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DRILLING ICE MANAGEMENT PLAN
Chukchi Sea, Alaska

Submitted to:

U. S. Department of the Interior
Bureau of Safety and Environmental Enforcement
Alaska Outer Continental Shelf Region

Submitted by:

Shell Gulf of Mexico Inc.

DRILLING ICE MANAGEMENT PLAN

Approval: **Approved for the Alaska Asset**

Shell Exploration & Production Company	**Approved**	**Date**
VP Wells Arctic & Industry Regulatory Affairs	*Signature on file*	7/9/2014

Effective	This document is effective per the latest approval date above.
Expires	In force until revised and/or superseded.
Custodian	Alaska Marine Manager
Author	Ice Management Lead (July, 2014 Revision)
Reviewers	Principal Arctic Marine Facilities Advisor VP Alaska BOM VP Arctic HSSE VP Alaska Operations Alaska Maritime Assurance Manager Alaska Wells Operations Manager Arctic Execution Manager Offshore Regulatory Team Lead

Topic	Define the method and system to ensure the safe departure of the drilling unit from the well site due to incursion of hazardous sea ice.
Purpose/Scope	The purpose of this Drilling Ice Management Plan is to provide a consistent, safe method for full compliance with the Alaska Venture operating / permitting requirements with regard to the Critical Operation Curtailment Plan which encompasses the Drilling Ice Management Plan.
Applies to	This document applies to all Shell employees and contractors conducting operations on behalf of the Shell Alaska Venture.
Primary Responsibility	Alaska Venture Maritime & Logistics supervision shall be responsible for assuring that this plan is provided and that operators are instructed to use this procedure prior to all marine drilling operations in Arctic waters where sea ice incursion is expected.

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I. INTRODUCTION

A. Scope

A Critical Operations Curtailment Plan (COCP) is in place for the Shell Gulf of Mexico Inc. (Shell) Chukchi Sea Exploration Drilling Program. As part of the COCP, this Drilling Ice Management Plan (DIMP) has been developed. The description of notification of curtailment (an excerpt from the COCP) is presented in Attachment 1.

Drilling operations in the Chukchi Sea will be conducted using two drilling units operating simultaneously. The drilling units are the *"Noble Discoverer"* and the *"Polar Pioneer"*. Both drilling units will operate according to this Drilling Ice Management Plan

The DIMP addresses the following activities:

- Vessels
- Shell Ice and Weather Advisory Center (SIWAC), located in Anchorage
- Ice Alerts and Procedures
- Ice Management Philosophy
- Well Suspension Contingencies
- Mooring System Recovery and Release
- Moving onto or returning to the Drill Site
- Training

The DIMP:

- Defines Roles and Responsibilities
- Establishes Alert Levels
- Establishes Responses to Alert Levels

The DIMP facilitates appropriate decision-making and responses to the threat of hazardous ice and procedures set forth in the DIMP to prevent damage or harm to personnel, assets, or the environment.

Nothing in this document takes away the authority and accountability of the Master(s) of the vessels for the safety of their personnel and vessels, and for protection of the environment.

This plan is not a substitute for good judgment.

Guidance Note: This document is not intended to contain detailed procedures. Detailed procedures are contained within the vessel-specific operating manuals and the Shell Ice Management Guidance and Procedures manual.

B. Drilling Ice Management Plan Objective

- The objectives of the DIMP are to detect and monitor sea ice conditions, identify hazardous ice and determine manageability as per the DIMP and Alert System in order to ensure risk to personnel, drilling units, vessels or wells is reduced to ALARP.
- The Ice Alert System is central to the function of the DIMP. It is based on five progressive alert levels. Each level defines operational status, roles, responsibilities and actions required.

C. Drilling Ice Management Principles

- Early detection of ice features
- Assessment of the ice regime
- Identification of Hazardous Ice
- Assessment of Ice Management Vessel (IMV) capabilities to manage ice
- Calculation and monitoring of Hazardous Ice arrival at drill site, Hazard Time (HT)
- Continuous assessment of time required to secure the well, Secure Time (ST)
- Continuous assessment of time required to move rig off location, Move Time (MT)
- Alert Level assignment which triggers the appropriate responses
- Development of ice management strategy
- Monitoring effectiveness of strategy
- Predefined roles and responsibilities

II. DEFINITIONS

A. Roles and Responsibilities

Responsibilities have been defined for key on-site personnel in Section V. In addition to the defined personnel the following onshore positions have a role to play in the DIMP.

Wells Operations Manager

Shell's Wells Operations Manager is the senior Shell shore-based manager responsible for all Shell well operations offshore Alaska.

Wells Operations Team Leads

The Wells Operations Team Leads are responsible for Shell well operations at a specific well site. There is a Wells Operations Team Lead ashore for each drilling location who will update the OEMT on Ice Alert Status or changes to the Ice Alert Level.

