

Towards a new Danish research vessel

Status for plans

Dennis Lisbjerg, Head of Maritim Service, DTU Aqua

ERVO, 11. June 2015



DTU Aqua Mission and vision

National Institute for Aquatic Resources at The Technical University of Denmark

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**.



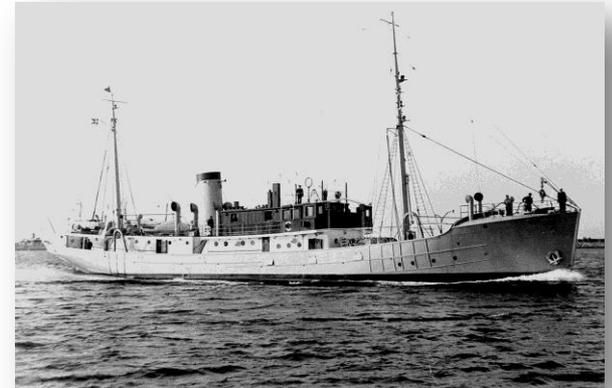
100 years of marine research with Dana x4

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.

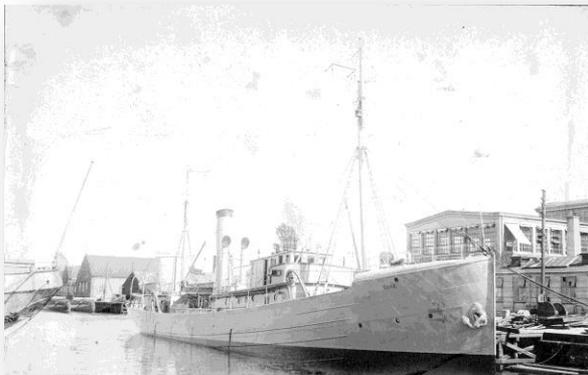


Dana I
1920-1921

The first – wooden build DANA.
First eel-expeditions to the
Sargasso Sea.



Dana III
1937-1977



Dana II
1925-1935

A steam trawler, went on a two
year round the world expedition.

Dana IV
1981-

Eel expedition in 2014 to
the Sargasso Sea.



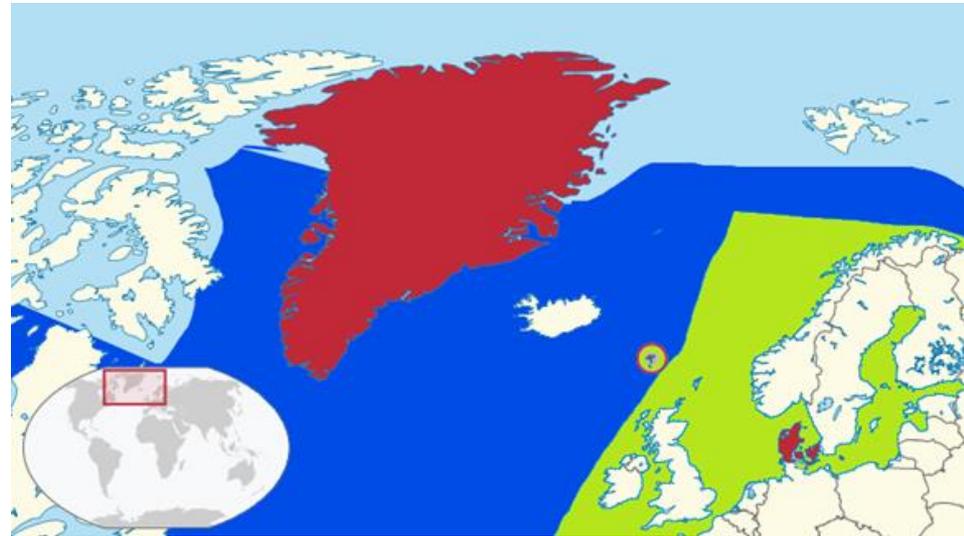
Dana - replacement

DTU plans to retire Dana IV in 2018.

