Towards a new Danish research vessel

Status for plans

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DTU Aqua Mission and vision

Mission: DTU Aqua carries out research, provides advice, educates at university-level and contributes to innovation in sustainable exploitation and management of aquatic resources.

The vision of DTU Aqua is to enable ecologically and economically sustainable exploitation of aquatic resources applying an integrated ecosystem approach which utilises synergies in natural and technical science disciplines covering:

- **all aquatic ecosystem components** and trophic levels,
- **natural** (e.g. physics and climate) and **anthropogenic** (e.g. fisheries, pollution, shipping and offshore energy) **drivers of change**,
- **integrating modern technologies**.
100 years of marine research with Dana x4

The DANA vessels have contributed significantly to the Danish marine research, which is highly recognised in the European research community. A replacement of DANA IV should ensure access to a ‘state of the art’ research vessel for researchers at all Danish institutions.

**Dana I**
*1920-1921*
The first – wodden build DANA. First eel-expeditions to the Sargasso Sea.

**Dana II**
*1925-1935*
A steam trawler, went on a two year round the world expedition.

**Dana III**
*1937-1977*

**Dana IV**
*1981-
Eel expedition in 2014 to the Sargasso Sea.*
Dana - replacement

DTU plans to retire Dana IV in 2018.

If DTU is the only primary user for the new vessel, it will be built for fisheries research in the Baltic, North Sea and eastern North Atlantic only (light green area in the map). However, as a first priority DTU works on a larger version and seeks for partners to realize this.

Greenland has expressed interest to join and in combination a vessel could to be designed and used for multipurpose research in open ocean/arctic waters. Collaboration would ensure maximum utilization of the vessel, minimizing marginal cost of building and operating a 70m research vessel with a broad range of capabilities in open ocean and ice-edge research.
TIMELINE new DANA V

- **2014**: Settle partnership
- **2015**: Finance settled, Specifications ready by August 2015
- **2016**: Tender, Detailed design
- **2017**: Partnership clear by June 2015, Yard contract by April 2016
- **2018**: Building, Test and operation, Overlevering Marts 2018

(Rev Maj 2015)
Designs

- Previous concept study from 2008 for a multi-purpose 65 meter research vessel
Development of concept studies

- Initiated two new concept studies for a research vessel
- Focus on the scenario with a new vessel that will be operated together with GNI
- Focus on fisheries research but with some multi-purpose capability
- Contacted two Naval Achitech companies (Denmark and Germany) in Nov/Dec 2014
- We have had 2 meetings with each company to discuss requirements and ideas for design
- Delivered report in April 2015
Development of requirements

Process:
- User input
  - Meeting with own researchers, GNI
  - Interview with selected other representatives from other research disciplines
- Looking at GA of other research vessels of similar size
- Visit to research vessels: GO Sars, Celtic Explorer, Paamiut
- Visit to fishing vessels: Denmark, Faroe Island
New Dana – research capabilities

A new high ice-classed research vessel designed for:

- marine biological research,
- climate and environmental research,
- geological research,
- fisheries research.

She would carry multiple laboratories outfitted with extensive and wide-ranging scientific equipment for analysis and measurements as well as different tools for water, atmosphere, biota and seabed sampling.

Would be fitted to accommodate approx. 20 scientists and laboratory containers to be docked to laboratory areas.

The outfitting would incl.

- towing capacity for trawl fishing,
- a crane/A-frame for lifting large/heavy equipment over the side/stern,
- a drop keels/moon pool for deployment of instruments/sensors,
- handling seismic streamers,
Arctic capabilities

Presently planned with ice class Baltic 1A or PC7 to keep running costs down, thus fit for first year ice only.
New Dana – concept design

The two companies provided concept designs for a 60-65m vessel delivering the requested fisheries and multipurpose research performance.

With a basic budget of 220 mio. kr. (30 M€), however, considering optional improvements with a max. budget of 330 mio. kr. for building costs, leaving 20 mio. kr. for planning and design and 50 mio. kr. for scientific equipment total of 400 mio. Kr (53 M€).

Most important design drivers:

• **Area of operation (ice class):** Baltic Sea, Skagerrak, North Sea, North Atlantic to 80+ degrees North (April-October in the Atlantic, Greenland from June).

• The propulsion machinery to be diesel electric. Optimised for energy saving, low noise and emission, and to some extent have redundancy. Relatively **large bunker capacities (300-500 m³)**.

