ICE General Presentation prepared for EMSHIP SAB

FEBRUARY 2017

ICE in a Nutshell

- Europe’s largest independent ship design group
- In business 50 years, clients world-wide
- Conceptual, basic/Class and detail design, in all marine design disciplines
- 700,000 professional man-hours / year (2014)
- Offshore energy, commercial and naval ship design

Ship Design Markets

Defence

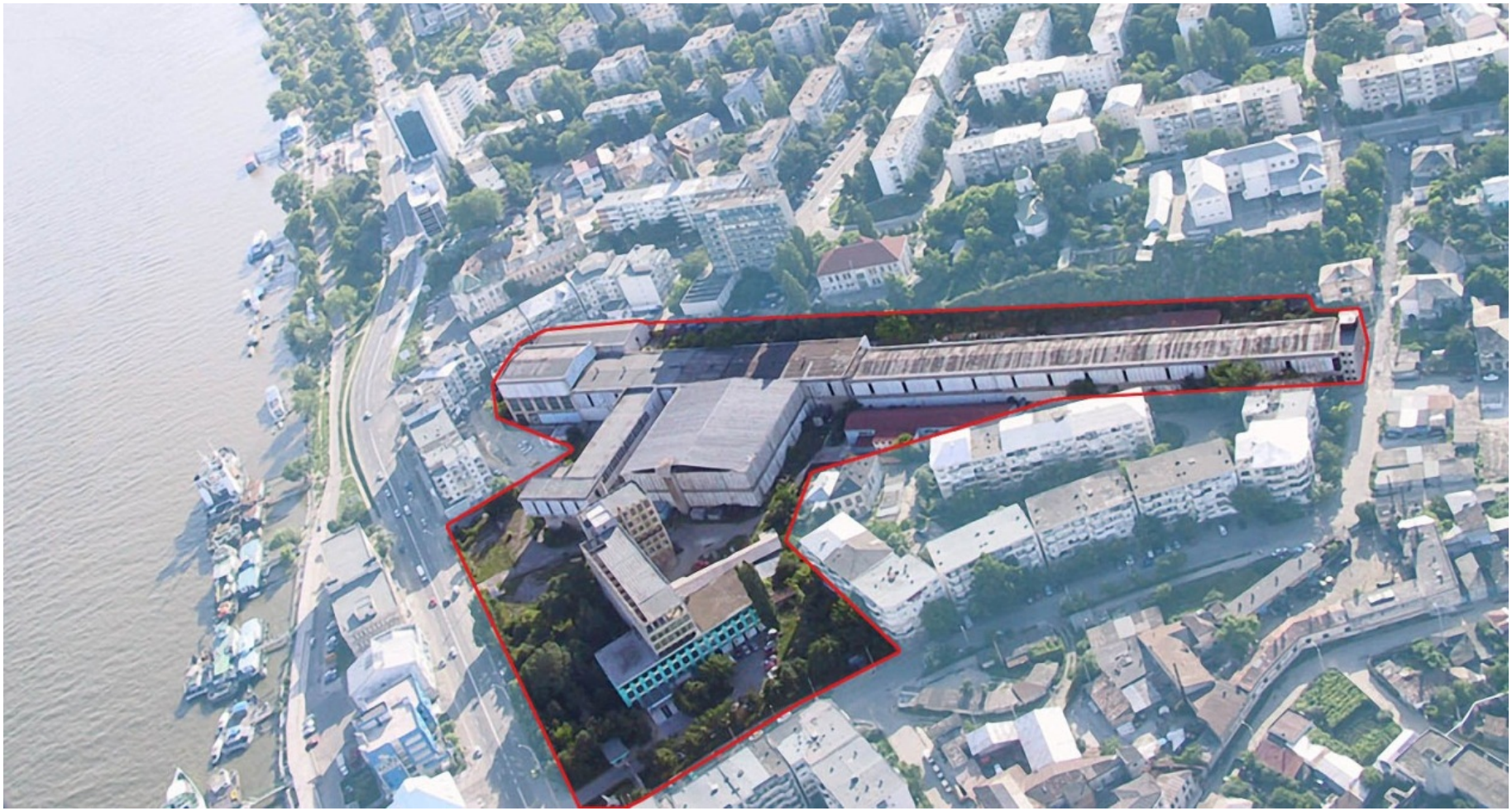
Commercial Marine

Offshore Oil & Gas

Location of ICE Offices & Projects

ICE MARINE DESIGN

ICE Main Design Facilities – Aerial View



ICE Main Design Office

ICE Typical Project Room

ICE MARINE DESIGN

Labour Resources (2014 peak)

ICE MARINE DESIGN

	Structural Analysis	Hull	Outfit & Deck Outfit	Machinery & Piping	Electrical	Naval Archit.	TOTAL
Department Managers	1	1	1	1	1	1	**6**
Senior Engineer	5	14	11	17	7	3	**57**
Principal Engineer	2	18	21	26	18	1	**86**
Engineer	6	11	26	41	28	4	**116**
Junior Engineer	2	4	5	16	18	0	**45**
Draftsman	0	1	0	0	1	0	**2**
Checker	0	0	0	3	1	0	**4**
Subcontractor	0	15	15	21	8	1	**60**
Total Design Staff	**16**	**64**	**79**	**125**	**82**	**10**	**376**
Doc. Controllers							**11**
AVEVA Marine Software Administration							**3**
Quality Engineers (all Naval Architects or Engineers)							**4**
Planners (all Naval Architects or Engineers)							**7**
Project Managers (all Naval Architects or Engineers)							**5**
						Total Project Resources	**406**
Management							**18**
Administrativ Staff							**42**
						Total Management & Administrative Staff	**60**
						Total ICE Employment	**466**

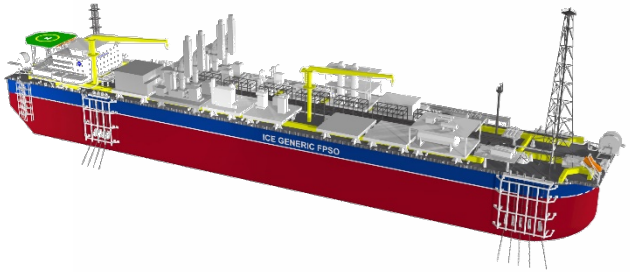
Minumum Qualification Requirement :

Senior Engineer	- University Graduates with over 12 years experience.
Principal Engineer	- University Graduates with 8 to 12 years experience.
Engineer	- University Graduates with 2 to 8 years experience.
Junior Engineer	- University Graduates with up to 2 years experience.

ICE Ship Design Scope

Concept Studies **Concept Design** **Basic Design** **Detailed Design** **Prod. Info**

Multi-Discipline Project Teams



CONCEPTUAL DESIGN
- General Arrangement
- Visualisations / Presentations
- Vessel Specification
- Cost / Benefit assessments

▶ **QUOTATION DOCUMENTS**

INITIAL DESIGN
- Hull form design
- Tank Plan & Capacities
- Intact and damage stability
- Vessel Performance
- Equipment specification
- Motion & operability
- Seakeeping
- Manoeuvring
- Resistance / propulsion
- Preliminary material specific.
- ER arrangement
- Midship section
- Light ship weight estimation

▶ **PERFORMANCE DOCUMENTATION**

STRUCTURE & HULL
- Structural design
- Main structural analysis
- Main scantling drawings
- Deck Lay outs

MACHINERY
- System Drawings (P&ID's)
- Related Calculations
- Machinery Lay outs

ELECTRICAL
- System diagrams
- Related calculations
- Lay outs of control room, wheelhouse etc

▶ **MAIN CLASS DRAWINGS**

HULL & STRUCTURE
- Detailed hull design
- Parts
- Brackets
- Endcuts, etc.