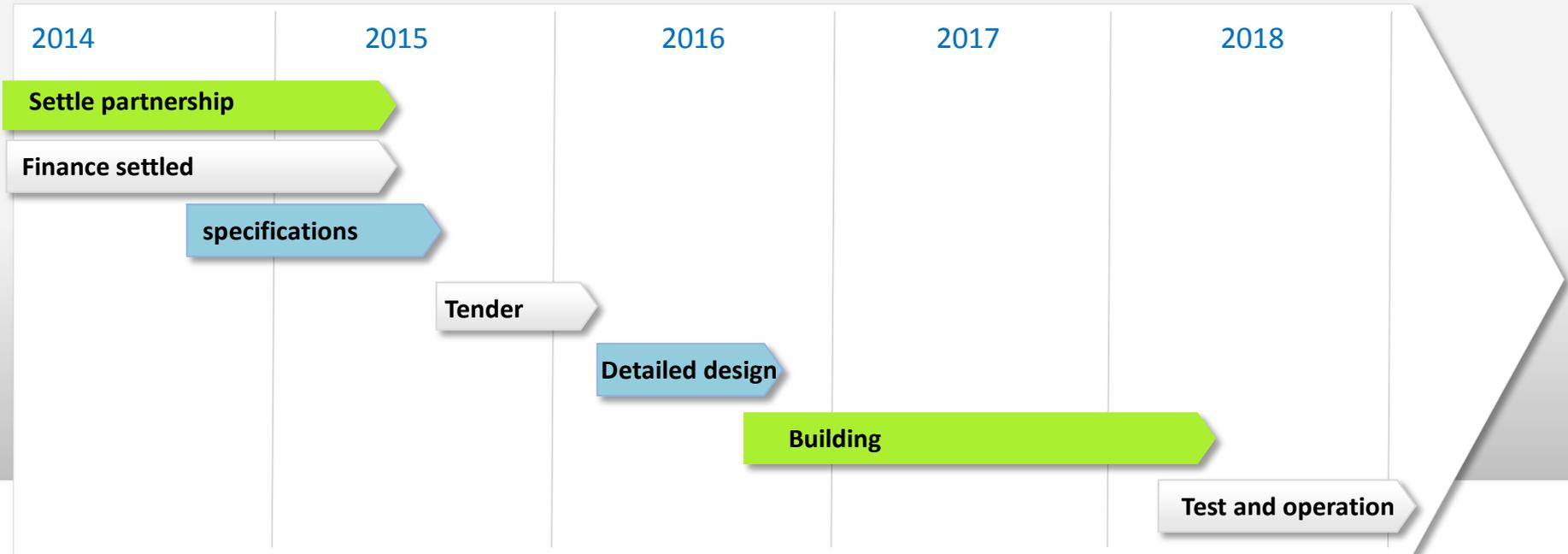
If DTU is the only primary user for the new vessel, it will be built for fisheries research in the Baltic, North Sea and eastern North Atlantic only (light green area in the map). However, as a first priority DTU works on a larger version and seeks for partners to realize this.

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



Partnership clear by June 2015



Specification ready by August 2015



Yard contract by April 2016



Overlevering Marts 2018

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

Main Specifications		
Topic	DTU Aqua/GNI	Comments
General specifications		
Area of operation	Baltic Sea, Skagerrak, North Sea, North Atlantic Sea to 80 degrees north	
Operations period	All year (May - October in the Atlantic, Greenland coast from June)	Operation in glacier ice at the Greenland coast.
Operational days per expedition	Min abt. 30 (min. 300 cbm max 500 cbm bunkers)	
Life expectancy	30 years +	
Ice Class	1A (Hull + Rudder + Propeller/shaft)	1A necessary for certain GNI expeditions!
Draught	Max. 6,5m	
Codes / Requirements	Danish Flag registration - international rules and regulations (IMO, SOLAS, MARPOL etc.) and national rules and requirements as administrated by Danish Maritime Administration.	
Class	Class notation DNV +1A1, SP5, E0, ICE-1A ("light").	DYNPOS-AUT, NAUT-AW, SILENT-R, COMF-V (2)C(2) as options
Max. and nom speed	Service speed 12 knots at 85%MCR	
Dynamisk positionering	"DP-0" (Limited DP functions similar to existing Dana)	
Corrosion protection	ICCP	
Roll Damping	Anti rolling tank	
Research and fishery equipment.		
Trawl deck (main deck)	2 trawl lanes: 40 m. length, minimum 4 m. wide, 0,6 to 0,7 m. protected walk path on sides of trawl lane.	40 m. effective trawl length, slip and sweep line winches to be outside the 40 m.
Flex deck (main deck)	Bolt grid, must accommodate 2 pcs longitudinal + 1 pc athwartship	
Chutes	1 pc. 6 cbm + 2 pc. 3 Cbm	
Chutes' hatches	2 pcs same size, 1 with "flipover" cover for filling into only 1 of the 3 cbm chutes	
CTD Hangar	Deployment of smaller gear through side of hangar, larger plankton gear by slip. 1 pc. traditional derrick + 1 "smart" derrick for deployment of research gear.	Paravane to be launched from fore deck, in order to position the paravane about midships 2 m. submerged during measurements.

A-Frame	5 tonnes SWL over center of chutes, "smart type which can turn to horizontal position over main deck"	A-Frame to be in full ship's width
Crane aft deck	Knuckle boom crane, 14 m reach 5 ton swl	
Provision crane fore deck		Could be a combination with paravane launching system

Development of requirements

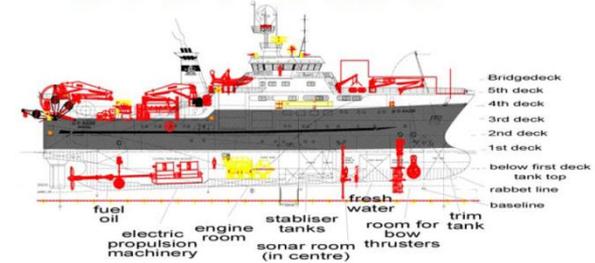
Process:

- 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

Concept Sweden



G.O. Sars



Mirabilis, Namibia



Celtic Explorer Irland



Concept Belgian



New Dana – research capabilities

A new high ice-classed research vessel designed for:

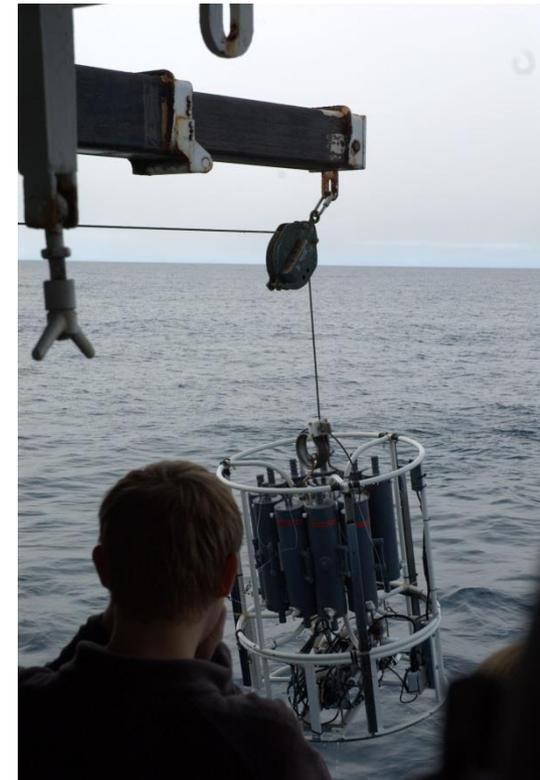
- marine biological research,
- climate and environmental research,
- geological research,
- fisheries research.

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.

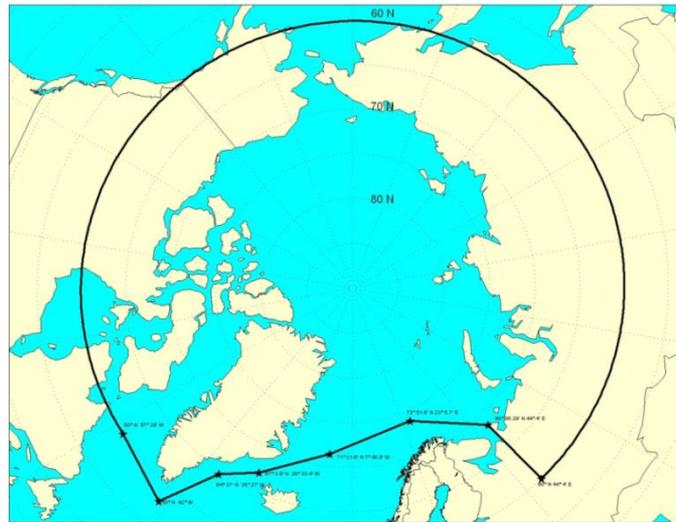
- towing capacity for trawl fishing,
- a crane/A-frame for lifting large/heavy equipment over the side/stern,
- a drop keels/moon pool for deployment of instruments/sensors,
- handling seismic streamers,



Arctic capabilities

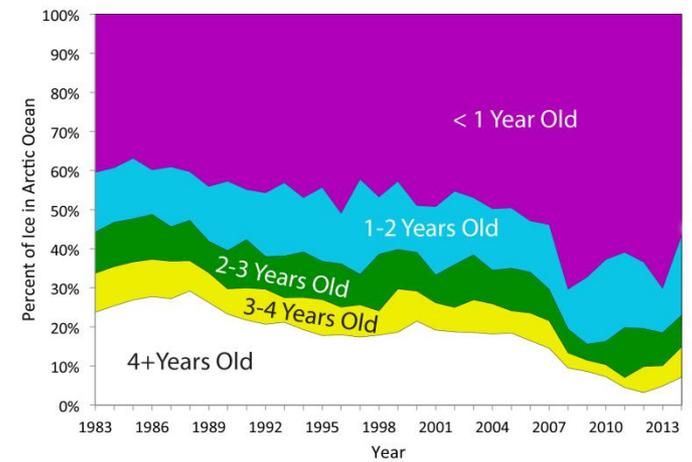
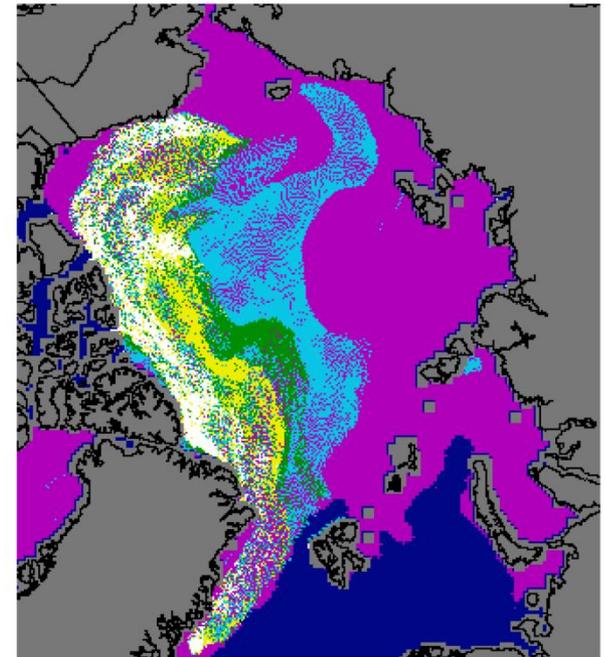
Presently planned with ice class Baltic 1A or PC7 to keep running costs down, thus fit for first year ice only

		PC1 PC2 PC3 PC4 PC5	Year-Round Navigation in <u>Arctic</u> Waters
Winter Navigation in <u>Sub-Arctic</u> Waters	IA Super	PC6	Summer Navigation in <u>Arctic</u> Waters
	IA	PC7	
	IB IC		