Ice Management Lead Anchorage

The Ice Management Lead heads the ice management team and works with the offshore Ice Advisors (IAs) stationed on vessels to develop daily strategies and designate areas or ice features which are of concern. The Ice Management Lead liaises with the Shell Wells Operations Team Lead, SIWAC and the OEMT.

Shell Ice and Weather Advisory Center (SIWAC)

Based in Anchorage Alaska SIWAC develops ice and weather forecasts and analysis for Shell Management and the marine fleet. A full description is available in section IV.

SIMOPS Coordinators

The SIMOPS Coordinators working under the direction of the OEMT, will assist in coordinating the cascading activities of the entire fleet from the consequences of having to relocate a drilling unit(s) per the DIMP.

Operations Execution Management Team (OEMT)

The OEMT, comprised of leadership from each business function and representation from support functions, implements the control and recovery of the 7-day operational Integrated Activity Plan (IAP) in accordance with the Integrated Operations Management Procedures (IOMP). The scope of the IOMP is to support field operations by maintaining up-to-date information, providing resources as needed, coordinating activities, and to bring decision-makers together to coordinate exploration and support activities.

B. Definitions and Abbreviations

AHTS	anchor handling tug supply
Aiviq	MV *Aiviq* – Secondary IMV and anchor handling vessel
APD	Applications for Permit to Drill
AT	Alert Time - The result of (HT) – (T-Time) which translates to Alert Level
API	American Petroleum Institute
bbl	barrel(s)
BHA	Bottom Hole Assembly
BOP	Blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CIS	Canadian Ice Services
cm	centimeter(s)
COCP	Critical Operations Curtailment Plan
Dia.	diameter
DNV	Det Norske Veritas

DP	Dynamic Positioning
ea	each
Fennica	M/V *Fennica* – Primary IMV
ft	foot/feet
FTP	file transfer protocol
FY	First-year ice. Sea ice of not more than one winter's growth, developing from young ice; 12 inches (in.) (30 centimeters [cm]) or greater. It may be subdivided into thin FY 30-70 cm – sometimes referred to as white ice, medium FY 70-120 cm and thick FY >120 cm up to 2 m.
gals.	gallons
GFS	Global Forecast System
GIS	Geographic Information System
Hazardous Ice	Ice, which due to its size, stage of development, concentration, set and drift is considered to be a threat to the safety of personnel, the drilling unit and well operations. Close proximity of an ice feature regardless of its set and drift may determine it to be hazardous ice. Guidance Note: Sea state as well as visibility may influence what is categorized as hazardous ice.
HOS	Hang-off Sub
hp	horsepower
HT	Hazard Time. The estimated time it will take for hazardous ice to reach the drill site.
Hz	hertz
IA	Ice Advisor
IAP	Integrated Activity Plan
IOC	Integrated Operations Center
IOMP	Integrated Operations Management Procedures
IMO	International Maritime Organization
DIMP	Drilling Ice Management Plan
IMV	Ice management vessel. Any ice class vessel tasked with ice management duties in support of the drilling unit. This includes the primary ice management vessel (IMV) and the ice class Anchor Handling Tug Supply (AHTS)
in.	Inch(es)
kg	kilogram(s)
kW	kilowatt(s)
lb	pound(s)

LMRP	Lower Marine Riser Package
m	meter(s)
m^2	square meter(s)
m^3	cubic meter(s)
MHz	megahertz
MODU	Mobile Offshore Drilling Unit. MODU's are facilities designed or modified to engage in drilling and exploration activities. The term MODU includes drilling vessels, semisubmersibles, submersibles, jack-ups, and similar facilities that can be moved without substantial effort. These facilities may or may not have self-propulsion equipment on board and may require dynamic positioning equipment or mooring systems to maintain their position.
mt	metric tons
MT	Move-off Time. The time required to clear decks on the anchor handler recover or release moorings conventionally and move off the drill site in an orderly fashion.
M/V	Motor Vessel
MY	Multi-year ice. Old Ice (OI) up to 3 m or more thick which has survived at least two summers' melt. Hummocks are smoother than on SY and the ice is almost salt-free. Where bare, this ice is usually blue in color. The melt pattern consists of large interconnecting, irregular puddles on the surface in summer and a well-developed drainage system.
NOAA	National Oceanic and Atmospheric Administration
Noble Discoverer	Turret-moored drilling vessel (MODU)
Nordica	M/V *Nordica* – Primary IMV
OCS	Outer Continental Shelf
OEMT	Operations Execution Management Team
OI	Old ice. Sea ice which has survived at least one summer's melt. Topographic features generally are smoother than FY. It may be subdivided into Second-year (SY) ice and Multi-Year (MY) ice.
OIM	Offshore Installation Manager
OSR	Oil Spill Response
OSV	Offshore Supply Vessel
PIC	person in charge
Polar Pioneer	Column stabilized semi-submersible drilling unit (MODU).
psi	pounds per square inch
RAR	rig anchor release
RP	Recommended Practice