OUTFITTING & ACCOMODATION
- Deck arrangements
- Foundations
- Ladders, etc
- Insulation
- Panels
- Ceiling, etc.

MACHINERY
- Equipment arrangement
- Piping arrangements

ELECTRICAL
- Equipment arrangement
- Cable arrangements

▶ **WORKSHOP DRAWINGS**

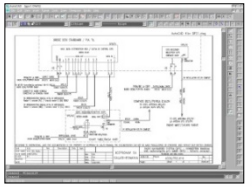
HULL
Production information
- Shrinkage & Excess
- Welding & bevels
- etc.

Nesting

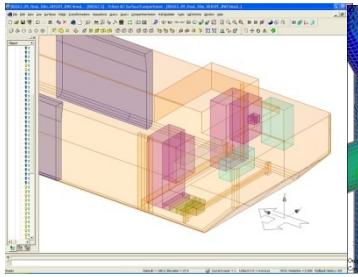
N/C information
Templates
Panel line information
Part Lists
Cutting sketches

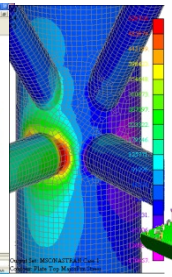
MACHINERY
Isometric drawings
Cutting information
Bending information
Spool information
Material lists

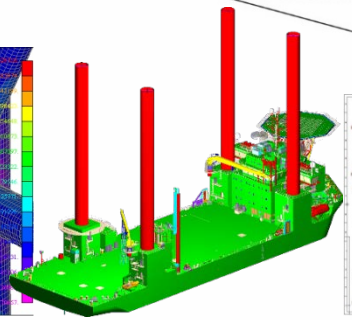
ELECTRICAL
Material lists

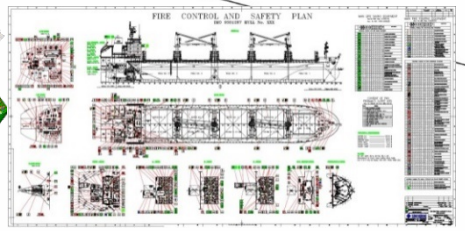


▶ **PRODUCTION INFORMATION**









ICE Design Software Tools

- AVEVA Marine 12 - **BD**, **DD**, Prod. Info.
- Autodesk AutoCad - All design stages
- Siemens UGS Femap NX for Nastran - **CD**, **BD** & **DD**
- CSI SAP2000 - **BD** & **DD**
- Napa System - **CD** & **BD**
- Intergraph Caesar II - **DD**
- Intergraph SmartPlant Instrumentation - **BD** & **DD**
- PipingSolutions Triflex - **DD**
- Sunrise Systems Pipenet - **BD** & **DD**
- Zeataline Projects PipeData-PRO - **DD**
- OTI ETAP - **BD**
- McNeel Rhinoceros, Flamingo - **CD**
- HydroComp NavCad - **CD** & **BD**
- PTC MathCad - All design stages
- Shipflow + Tecplot - **CD**
- ShipWeight - **CD** & **BD**

Legend: **CD** = Concept Design; **BD** = Basic Design; **DD** = Details Design

Cruise Vessels & Ferries - Sample Projects

ICE MARINE DESIGN

- ICE has over the last decade been involved in a number of passenger ship design projects ranging from the world's largest cruise vessels to fast ferries, RoPax ferries and luxury yachts.


Oasis of the Seas


Queen Mary 2

Stena Hollandica


AIDAprima


MSC Fantasia


Crystal Serenity


MSC Musica

M/S Visby

Cote des Flandres


Norwegian Epic


Celebrity Millennium


Coral Princess

Nissos Mikonos


Armand-Imbeau II

Cruise Ship “MSC Fantasia” A33

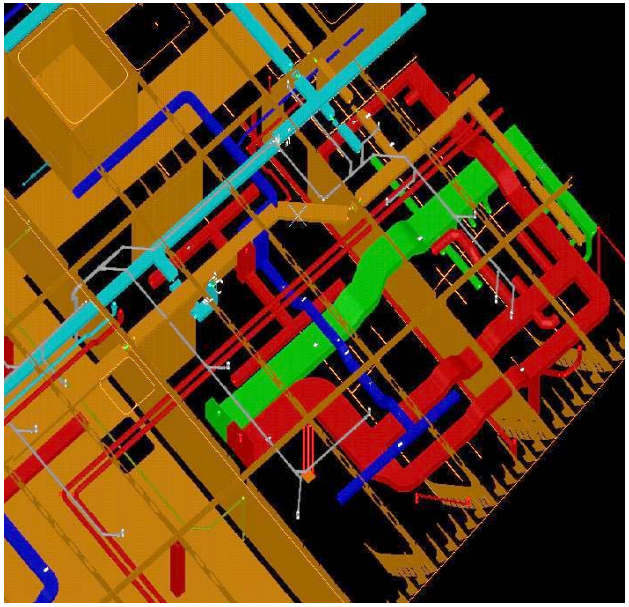
Class: BV
Tonnage: 137,936 GT
Capacity: 3,900 passengers
Crew: 1,313

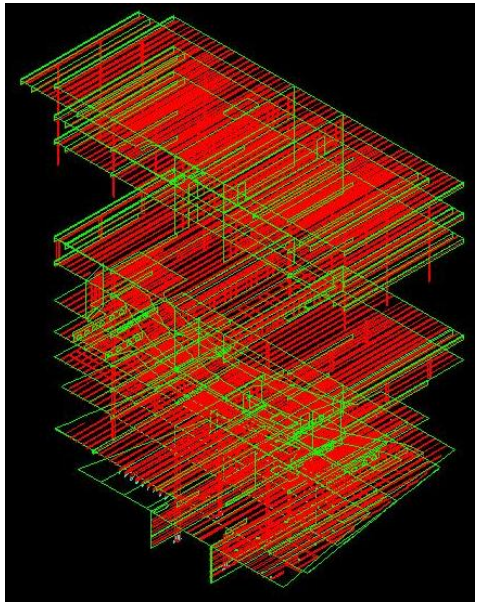
Year: 2006 -07
Shipyard: STX Europe, France
Operator: MSC Cruises

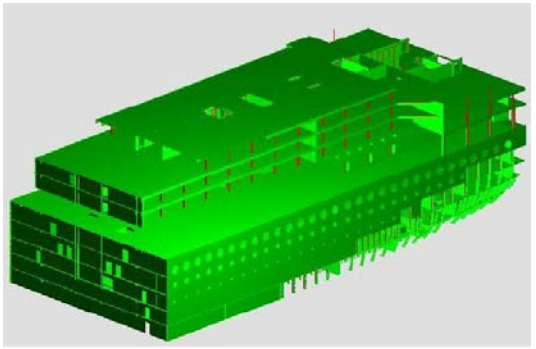
ICE Scope of Work:

- Basic & detail design for hull structure;
- Lifting and turning calculations and reports (including drawings);
- Coordination drawings for piping and outfitting (selected zones);
- Production information – plates and profiles specifications, assembling drawings and cutting information;
- Production information – material specifications, penetration lists and isometric sketches;
- Detail design for HVAC.