Polar Code application Area

Arctic Sea Ice Age, March 2014



NSIDC, Courtesy M. Tschudi, University of Colorado

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

VESEL DESCRIPTION
 TLS-Contract 150102.00
 Date: Mar. 27th 2015

TECHNOLOG services

VESEL DESCRIPTION

MULTIPURPOSE FISHERY RESEARCH SHIP

DANA - REPLACEMENT

DTU AQUA

Client: _____ Created by: _____

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DTU Aqua National Institute of Aquatic Resources

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 National Institute of Aquatic Resources
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REVISION	DATE	DOCUMENT
0	Mar. 27 th 2015	Initial Issue

GENERAL REMARK FOR THIS DOCUMENT:

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OSK-ShipTech A/S

Concept Design
New Research Vessel

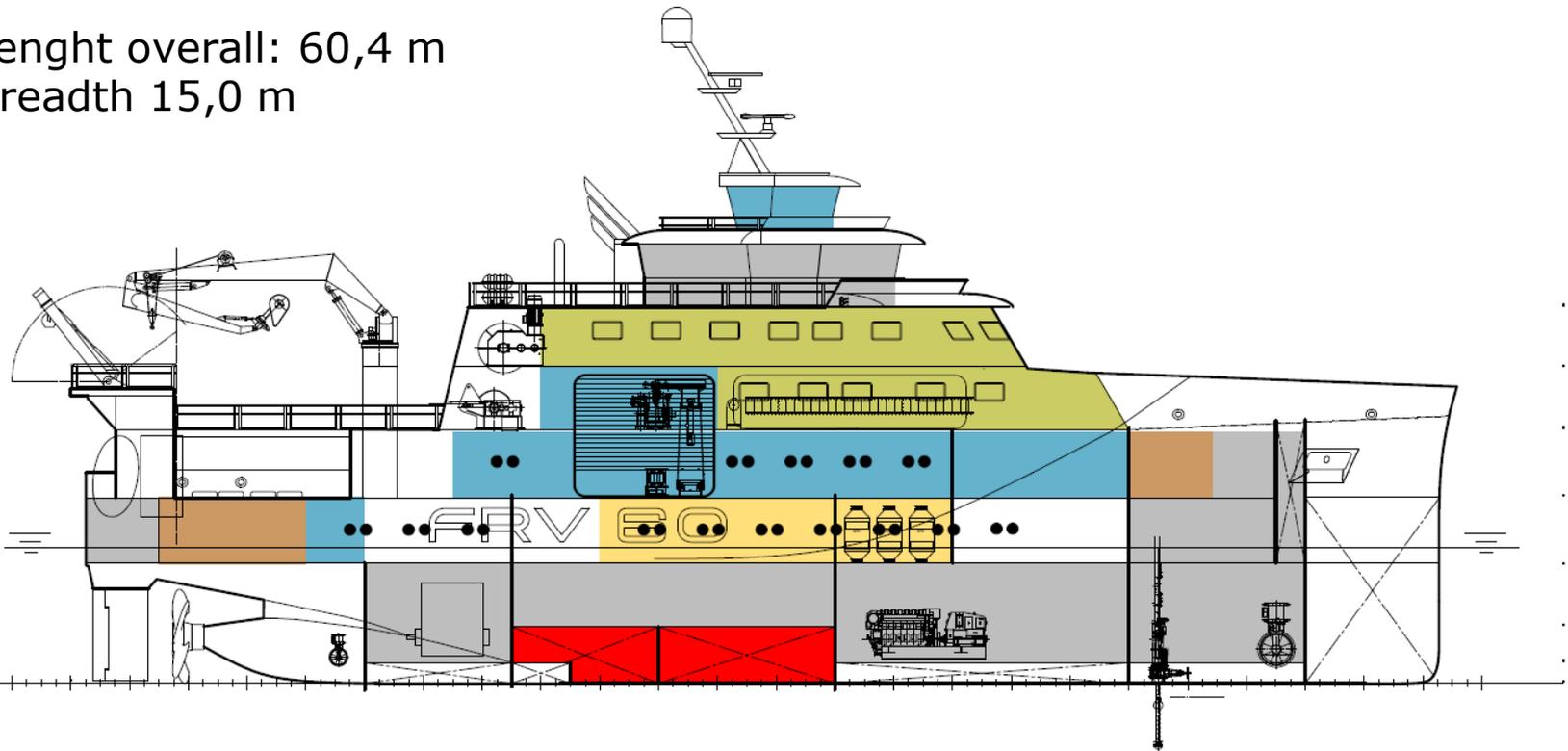
DTU – AQUA

(OSK-ShipTech no. Report 140410.0130.01 rev.1)