• **40m trawl track** – occupying half breadth of vessel at the most “usable” length of the vessel for net wings/bobbin chain and geological cores.

• **A-frame and trawl slip/trawl bridge/trawl doors** at same position (transom stern). A-frame to be utilised as trawl net lifting boom having full span over vessel breadth.

• **Living quarters on upper deck** for 36 persons in 10 double and 16 single cabins.
Two concept studies
General Arrangement - 1

Length overall: 60.4 m
Breadth 15.0 m
## General Arrangement - 2

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length Lpp</td>
<td>63 m</td>
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<tr>
<td>Length Loa</td>
<td>64.8 m</td>
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<tr>
<td>Breadth</td>
<td>15.5 m</td>
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<tr>
<td>Design draft</td>
<td>5.0 m</td>
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<tr>
<td>Design displacement</td>
<td>2970 Ton</td>
</tr>
<tr>
<td>Depth to main deck</td>
<td>8.0 m</td>
</tr>
</tbody>
</table>
General Arrangement

Lower deck

Tank top
General Arrangement

Deck 4

Main deck
General Arrangement

Deck 4

Main deck

Lower deck
Options – to be considered

Full implementation of IMO Polar Code B, PC7 with double hull not only in tank areas, winterisation and extended navigation equipment  plus 13 mio. kr.

A drop keel solution with full interchangeable sensors; trunk arrangement to above water line; will interfere heavily with present general arrangement over 3 decks and overall length of the vessel to be increased by ca. 5 m.  plus 30 mio. kr.

Option 2 Diesel electric engine with battery pack and ICES 209/Silent R  plus 29 mio. kr.

Dynamic positioning system DP1  plus 8 mio. kr

EL-winches, improved A-frame  plus 13 mio. kr.

Other extra options  plus 15 mio. kr.
Moving on: discussions with user groups

Iterate on the design with user groups. Knowing the constraints of the design and the main design drivers (trawl lane, A-frame, net-drum, trawl winches).

Expect to setup user groups for each research discipline and discuss use scenarios (configurations and operations)

Other uses to consider: oilspill/recovery, commercial industry test platform
Moving on: legal procurement aspects

Currently looking at legal aspects for the entire procurement process in order to decide on tender for designer and tender for yard as well as contractual set-up.

Collecting experiences from:
- The Danish Navy and the Fisheries Control Unit
- Research vessels from other countries (Norway)
- Danish industry

Option 1a – tight contract with yard, as consultant make Basic Design
- Request for interest of yards
- Basic Design (Classification Drawings) with Class Approval
- Detailed design drawings
- Yard Tender Docs, Tendering and Final Contract
- Fabrication documents

Advantages:
- Many yards can bid
- Good yard price as there is not many unknowns (little risk)
- Faster process – basic design done in parallel to tendering process

Disadvantages:
- Unclear responsibility of design flaws
- Missing opportunity of yard designers input

Option 2b – request for interest at tender phase - ”normal setup”
- Concept design
- Plan Approval Work for Shipyard documents
- Detailed design drawings
- Fabrication documents

Advantages:
- Clear responsibility
- Yard input to design
- Good yard price

Disadvantages:
- Longer time
- Fewer yards capable of doing it
- Uncertain quality of yard designers

Design Phase Consultancy
Yard
Construction Phase Consultancy
Thank you
Research related basic design drivers

The vessel to be designed for following main fishery research facilities:

• 2 trawl winches (combined wire and dynema rope, 25 ton, 3000m Ø26 mm wire, on open deck to lower wire angel and thus saving lifetime of trawl wires)
• One net drum positioned above working deck
• Heavy wet labs below main deck, rest of labs on main deck.

Smart A-frame 5 ton SWL at aft for piston core handling etc.

Knuckle boom crane, 5 ton/14m on aft deck; combined provision and paravane crane at fore deck.

Research flex deck for various research/offshore configuration including, 3 pcs 20’ ISO containers.

CTD winch and retractable boom/ J-frame in CTD hangar mid-ship, out-reach 5m.

Bottom well for drop keel facilitating miscellaneous fixed electronic sensors (only changeable from “outside”) in order to have sensors positioned outside vortex zone/stream line of the hull.

Retractable azimuth thruster, e.g. combined azimuth and bow tunnel thruster in order to achieve dynamic positioning capabilities, not necessarily meeting class DP notation.