



[Return to Session Menu](#)

DYNAMIC POSITIONING CONFERENCE
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THRUSTERS SESSION

**Challenges in Ship Design to Maintain
Thrusters Inside Ship**

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NAVAL ARCHITECTS & MARINE SOLUTIONS

Challenges in Ship Design when Maintaining Thrusters inside ship

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Presentation Objectives

- Overall Service Demands for a Thruster
- Principles and Function of different Thruster Containers /Canisters
- Challenges in Ship Design related to Thruster Canisters and Thruster Maintenance inside ship

Overall Service Demands for Thrusters

- Thruster's Role in Dynamic Positioning is essential → vulnerability
- Maintenance situations:
 - Annual Inspections
 - Cleaning and Inspection of Propeller
 - Replacement of Propeller Shaft Seal – life time 3-5 years
 - Replacement of Azimuthing Seal, Replacement of Anodes
 - Overhaul requirements from Classification – every 5 years (condition monitoring → 10 years)
 - Unexpected service needs – underwater collisions, etc.

Objectives for Installing Thruster Canisters

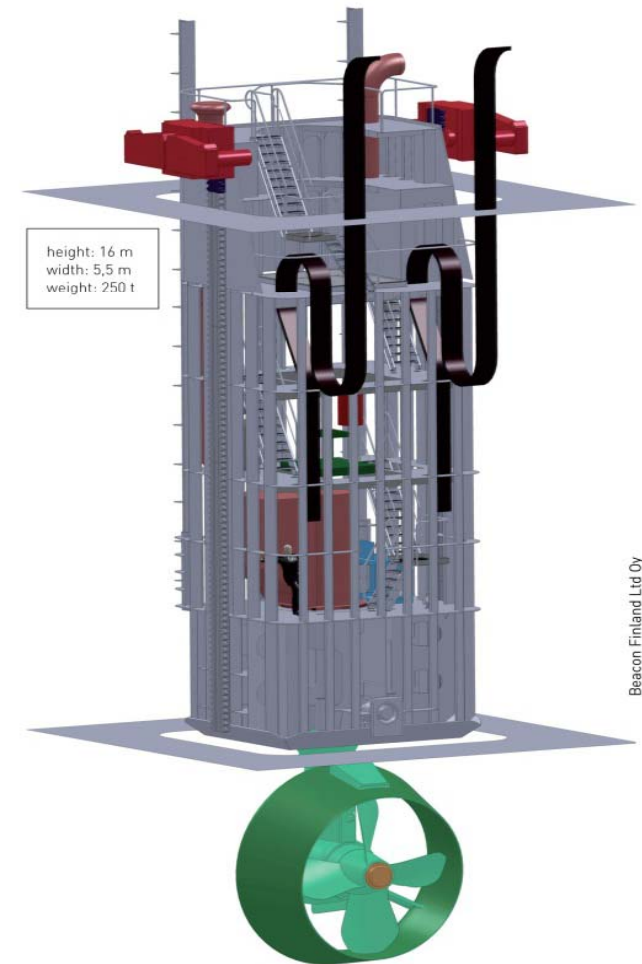
- First Canisters installed into Drillships in the year 2000
- Objectives for Installation
 - Improve vessel productivity through reduction of capacity down time
 - Enable thruster unit maintenance more easy and safe
 - Reduce maintenance related costs
 - No need for commercial diver assistance



Drillship Jack Ryan

Original Canister – Principles and Function

- Basic use and Functionality
 - Shallow water operation
 - Reduce vessel resistance in transit
 - Maintenance purposes
- Requirements for retraction and use
 - Jacking system for lifting and lowering, supported by a guide system
 - Locking systems for ultimate positions
 - Seal arrangement to have a dry trunk space



Original Canister – Principles and Function

- All Thruster functions inside the Canister
 - Main drive, lubrication system, steering hydraulics, control system, auxiliaries
- The cooling water, lubrication oil, power supplies, control cables, bilge system must be carried through umbilicals to the canister
- Forced ventilation to the canister and exhaust air from the canister

Service opportunities with Original Canister

- Replacement of worn or failed propeller shaft seal
- Right angle gear inspection
- Anode replacement
- Cleaning and inspection of propeller
- The canister offers the possibility to underwater installation of a complete thruster unit