Date: 13.05.2015
 Sign: KHMMH

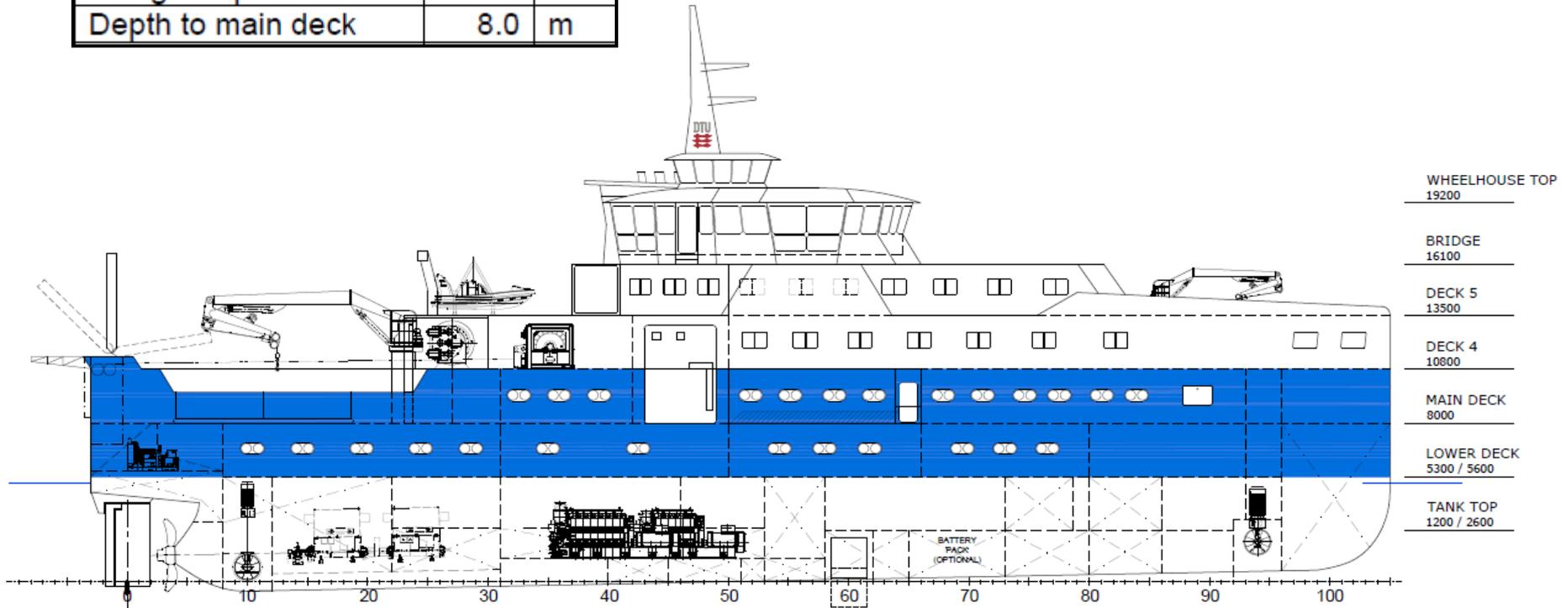
General Arrangement - 1

Length overall: 60,4 m
 Breadth 15,0 m

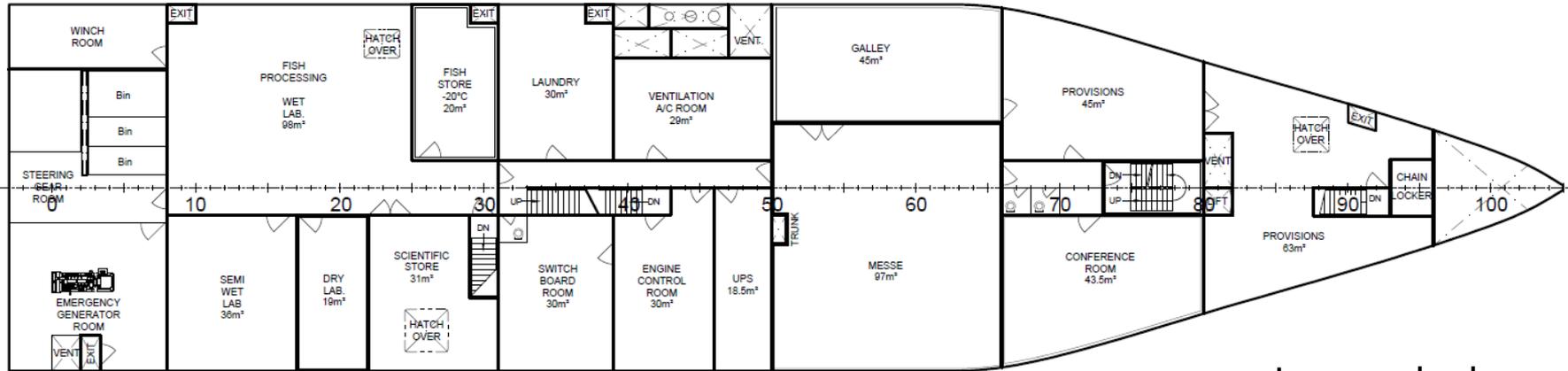


General Arrangement - 2

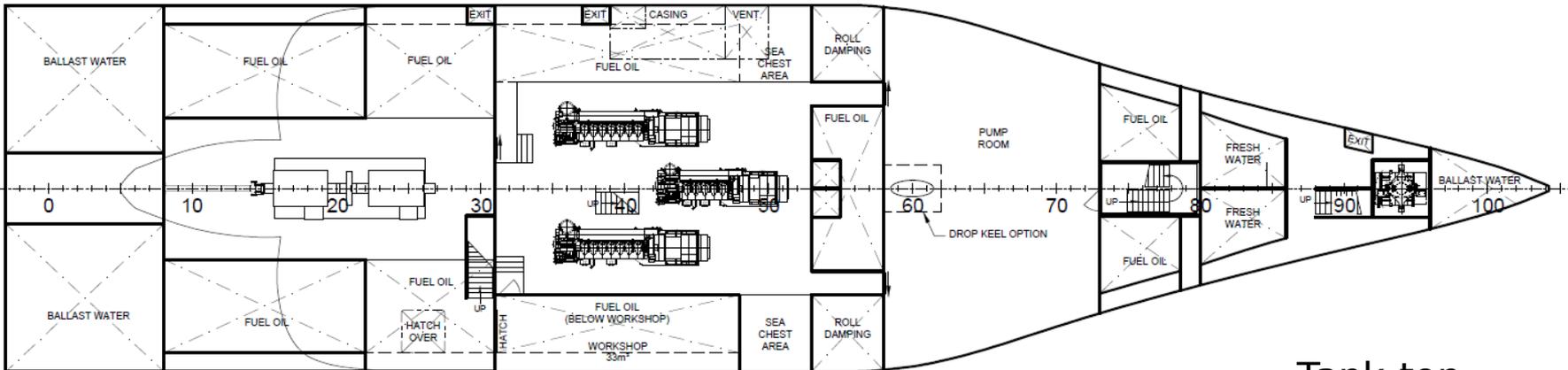
Length Lpp	63	m
Length Loa	64.8	m
Breadth	15.5	m
Design draft	5.0	m
Design displacement	2970	Ton
Depth to main deck	8.0	m



