FROM OUR DESIGN PORTFOLIO

ICE MARINE DESIGN

ZERO-EMISSION SERVICE OPERATION VESSEL

ICE has developed a Work-Station Service Operation Vessel design suitable for emission free operations and cost-effective maintenance of offshore wind farms. The concept uses a battery-powered propulsion system and modular accommodation components. The battery system is designed to be recharged using an offshore charging station.

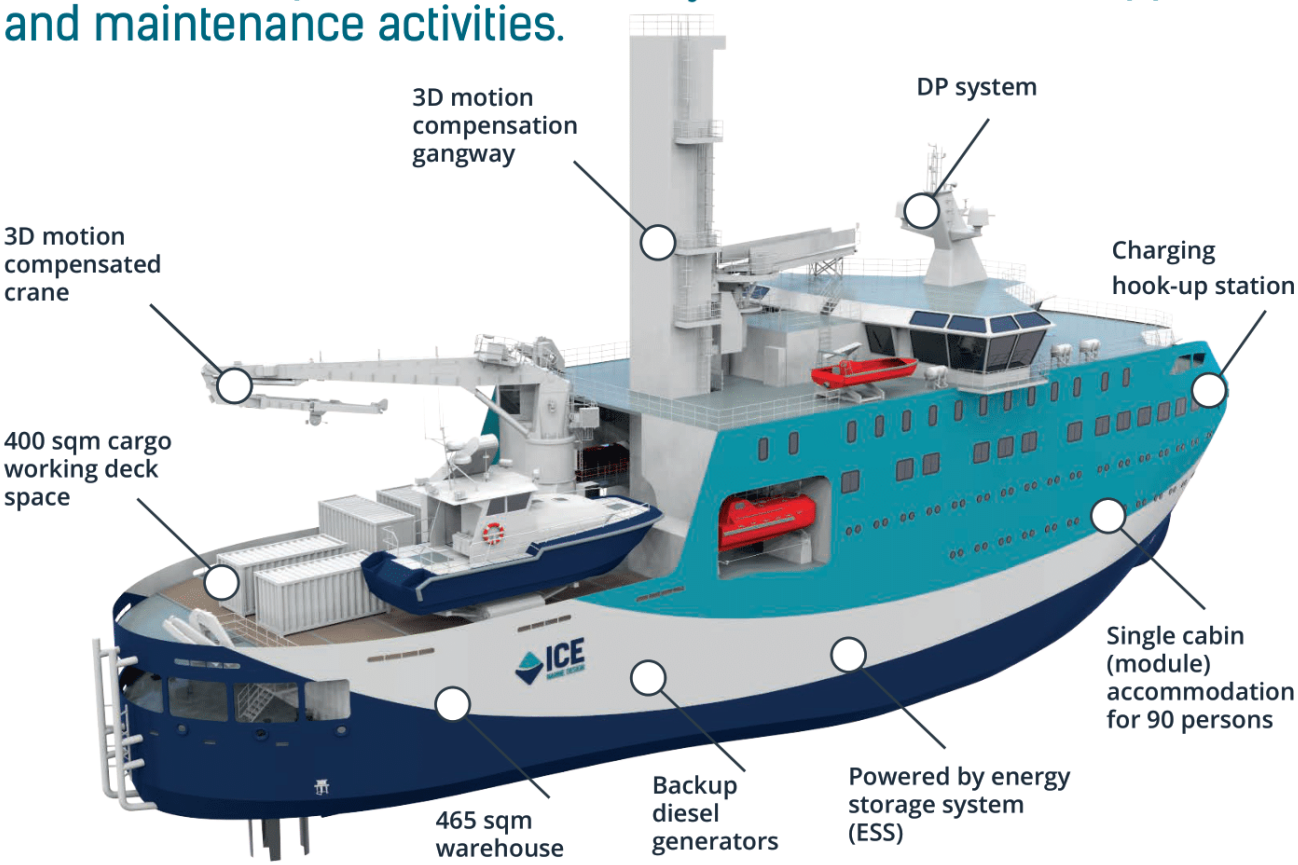
High operational workability is facilitated by positioning the motion compensated gangway along the vessel centreline, enabling transfer of technicians to either side of the vessel. The design offers 465 sqm enclosed warehouse space and a 400 sqm working space on the weather deck aft.