References 2000 – 2014

No.	Owner	Country	Ship Delivery
1	Global Marine (Transocean)	USA	2000
2	Global Marine (Transocean)	USA	2000
3	Transocean	USA	2010
4	DeepSea Metro	Greece	2011
5	DeepSea Metro	Greece	2011
6	Noble	USA	2013
7	Noble	USA	2013
8	Ensco	USA	2014
9	Ensco	USA	2014
10	Noble	USA	2014
11	Noble	USA	2014
12	Rowan	USA	2013
13	Rowan	USA	2014
14	Rowan	USA	2014

New Canister Designs

- Short Canister
 - Shorter version of the original canister to fit vessels with smaller depth
 - Fits inside the hull in retracted position
 - Same service and inspection functions as for the original canister

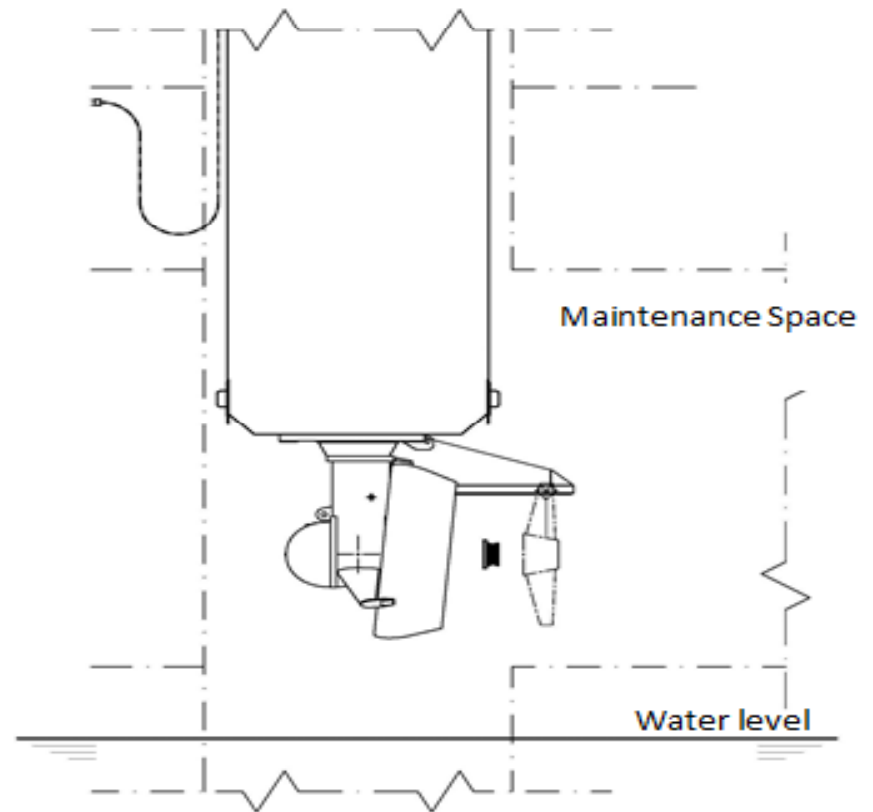


Fig. Replacement of Propeller Seal

Underwater Service Space

- Thruster Trunk separated from service space by WT bulkhead doors
- Trunk closed by WT bottom hatch
- Sea water is pumped out of the trunk
- The WT bulkhead door is opened and the service space is ready for use
- The WT bulkhead door is closed during service work