General Arrangement

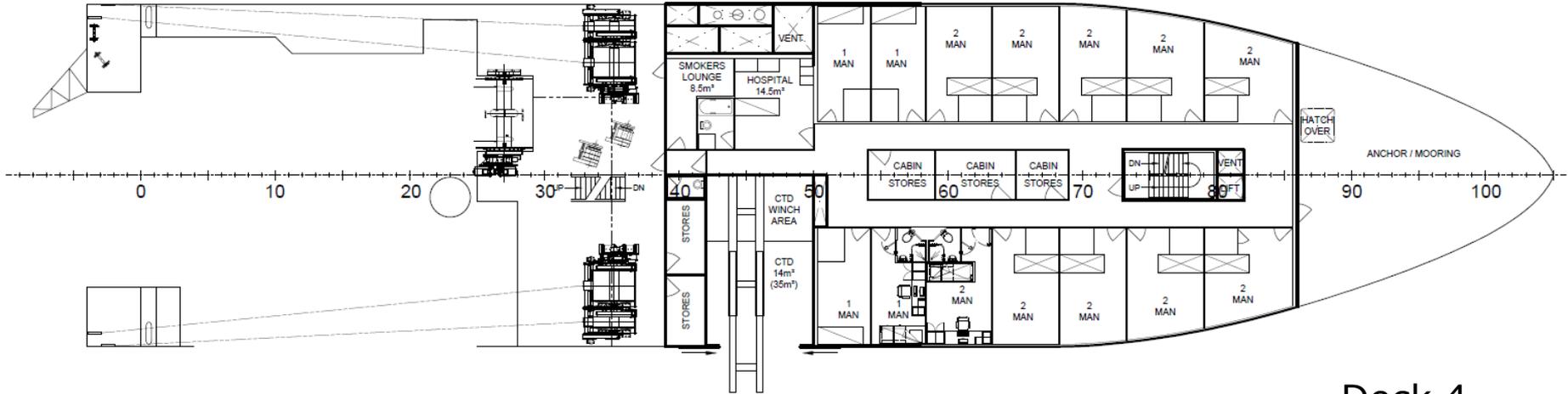


Lower deck

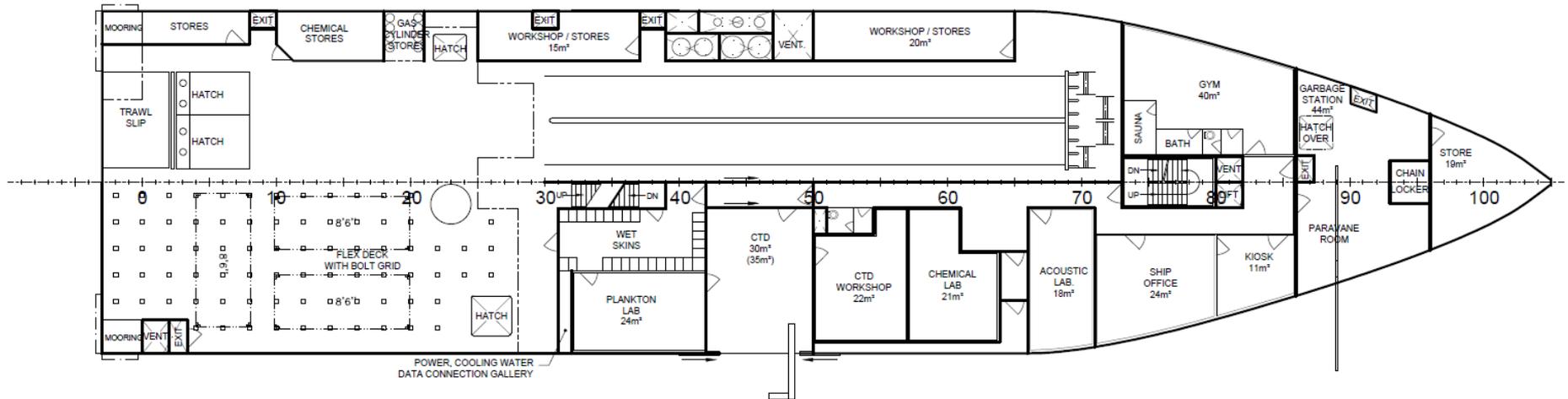


Tank top

General Arrangement



Deck 4

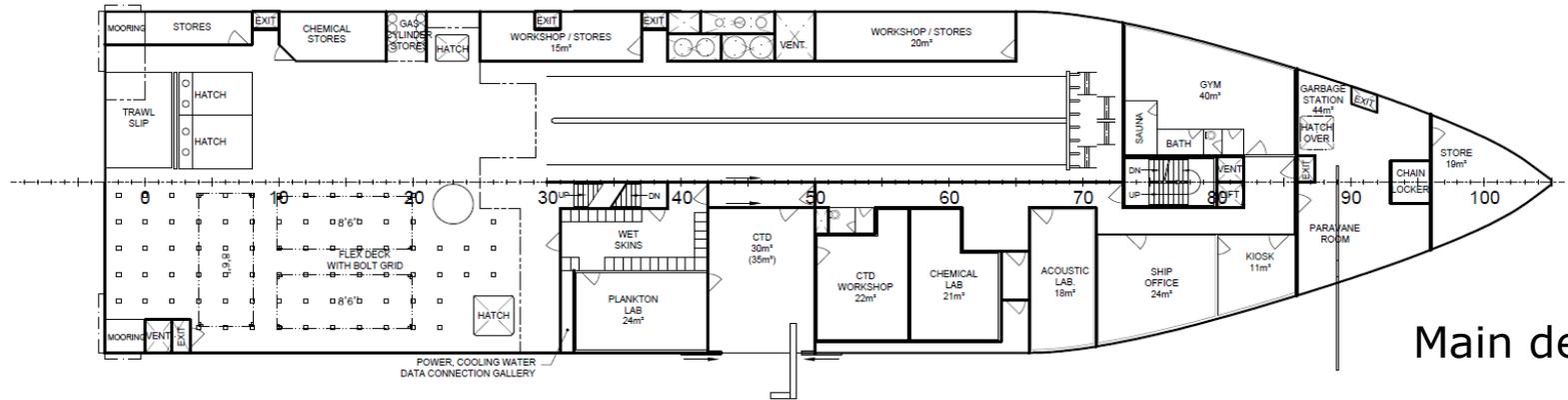