Cruise Ship “MSC Fantasia” A33

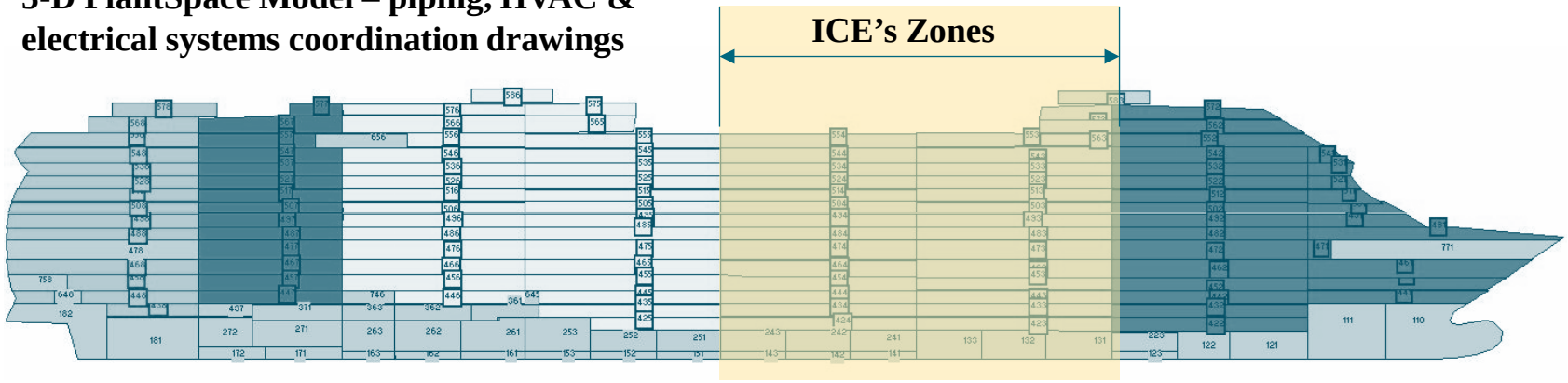






3-D TRIBON Model – hull design

3-D PlantSpace Model – piping, HVAC & electrical systems coordination drawings



Ro-Ro Passenger Ferry “Cote des Flandres” (ex- Berlioz) O32

Class: BV
Tonnage: 33,796 GT
Capacity: 1900 passengers, 2000 lane metres (120 lorries or 700 cars)

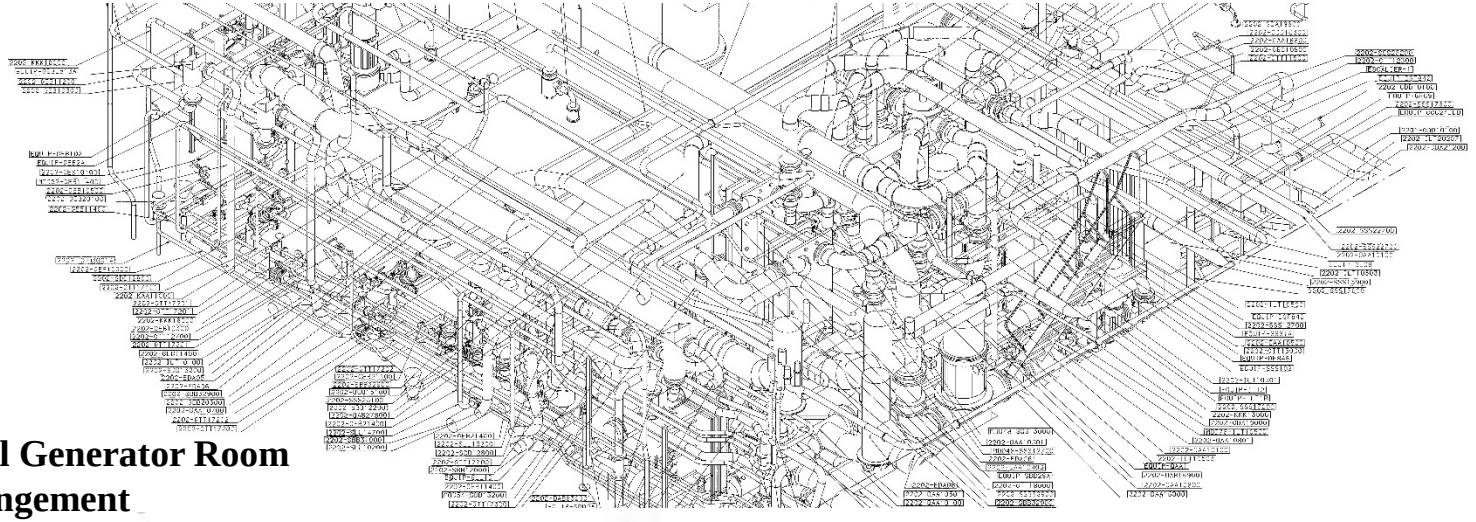
Year: 2003 -04
Shipyard: STX Europe, France
Operator: DFDS Seaways France

ICE Scope of Work:

- Detail design for hull structure for the entire vessel (incl. workshop drawings and production information);
- Machinery & tank area: detail design (piping with DN $\geq$ 25 mm, HVAC, cable trays, hull outfitting, foundations, floors, beams & padeyes for equipment handling) for the entire length of the vessel (incl. casings and funnels).

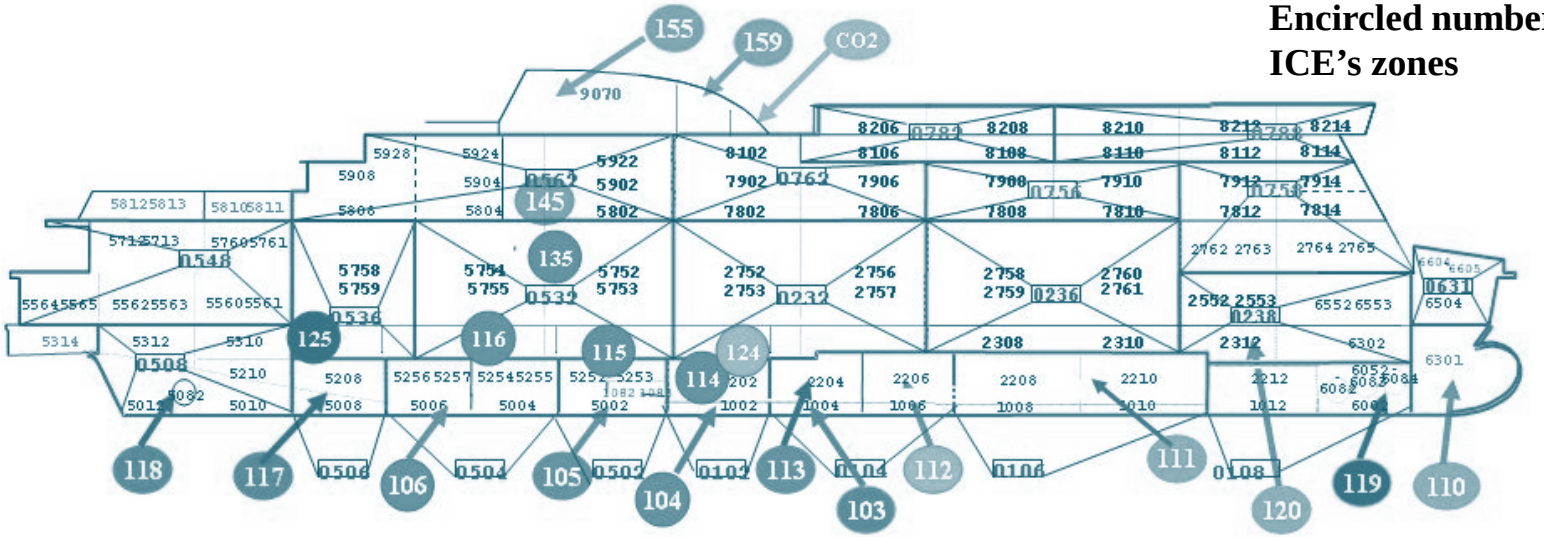
Ro-Ro Passenger Ferry “Cote des Flandres” (ex- Berlioz) O32