ZERO-EMISSION WS-90-SOV

Design Highlights:

- Operates on Energy Storage System (ESS), rechargeable offshore,
- Charging buoy hook-up station,
- Diesel generators for backup only,
- Safe walk-to-work transfer by 3D motion compensated gangway,
- 3D motion compensated crane for efficient cargo handling,
- Smart container skidding and seafastening system in the warehouse below deck,
- Ship-to-ship transfer capability,
- Standardized, cost-effective vessel design that can be readily adapted to a variety of operational conditions and building methods,
- Integration of an HVAC system that provides 100% fresh air flow.

ICE's ZERO-EMISSION WS-90-SOV design combines safety, comfort and operational efficiency for offshore wind support and maintenance activities.



Sustainability

The ICE WS-90-SOV design features EES capacity for one day's operation, which, combined with the battery offshore charging system, enables zero-emission operation.

Logistics, Efficiency & Safety

ICE WS-90-SOV concept combines workshops & storage space, high-comfort accommodation facilities and a transport method in one single design.

The 3D motion compensated gangway enables safe and flexible walk-to-work operations in significant wave-heights (Hs) up to 4.0 m.

The SOV is designed to operate under normal conditions solely on battery power for up to 15 hours before recharging, including hotel consumption and use of gangway and DP. The vessel is also designed to offer sufficient storage, efficient logistics and safe access to wind turbines from the vessels for technicians.

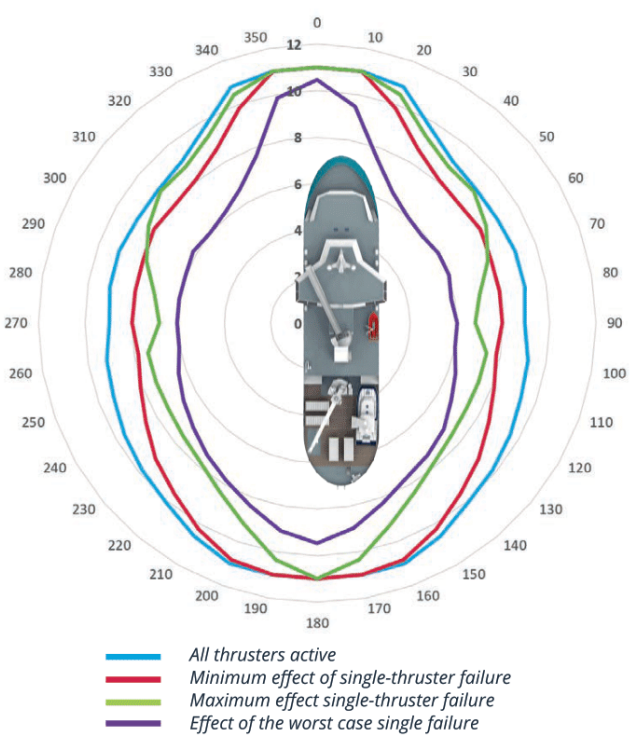
Accommodation

Designed to accommodate 90 personnel on board (POB), the vessel will allow owners to offer enhanced operation and maintenance (O&M) services to end customers. The fully electric operation enables increased level of comfort for the crew and maintenance personnel on board due to reduced noise and vibration.

DP Capability

DP mode ..... IMO DP-2
DP performance ..... ERN (99,98.5,90,70)

Environmental Conditions, Beaufort Numbers
Wind and Waves, colinear 0.75 m/s current also considered



Principal Dimensions

Length o.a. ..... 84.00 m
Breadth mld ..... 19.20 m
Depth mld ..... 7.50 m
Draught, design ..... 5.00 m
Freeboard at design draught..... 2.50 m
Deckload (A Deck aft) ..... 5.0 t/sqm
Cargo deck area ..... 400 sqm
Warehouse area ..... 465 sqm
Trial speed at design draught ..... 14 knots
Endurance ..... 30 days

Capacities

Fuel Oil ..... 71.70 cbm
Fresh Water ..... 647.40 cbm
Containers ..... 9 x 20 ft in normal or Hi-Cube
Warehouse 5 x 20 ft containers
Weather Deck 4 x 20 ft containers

Accommodation & Facilities

Accommodation, up to ..... 90 POB

Covered warehouse, changing rooms, drying room, galley, mess hall, lounges, offices, meeting rooms, gymnasium, high standard single cabin units, hospital and laundry facilities.

