery inspection, research and patrol. Each vessel has one Brunvoll Retractable Azimuth thruster system.



# Brunvoll in ocean patrol operations



1991 "Thetis"

## "Thetis Class" 4 Ocean Patrol Vessels for the Royal Danish Navy

The Thetis Class vessels built at Svendborg Skibsværft in Denmark presented a major thruster design challenge. The space available for the retractable azimuth thruster was extremely limited. Brunvoll developed a highly integrated and robust solution with a marginal footprint, which introduced a whole new concept in retractable

azimuth thruster design. The Royal Danish Navy uses the ice-strengthened Thetis frigates for fishery protection, surveillance, air-sea rescue, anti-pollution and ice reconnaissance. The Brunvoll thruster units can hold the bow against an athwartship wind of 28kt. The retractable azimuth thruster can propel the ship at 10kt.



1992 "Hvidebjørnen"



2002 HMS "Enterprise"

1974/2000 ORP "Lech"



28



1974/1998 ORP "Piast"



1992 "Vedderen"



1991 "Triton"



2002 HMS "Echo"  
1986 USNS Salvor



1985 USNS "Grasp"



1986 USNS "Grapple"



1986 USNS Salvor

# Brunvoll in many navy support vessels

The "Cantabria" auxiliary oiler and multiproduct replenishment ship was delivered to the Spanish Navy in 2010. The vessel enables fast transfer of stores from ship to ship or to shore. The vessel has a Brunvoll tunnel thruster for precise manoeuvring.



2002 EGV "Frankfurt am Main"  
One of a series of replenishment ships for the German naval fleet, equipped with a Brunvoll tunnel thruster for precise manoeuvring operations.

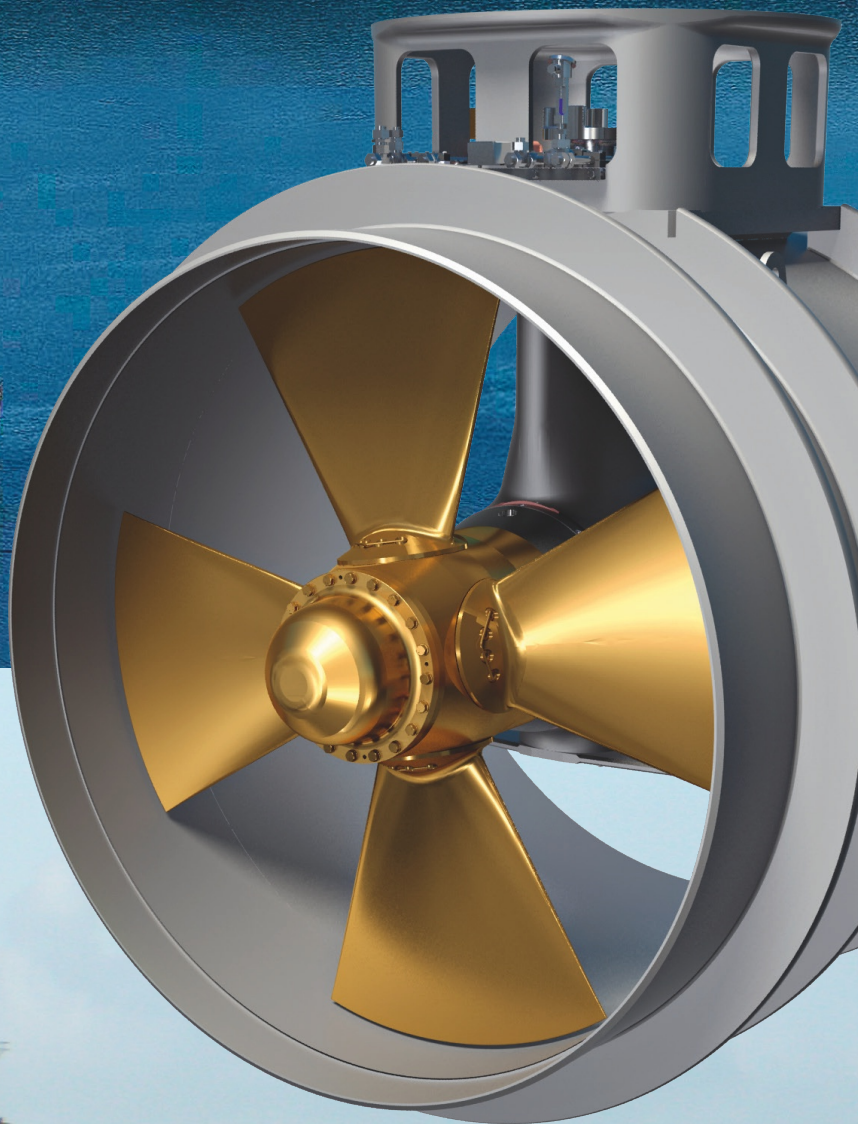


2006 "Mounts Bay"



2006 "Cardigan Bay"





2006 "Largs Bay", now "HMAS Choules"

1994 "Donau"



Brunvoll information resources are available in the publications shown here.

Please contact us if you would like to receive any of our brochures.

You are also welcome to read or download them as PDF files at [www.brunvoll.no](http://www.brunvoll.no)

**THRUSTER RANGE**

Thruster Systems for any kind of ship



**CONTROL SYSTEMS**

BruCon from Blade to Bridge  
The Modular Control System for Manoeuvring, Positioning and Propulsion

**SERVICE**

Renowned for Efficient and Reliable Service world wide

**BRUNVOLL**

Company Presentation

**CRUISE**

The World's No.1 in Cruise Ships




**FISHING & RESEARCH**

Trusted by the most demanding Fishermen and Researchers



**MERCHANT**

Trusted in the Merchant Fleet for 50 years




**NAVY**

Trusted for shock qualified naval thruster solutions worldwide



**OFFSHORE**

Trusted world wide for reliability and high performance in any offshore application



**YACHTS**

Superb thrusters for superyachts



BRUNVOLL AS  
Strandgata 4-6, NO-6415 Molde, Norway  
Phone +47 71 21 96 00. Telefax +47 71 21 96 90  
E-mail [office@brunvoll.no](mailto:office@brunvoll.no)  
[www.brunvoll.no](http://www.brunvoll.no)