ICE MARINE DESIGN

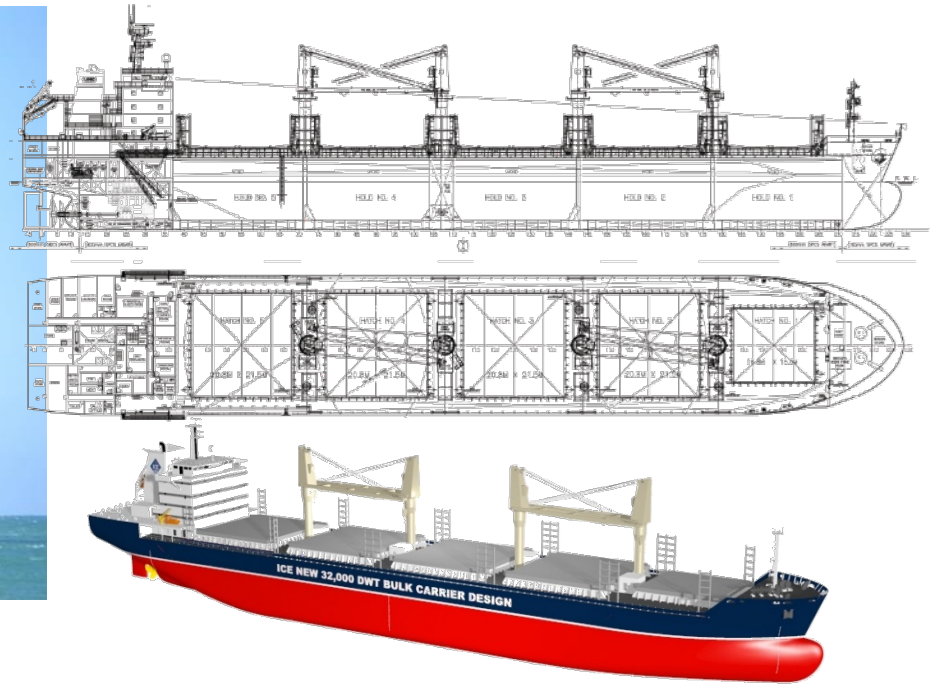


Diesel Generator Room Arrangement

Encircled numbers show ICE’s zones



ICE Property Design
32,000 dwt Bulk Carrier



Main Characteristics:
Deadweight, design: 32,000 t;
Length o.a.: 182.5 m;
Breadth mld.: 29.0 m;
Draught, design: 9.85 m;
Speed, service: 14 kn

32,000 dwt Double Hull Bulk Carrier
Conceptual, tank testing and basic design for a 32,000 dwt Double Hull Bulk Carrier; Year: 2008; Shipbuilder: ABG Shipyard Ltd., India; Owner: Precious Shipping Public Company Ltd., India.

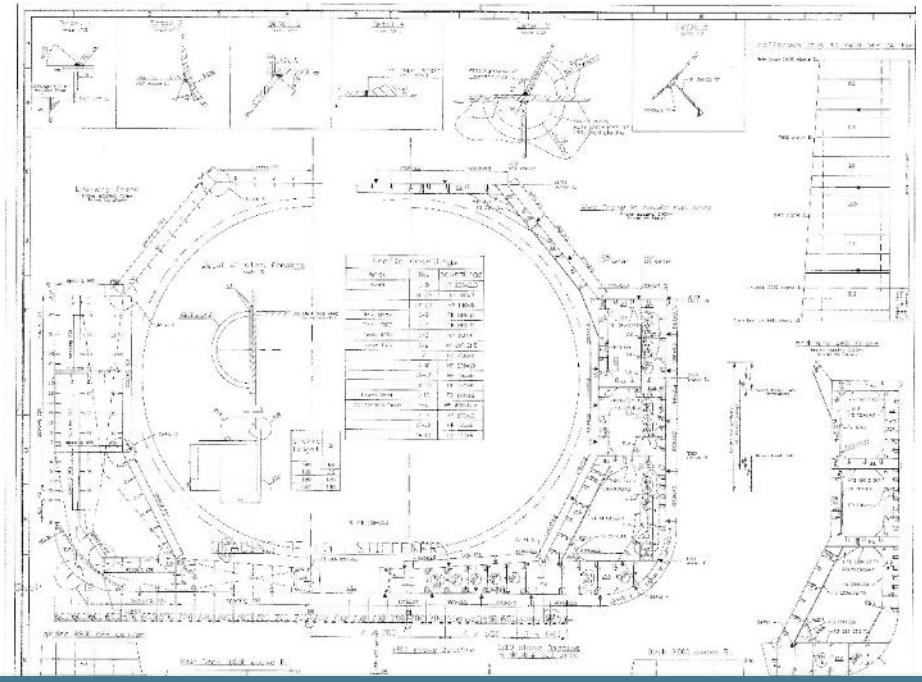
Sample Projects – Commercial Ship Design

ICE's Scope: Classification: BV

Steel structural classification drawings

Piping diagrams & list of valves

Basic design for steel structure (ER & aft area)



Main Characteristics:

7.500 m³ semi ref. LNG carrier, type 2G

Length o. a.: 117.80 m

Breadth = 18.60 m; Draught (LPG): 6,80 m

Speed: 15.50 knots

Number of cargo tanks: 2

Cargoes: LNG/LPG/Ethylene/Ammonia/VCM

7,500 cu. m. LNG/Ethylene/LPG Carrier

Basic Design for Steel Structure, Piping – AutoCAD; Model Test (resistance and self-propulsion tests, wake measurements); Year: 2006-08; Client/Shipyard: Tractebel Marine Engineering Germany / Gdansk, Remontowa Shipyard, Poland; Owner/Operator: Anthony Veder Rotterdam, Netherlands.

Sample Projects – Commercial Ship Design

ICE MARINE DESIGN

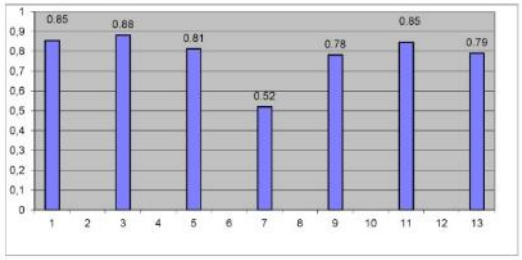
Classification: Russian Maritime Shipping Register

Double-acting Container Ship for Arctic Operations

Detail Design & Production Information for Hull & Outfitting: TRIBON; Year: 2004 -05; Shipbuilder: Aker Ostsee, Aker Finnyards; Owner/Operator: Russian MMC Norilsk Nickel.