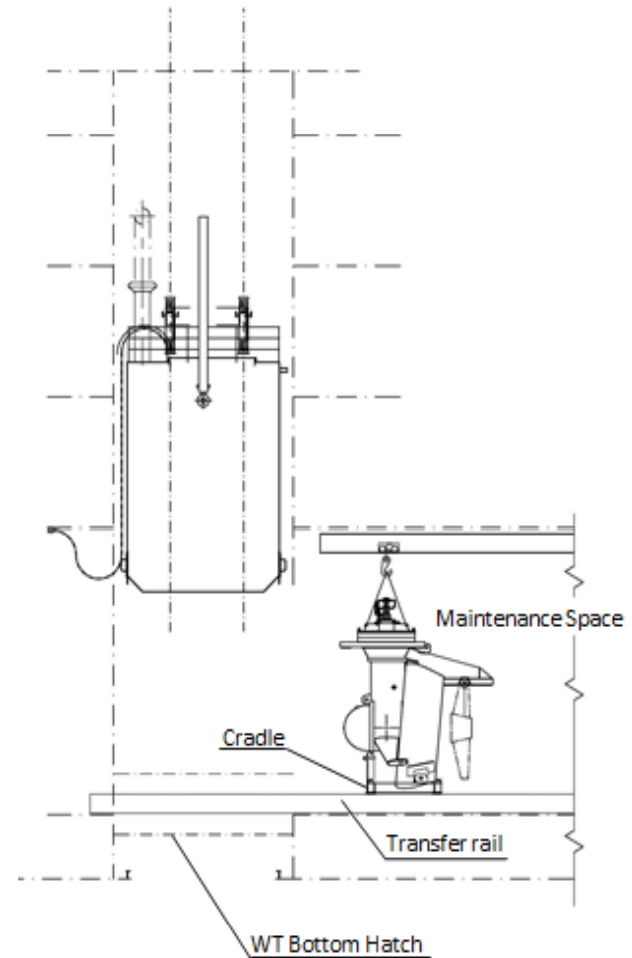
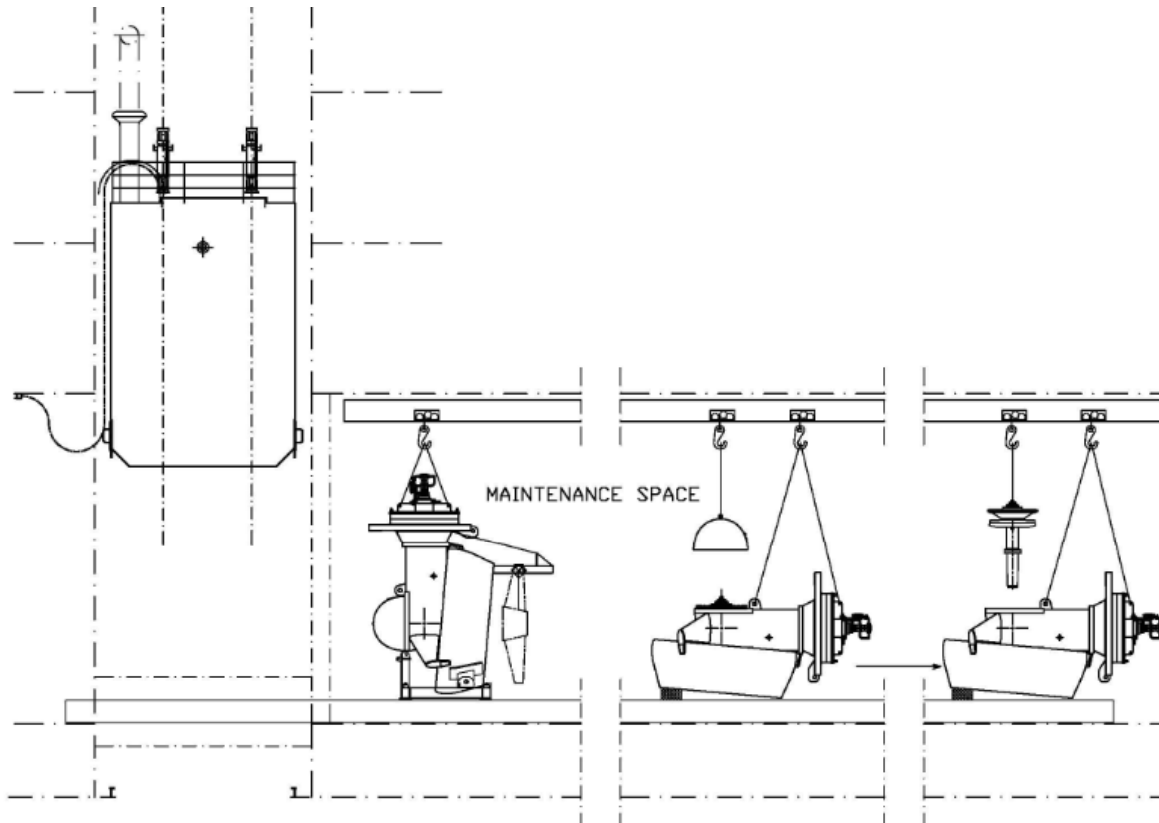