The HVAC system is a 100% fresh air intake system with Enthalpy Exchanger for the entire vessel.

Deck Cranes

3D motion compensated crane ..... 5.0 t @ 25 m / Offshore 15 t @ 15 m
Offshore/Deck crane ..... 1 x 3t @ 12m (offloading aft)
Provision crane ..... 1 t @ 10 m

Equipment

Access System ..... Motion compensated gangway, up to 30 m above LAT with 30m outreach and 1,000 kg 3D compensated lifting
Elevator ..... For access between warehouse/changing area to compensated gangway
Warehouse Crane ..... 1 x 1,500 kg @ 5 m
MOB ..... 1 x 6 POB
Daughter Craft ..... 1 x up to 10 POB or 1,000 kg of cargo

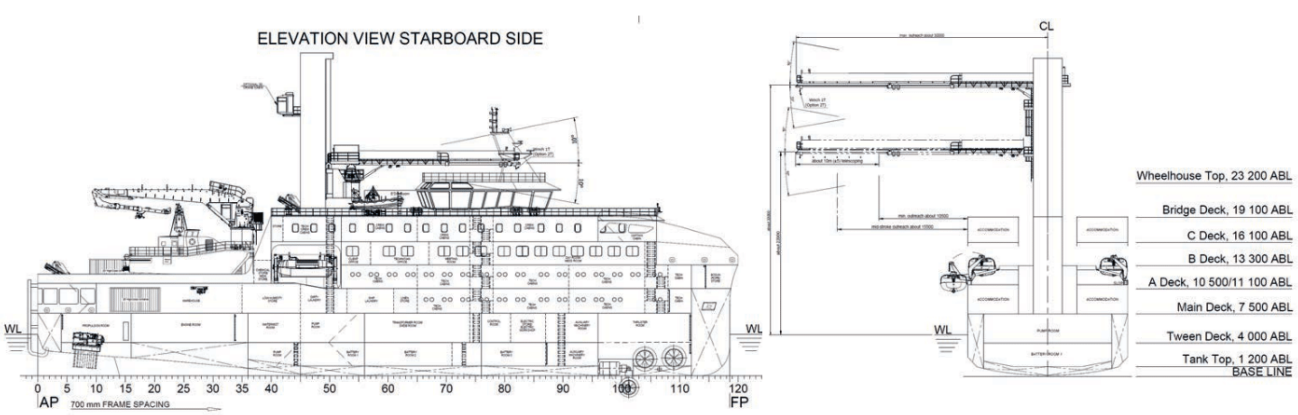
Designed for optional helideck.

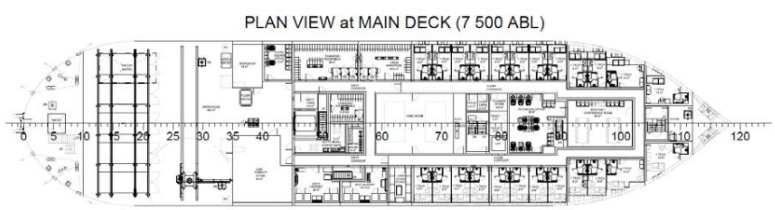
Power Generation

Battery Storage: ..... 42,780 kWh
Diesel Generators: ..... 2 x 1,140 kWe / 690 V / 60 Hz
Propulsion eVSP 26 PM Motor ..... 2 x 1,850 kW Azimuth
Swing-out Azimuth Thruster (forward) ..... 1 x 750 kW
Tunnel Thruster (forward) ..... 2 x 1,000 kW
Electric System ..... 960V DC / 60 Hz - 690V / 400V
Emergency Generator ..... 1 x 200 kWe /690 V /60 Hz

Class – DNV

✠ 1A, Offshore Service Vessel (Windfarm Maintenance), WALK2WORK, CRANE, DYNPOS (AUTR), NAUT (AW), E0, Battery(Power), BIS, CLEAN (DESIGN), BWM(T), Strengthened (DK), COMF-V(2)C(2), SPS, RECYCLABLE.