Sample Projects – Commercial Ship Design

Classification: GL



ICEPRONAV GALATI **Electrical Power Balance** 4648/2 651E001 RevF

No	Consumer denomination	Pcs.	Nominal power [Kw]	Abs. Power [Kw]	Loading coeff.	Total power cons. [K	Simultaneity coeff.	At sea		At sea with heating		Manoeuvre		Loading		Unloading		Emergency cond./fire		Emrgy DG	
								Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]	Constant cons. Power [kW]	Intermittent cons. Power [kW]
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
103	Electronic governor	1	12,6	14,8	0,7	10,4	1,0	0,0	10,4	0,0	10,4	0,0	10,4	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
104	Accumulator sludge tank	1	13,0	15,2	0,7	10,7	1,0	0,0	10,7	0,0		0,0	10,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
105	Mt. oil's fetcutter	2	2,2	2,6	0,7	3,6	0,5	0,0	1,8	0,0	10,7	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
106	Priming pp-fire/bilge/ballast pp.	1	2,5	2,9	0,7	2,1	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,1	0,0	0,0
107	Priming pump-bilge/ballast pp	1	2,5	2,9	0,7	2,1	1,0	0,0	2,1	0,0	2,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,1	2,1	0,0
108	ME preheating water pump	1	2,5	2,9	0,7	2,1	1,0	0,0	2,1	0,0	2,1	0,0	2,1	0,0	0,0	0,0	0,0	0,0	2,1	0,0	0,0
109	Air cooler cleaning pump	1	0,4	0,4	0,7	0,3	1,0	0,0	0,3	0,0	0,3	0,0	0,3	0,0	0,3	0,0	0,3	0,0	0,0	0,0	0,0
110	Grease separator	1	6,5	7,6	0,7	5,4	1,0	0,0	5,4	0,0	5,4	0,0	5,4	0,0	5,4	0,0	5,4	0,0	0,0	0,0	0,0
111	Priming emrcy fire pump	1	2,5	2,9	0,7	2,1	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	2,1
	Total constant consumers							0		0		0		0		0		2		2,1	
	Total intermittent consumers								33		31		29		6		6		4		
	0,8 x 0,6 simm. factor						0,6		20		18		17		3		3		2		
	TOTAL								20		18		17		3		3		5	2,1	
	Diesel generator		3x910kW					1x910kW		2x910kW		2x910kW		1x910kW		2x910kW		1x910kW		1x200kW	
	Loading coef.								0,02		0,01		0,01		0,00		0,00		0,00		0,01
	Emergency generator		1x200kW																		

Main Characteristics:
LOA: 179.96 m; LPP: 172.00 m
Breadth mld.: 32.20 m; Draught, design: 10.50 m
Speed, service: 15 kn
Crew: 31 persons
Cargo tanks 47,776 m3 / 5 pairs (100%)

Oil/Chemical tanker IMO3 of 37,000/41,000 dwt (series of 23 vessels built)
Conceptual, Model Testing, Basic Design, Detail Design and Prod. Info. for complete ship;
Design system: TRIBON, AutoCAD; Year: 2003 - 2005
Shipbuilder: Constanta Shipyard, Romania; Owner/Operator: Histria Shipping, Romania.

Sample Projects - Defence

Classification: LR

Main Dimensions:
Length mld.: 42.80 m;
Beam mld.: 7.00 m;
Max air draught: 18.32 m;
Depth at centreline: 3.91 m;
Speed, service: 25 Kn; Crew: 14

Mid-Shore Patrol Vessel
Year: 2010 -11;
Shipbuilder: Irving Shipbuilding Inc. (ISI) Halifax, Canada; Operator: Canadian Coast Guard

Sample Projects - Defence

T45 Destroyer
Client: BAE Systems, UK

Ocean Patrol Vessel / Corvette
Detail Design for Hull and Outfitting;
Design system: TRIBON;
Year: 2007-2008
Shipbuilder: VT – Shipbuilding ,UK
Owner/Operator: Royal Navy for Oman

Offshore Patrol Vessel
Detail Design for Hull and Outfitting, incl. technical assistance on-site; Design system: TRIBON; Year: 2007-2008; Shipbuilder: VT – Shipbuilding , UK; Owner: Brazilian Navy

Sample Projects – Defence

65,000 tonnes at full displacement
Length: 280m
Beam: 70m
Range: 8,000 to 10,000 nautical miles

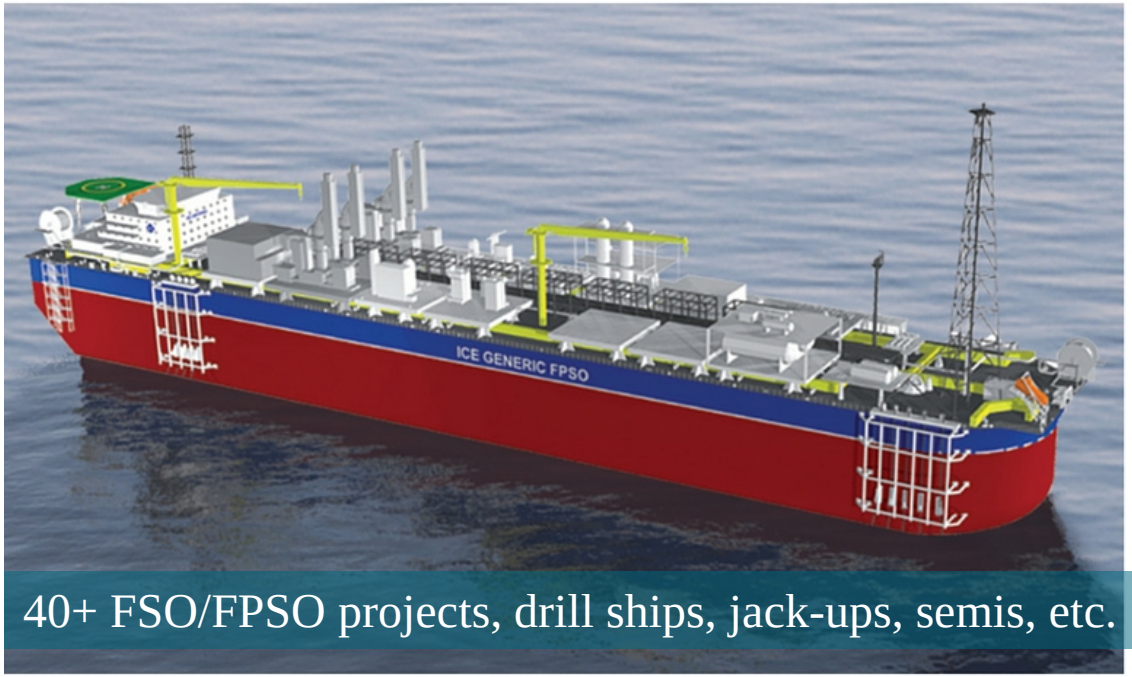
The Queen Elizabeth Class Aircraft Carriers
Technical Assistance, Piping & Outfitting; Design system: TRIBON; Year: 2008 - 13
Client: BVT Surface Fleet Ltd., UK Owner/Operator: Royal Navy