Main deck

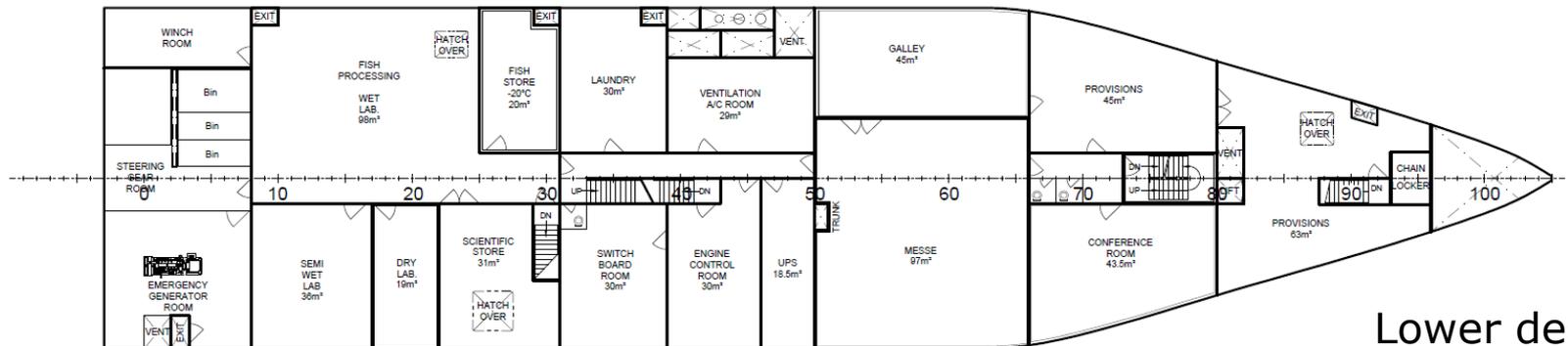
General Arrangement



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-winch, improved A-frame plus 13 mio. kr.

Other extra options plus 15 mio. kr.