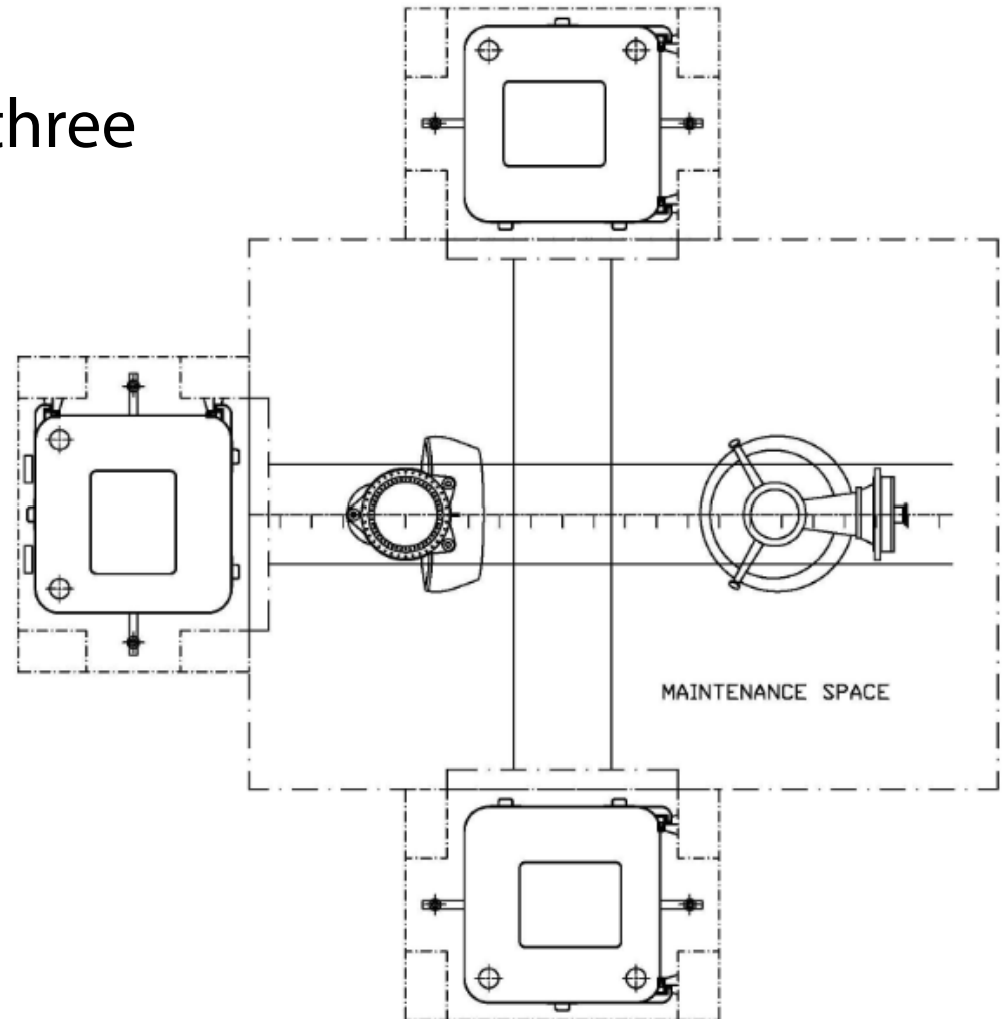
Fig. Dismantling of Thruster Unit

Underwater Maintenance Space for Azimuth Thruster



Maintenance Space Serving three Thrusters

- The trunks are separated from the service space by WT bulkhead doors



Features and Feasibility of Underwater Service Space

- Full Service of the Thruster, e.g.
 - Replacement of Propeller
 - Replacement of Propeller shaft and seal
 - Replacement of Azimuthing seal
 - Replacement of Anodes
 - Check of damages and leakages
 - Classification inspections
- Feasibility
 - Drillships, FPSO, FPDSO, FLNG, etc.

Comparison of Maintenance Possibilities

Original Canister

- Replacement of propeller shaft seal
- Replacement of anodes

Underwater Service Space

- Full service

Design Challenge → Space Definition

- Main Challenges in Space Definition
 - Operational requirements
 - Understanding of the possibilities the Canister offers
 - Definition of the Thruster size and type
 - Definition of the maintenance work to be done
 - Available on-deck space and supporting constructions
 - Space requirements of Auxiliaries operating the Canister

Conclusions

- The Canister concept offers many possibilities for efficient maintenance and cost savings
- The initial phase of the design is most critical for the outcome of the thruster design
 - Understanding the canister features
 - Learning from experienced designers
 - Deciding the preferred service work
 - Defining the elementary components
- Space dedicated to canisters pays off → increased popularity

Drillship "Deepwater Champion"

- *Furnished with six thruster canisters*

Thank you for your attention!