Sample Projects – FSO / FPSO / FPU

ICE MARINE DESIGN





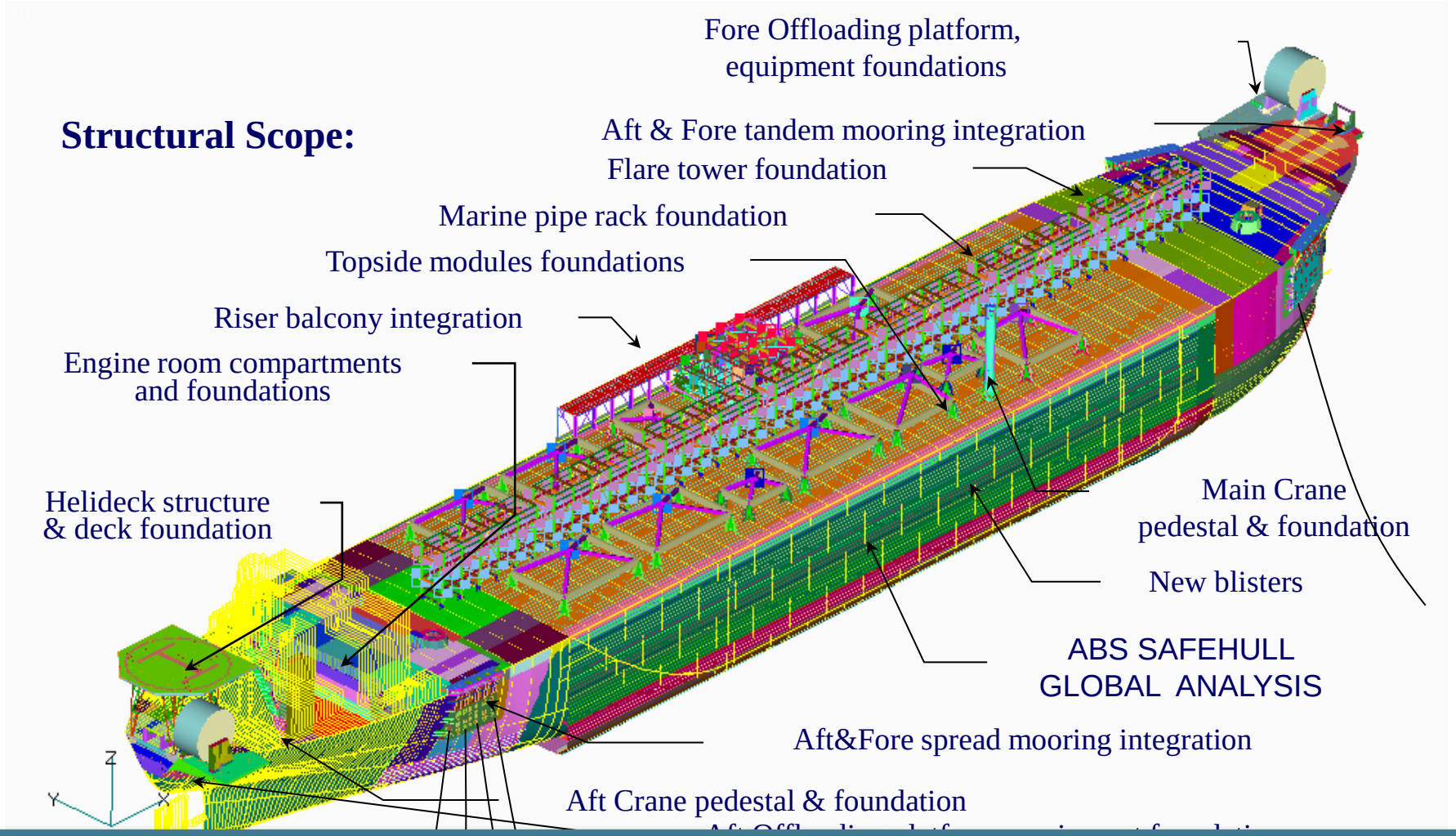




40+ FSO/FPSO projects, drill ships, jack-ups, semis, etc.

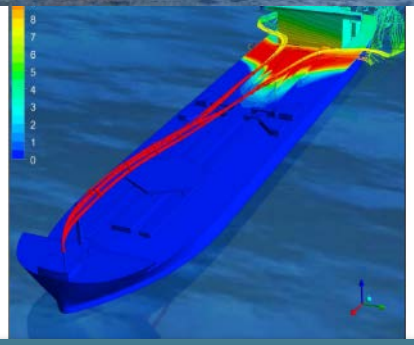


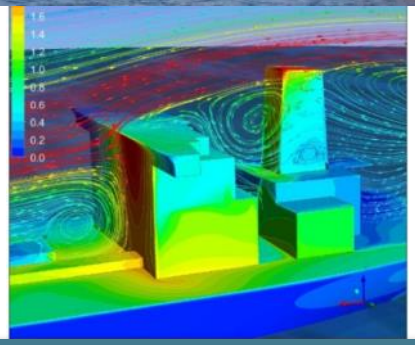

Sample Projects – Oil & Gas



Sample Projects – Oil & Gas

Main Characteristics:
LOA: 260.0 m
Breadth mld.: 46.0 m
Draught, design: 14,80 m
Light ship displacement: 22595 t
Deadweight: 124472 t





H2S Dispersion CFD Analysis:

- contours of H2S concentration on ship's external surfaces;
- path lines of the vented gases colored by H2S local concentration

Floating Storage and Offloading (FSO) vessel conversion

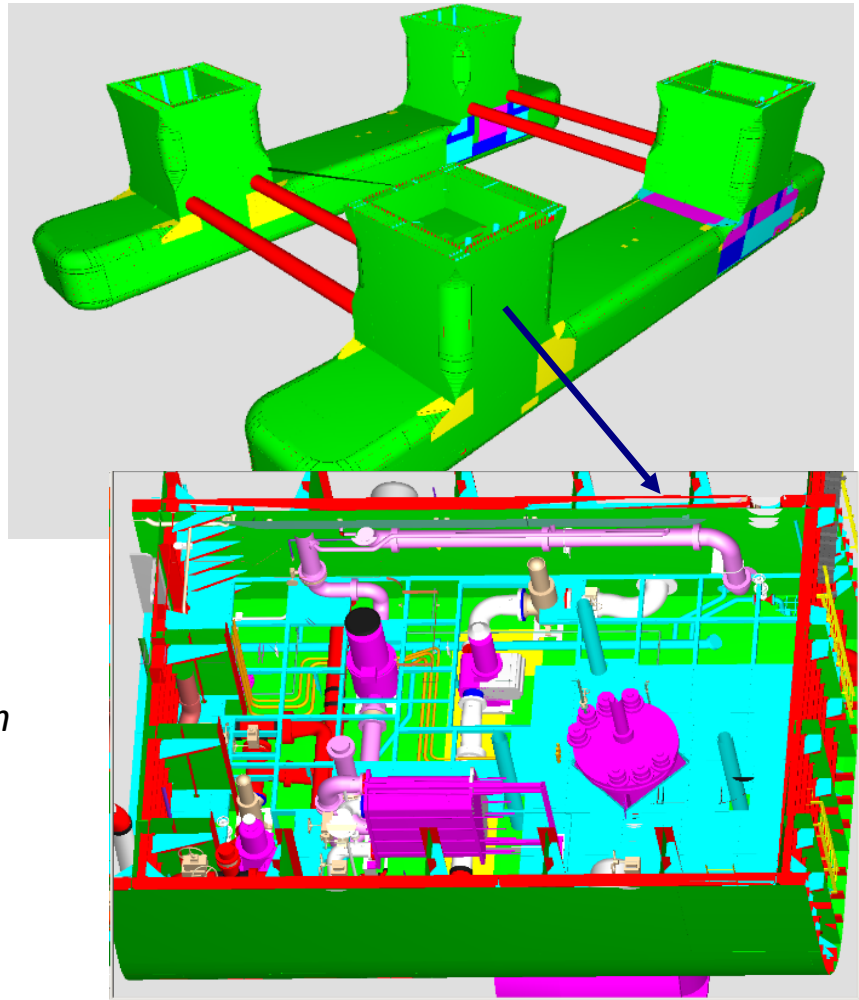
Basic and detail design for conversion of a shuttle tanker to an FSO for operation in the Middle East; naval architecture, structural, piping, electrical

Year: 2009; Client/Operator: Teekay, Norway.