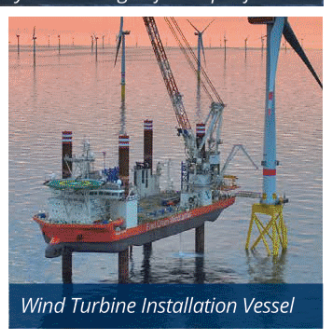


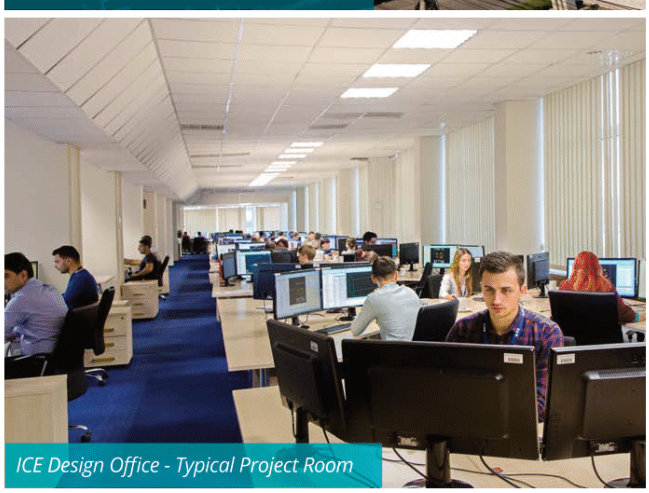
ICE GROUP CAPABILITIES AND RESOURCES

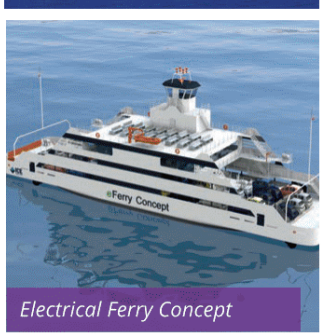
ICE is an independent full service marine design company with substantial capacity, serving clients world-wide. Our experience includes 40+ FSO / FPSO projects (new construction, conversions and various studies), jack-up drilling platforms, drill ships, semi-submersible drilling rigs, self-elevating vessels for wind turbine installation, well intervention vessels, converter platforms, etc. We are familiar with the rules of the major IACS Classification Societies and with Brazilian, UK and Norwegian (NORSOK and PSA) regulations. Most of our work is done for repeat clients.

ICE Main Design Office

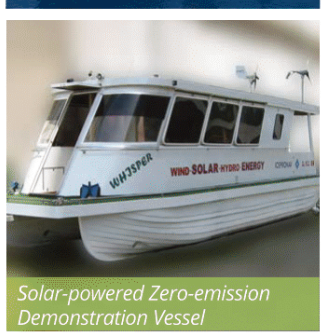

"Seajacks Hydra" serving the "SylWin Alpha" windfarm transformer platform. ICE contributed substantially to the design of both platforms.


Wind Turbine Installation Vessel


ICE Design Office - Typical Project Room



Electrical Ferry Concept



Solar-powered Zero-emission Demonstration Vessel

ICE MARINE DESIGN

ENGINEERING CERTAINTY

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With a 55-year track record and an annual output having exceeded 700,000 professional engineering man-hours, the International Contract Engineering (ICE) Group is one of Europe's largest independent ship design consultancies. We provide high-calibre multi-discipline design services to yards and owners in the commercial shipping, defence and offshore energy industries, ranging from conceptual studies and Class drawings to detail design and production information. We cover a full range of naval architecture and marine engineering disciplines such as hydrodynamics, structural, mechanical, piping, electrical, instrumentation, outfit and HVAC. Our experience includes gas carriers, passenger vessels, navy and coast guard ships, chemical tankers, drill ships, FSO/FPSOs and a range of other vessels. We also have available proprietary designs that can be adapted to clients' requirements.

With our head office in the Isle of Man and engineering facilities in Romania and Croatia, we provide high quality design and engineering at very competitive prices.