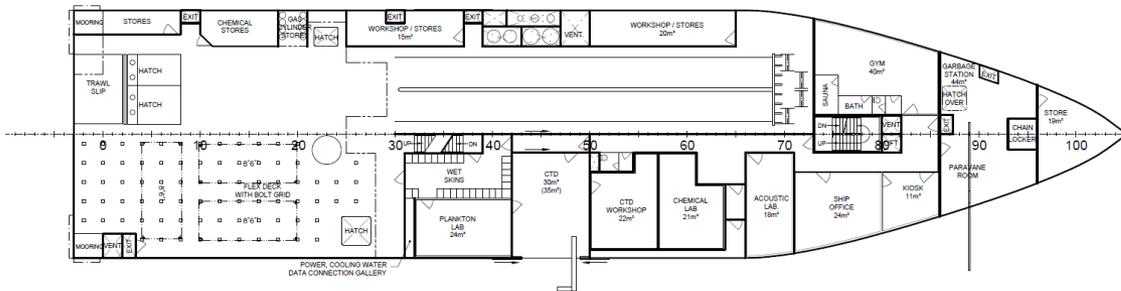


Moving on: discussions with user groups

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



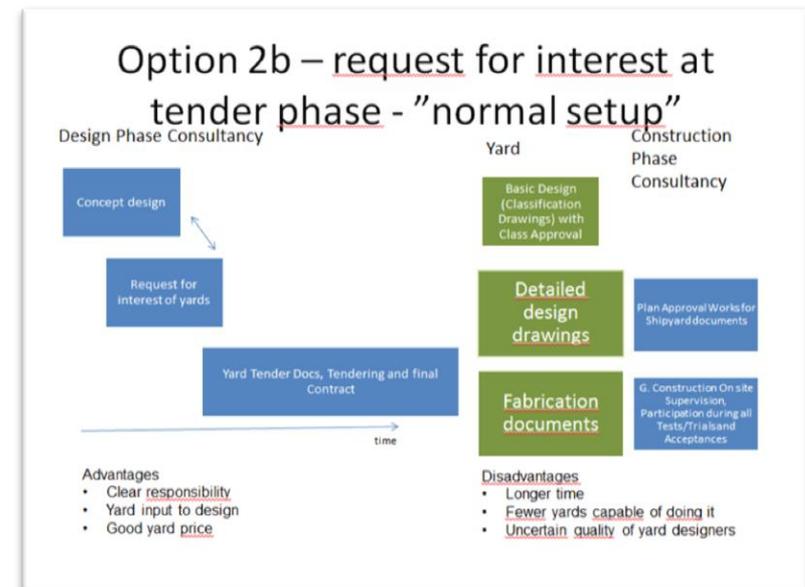
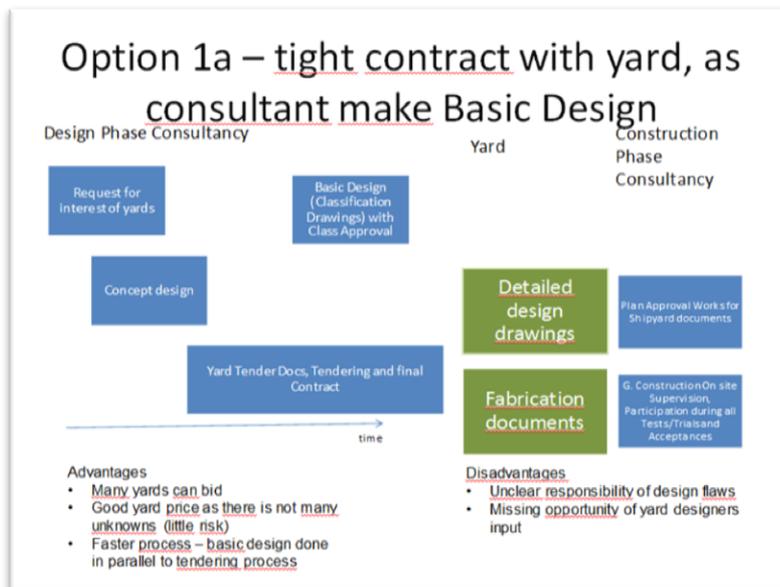
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Life expectancy	30 years +	
Ice Class	1A (Hull + Rudder + Propeller/shaft)	1A necessary for certain GNI expeditions!
Draught	Max. 6.5m	
Codes / Requirements	Danish flag registration - international rules and regulations (IMO, SOLAS, MARPOL, etc.) and national rules and requirements as administered by Danish Maritime Administration.	
Class	Class notation DNV+SA1, SP1, E0, ICE-1A ("light").	DYNPOS-AUT, NAUT-AW, SILENT-R, COMP-V [2102] as options
Max. and min. speed	Service speed 12 knots at 65%NAEC	
Dynamic positioning	"DP-0" (Limited DP functions similar to existing Dana)	
Corrosion protection	ICCP	
Roll Damping	Anti rolling tank	
Research and fishery equipment.		
Trawl deck (main deck)	2 trawl lanes: 40 m. length, minimum 4 m. wide, 5,6 to 0,7 m. protected walk path on sides of trawls.	40 m. effective trawl length, slip and sweepline winches to be outside the 40 m.
Flux deck (main deck)	Boat grid, must accommodate 2 pcs longitudinal + 1 pc athwartship	
Chutes	1 pc. 6 cbm + 2 pc. 3 cbm	
Chutes/hatches	2 pcs same size, 1 with "flipover" cover for filling into only 1 of the 3 cbm chutes	
CTD Hanger	Deployment of smaller gear through side of hanger, larger plankton gear by slip. 1 pc. traditional derrick + 1 "smart" derrick for deployment of research gear.	Paravane to be launched from fore deck, in order to position the paravane about midships 2 m. submerged during measurements.
Other equipment		
A-frame	5 tonnes SWL over center of chutes, "smart" type which can turn to horizontal position over main deck	A-frame to be in full ship's width
Crane aft deck	Knucke boom crane, 14 m reach 5 ton swl	
Provision crane fore deck		Could be a combination with paravane launching system

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



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 angle 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.