Sample Projects – Oil & Gas

Newbuilding semi -submersible drilling rig

Complete Detail engineering and production information for Columns and Pontoons Area



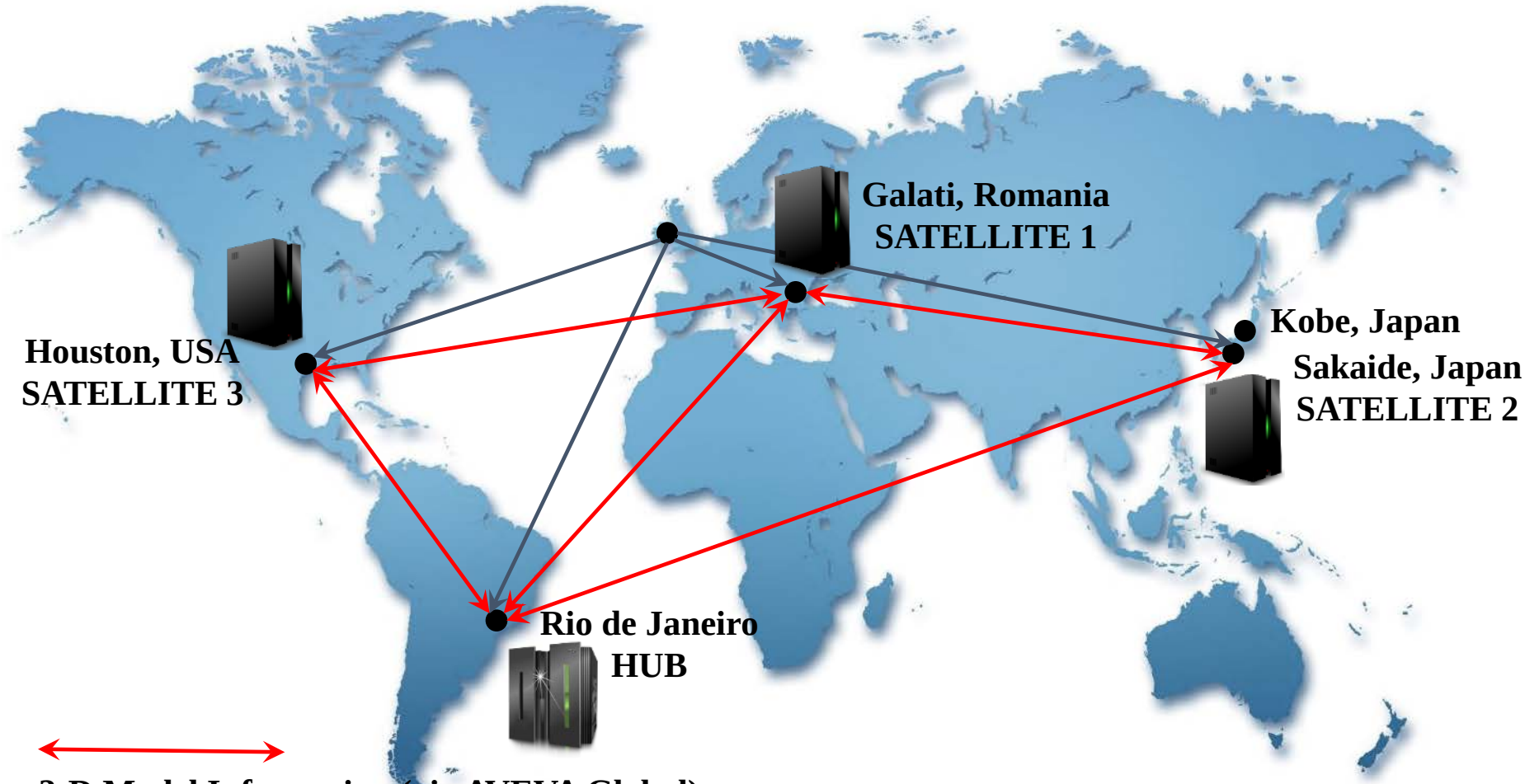
Thrusters Room (detail)

Sample Projects – Oil & Gas

Basic Drill Ship Design for GustoMSC (Holland) and detail design for Enseada Indústria Naval (Brazil & Japan)

Building the hull of the first of the six drill ships at Kawasaki's facility in Sakaide.

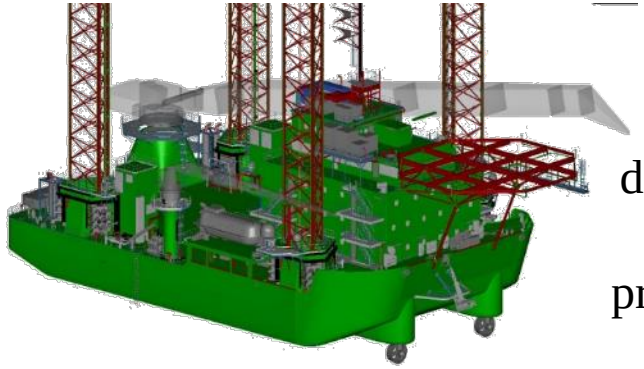
AVEVA Global
Concurrent Design by Multiple Teams



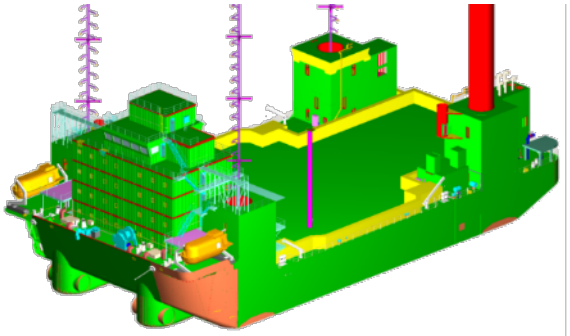
**AM Catalogues & specifications developed in Satellite 1 (Romania)

Sample Projects – WTI Vessels

- Wind Turbine Installation Vessels (WTI) for Seajacks International. *Class ABS.*



Completing basic design; 3-D model, all detail design and production information



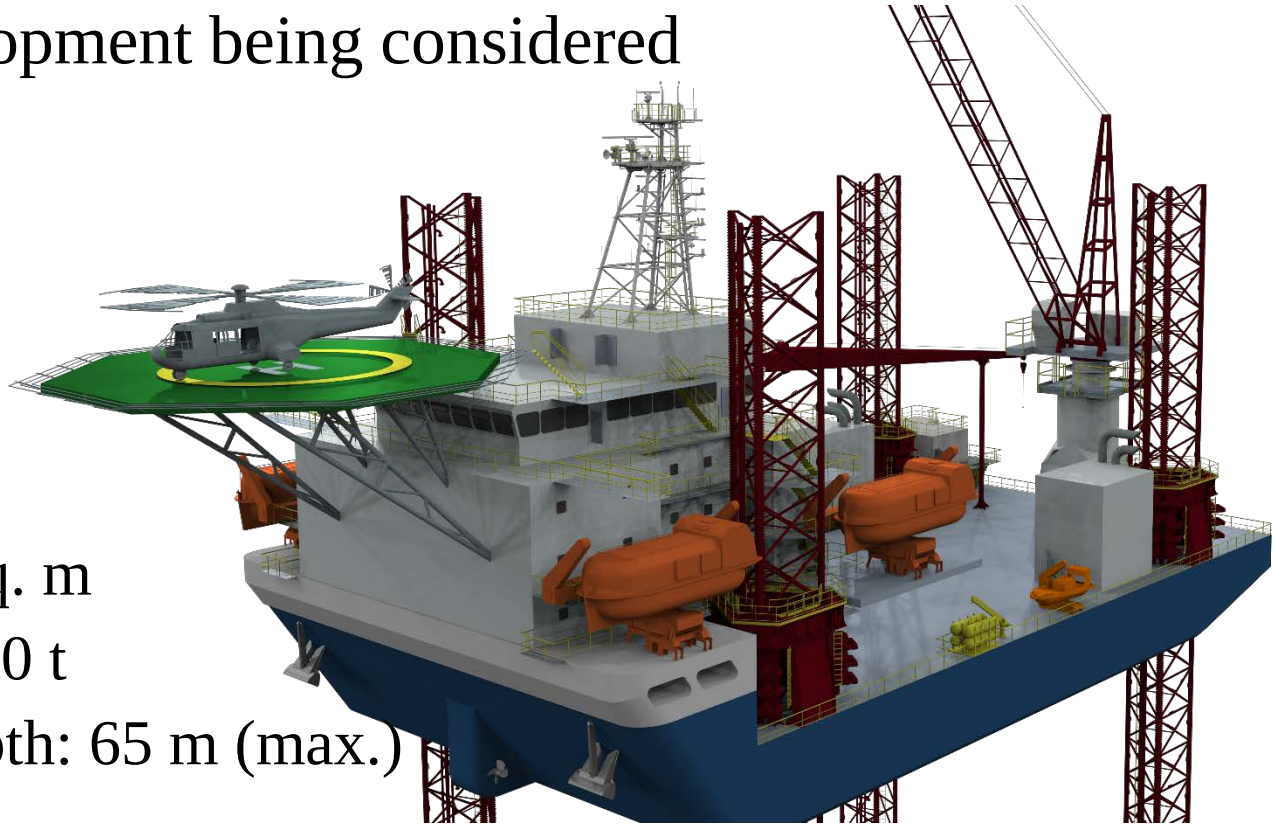
Proprietary Designs (IP) – GFPSO Hulls & EWT Vessel

ICE MARINE DESIGN

	G-1600-SM FPSO	G-350-T FPSO	Extended Well Test and Early Production (EWT) Vessel
Principal Dimensions			
Length o.a.	308.25 m	182.10 m	241,65 m
Length b.p.	305.00 m	180.70 m	229.60 m
Breadth mld.	53.00 m	32.20 m	44.00 m
Depth mld.	29.10 m	19.90 m	22.00 m
Draught, design	21.81 m	14.00 m	14.50 m
Hull form: FPSO service tailor-made shape, double side, single bottom EWT Vessel: Ship-shaped, double side, double bottom			
Capacities			
Deadweight (design)	260,000 t	62,025 t	99,600 t
Crude Oil Overall Offloading Capacity	1,600,000 bbl	350,000 bbl	500,000 bbl
Crude Oil Overall Storage Capacity	1,750,000 bbl	370,000 bbl	550,000 bbl
Slop tanks	6,682 m3	2 x 619 m3	2 x 1,240 m3
Water ballast tanks	104,715 m3	32,455 m3	45,965 m3
Diesel Oil	7,765 m3	4,500 m3	10,713 m3
CLASS:	**DNV**	**ABS**	**ABS**

Proprietary Designs (IP) – Liftboat

- Concept developed to meet requirements from a Middle East operator
- Further development being considered



Free Deck: 1,100 sq. m

Variable Load: 1,700 t

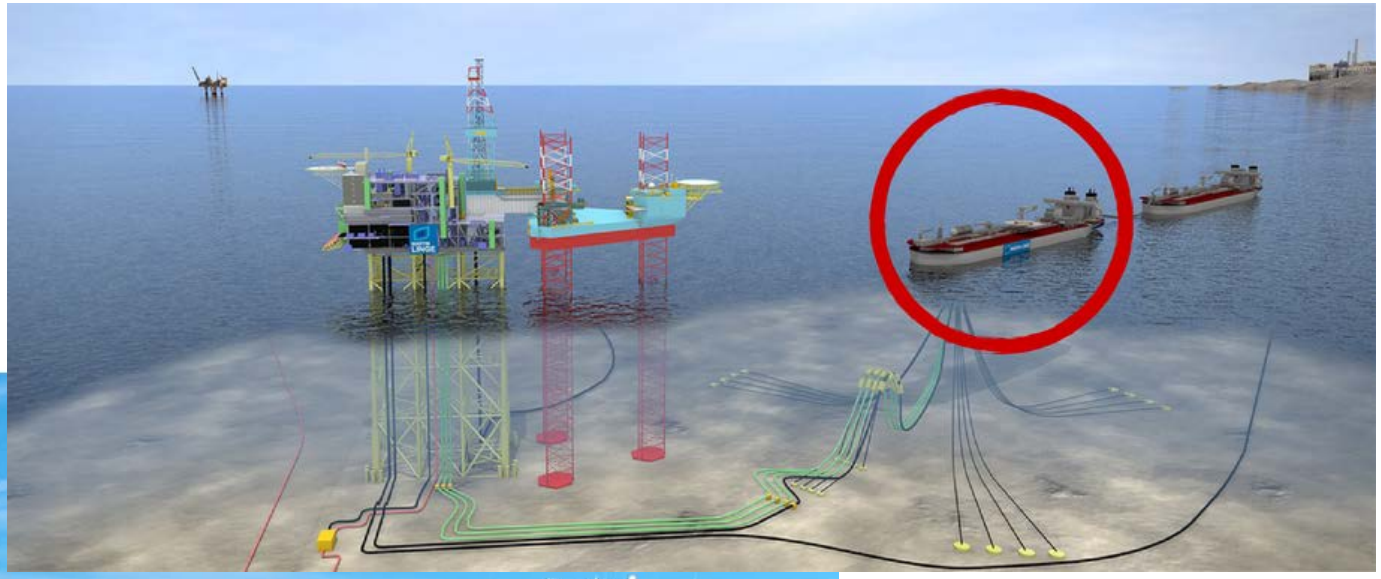
Working Water Depth: 65 m (max.)

Ongoing Projects – Japan

- KHI: Drill Ship – AVEVA Marine 3-D Model & Detail Design

Ongoing Projects – Norway

- Floating Storage and Offloading ("FSO") vessel conversion design for Total E&P Norge's Martin Linge Development on the Norwegian Continental Shelf (ongoing 2017)



Knot is a joint venture between NYK of Japan and Knutsen OAS of Norway.

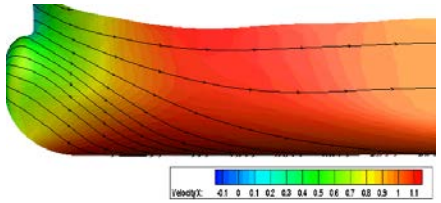
Integrated Advanced Ship Design

ICE's 2016 Master Thesis "**Initial Design of a Ship shaped Self-Propelled Drill Ship**" was undertaken by **Güner Dönmez**, a graduate of Piri Reis University, Engineering Faculty in Turkey.

The thesis focussed on dynamical positioning and intact stability.

Master Thesis Proposal for 2017

ICE MARINE DESIGN



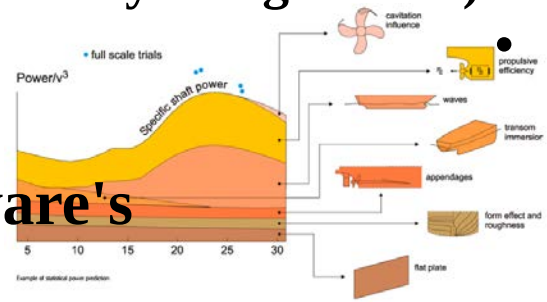
NUMERICAL INVESTIGATIONS ON SHIP PROPULSION PERFORMANCES

General Design

- Ship Type
- Ship Form
- EEDI (Energy Efficiency Design Index)

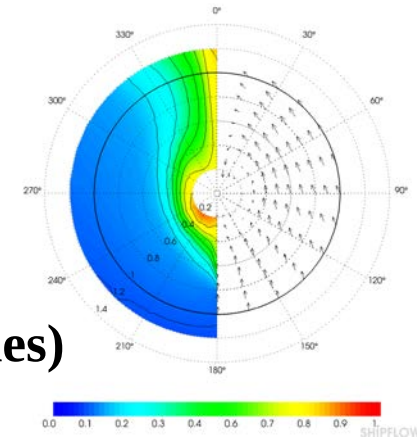
Hydrodynamic Performance

- Resistance Calculation
- Speed-Power Prediction
- Propeller Preliminary Design
- Trim Optimization



Tools & Software's

- Applicable International / Class Rules & Regulations
- AVEVA Marin ID / NAPA / Rhino5 3D / AutoCAD 2014
- Statistical Methods (e.g. Holtrop-Mennen, Wageningen-B Series)
- Numerical Methods (e.g. NUMECA Fine Marine, Shipflow)



Thank you for your attention.

ICE
MARINE DESIGN

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