RPM	revolutions per minute
SAR	Synthetic Aperture Radar
Shell	Shell Gulf of Mexico Inc.
SIMOPS	Simultaneous Operations
SIWAC	Shell Ice and Weather Advisory Center
Support Vessels	Includes all vessels defined in this plan (IMV/OSR/AHTS/OSV).
SWL	Safe Working Load
SY	Second-year ice. OI which has survived only one summer's melt. Thicker than FY with thickness up to 2.5 m, it stands higher out of the water. Ridged features as a result of melting during the preceding summer attain a smooth rounded shape. In contrast to MY ice, summer melting produces a regular pattern of numerous small puddles. Bare patches and puddles are usually greenish-blue.
ST	Secure Time. The time required to secure the well, disconnect the LMRP from the BOP, recover and secure the riser.
TD	Total depth
T-Time	Total Time. The sum of ST + MT
Tor Viking II	M/V *Tor Viking II* – Secondary IMV and anchor handling vessel
UHF	ultra high frequency
U.S.	United States
USCG	United States Coast Guard
VMT	Vessel Management Team. This team is headed by the drilling contractor's Master / OIM and includes the drilling contractor's Rig Manager / OIM, and the Chief Engineer/Barge Captain and Shell's Drilling Supervisor and IA
Wx	weather

III. VESSELS COVERED BY THE DRILLING ICE MANAGEMENT PLAN

- Drilling Unit – *"Noble Discoverer"*
- Drilling Unit – *"Polar Pioneer"*
- Primary Ice Management Vessel (IMV) – "*M/V Fennica"*
- Primary Ice Management Vessel (IMV) – "*M/V Nordica*"
- Secondary Ice Management Vessel (IMV) and Anchor Handler – "*M/V Tor Viking II"*
- Secondary Ice Management Vessel (IMV) and Anchor Handler – "*M/V Aiviq*"

Guidance Note: The term "drilling unit" is used throughout this document and refers to both the *"Noble Discoverer"* a self propelled drilling vessel and the *"Polar Pioneer"* a non self-propelled semi-submersible. Both units are defined as MODU's. The final authority with regard to safety onboard a drilling vessel is the Master. The final authority for safety onboard a non self-propelled semi-submersible is the OIM

A. Drilling Units

All planned exploration drilling in the identified lease blocks will be conducted with the *Noble Discoverer* and the *Polar Pioneer*.

The *Noble Discoverer* is a turret moored self-propelled drillship. Station keeping is accomplished using a turret-moored, 8-point anchor system. The underwater fairleads prevent ice fouling of the anchor lines. Turret mooring allows orientation of the vessel's bow into the prevailing metocean conditions to present minimum hull exposure to drifting ice. The vessel is rotated around the turret by hydraulic jacks. Rotation can be augmented by the use of the fitted bow and stern thrusters. Ice-strengthened sponsons have been retrofitted to the ship's hull.

The *Noble Discoverer* is classed by Det Norske Veritas (DNV) as a Mobile Offshore Drilling Unit (MODU) for worldwide service. It is a "1A1 Ship-Shaped Drilling Unit l" and is capable of performing drilling operations offshore Alaska. The *Noble Discoverer* has been issued with a DNV Appendix to Class stating:

"*The structural strength and material quality of the 'Ice Belt' formed by the sponsons below the 8,950 mm A/B level, have been reviewed against the requirements for the DNV ICE-05 Additional Class Notation and found to meet those requirements (as contained in DNV Rules for Classification of Ships, Pt 5 Ch 1, July 2006) for a design temperature of -15 degrees C*."

The *Polar Pioneer* is classed by Det Norske Veritas (DNV) as a Mobile Offshore Drilling Unit (MODU) for worldwide service. It is a non-self-propelled, "SPM thruster assisted" (TA) semisubmersible offshore drilling unit of twin-hull configuration. The rig is a "+ A1 Column Stabilized Unit" and is capable of performing drilling operations offshore Alaska.

Positioning is accomplished with a combination of an eight-point all chain catenary mooring system and dynamic positioning system.

Polar Pioneer was built in 1985, with unlimited operation area, in accordance with the "Norwegian Maritime Directorate" and to "Det Norske Veritas regulations," current at that time. While operating in Norwegian waters, the installation, with its inventory, equipment, crew and machinery was required to comply with current rules and regulations for operation on the Continental Shelf of Norway.

The drilling units will undergo inspections by BSEE and Det Norske Veritas (DNV) for certification before entering the theater. The DNV certificates will be forwarded to BOEM.

The drilling units will comply with all of the regulations of DNV, the International Maritime Organization (IMO), and the U.S. Coast Guard (USCG). All exploration drilling operations will be conducted under the provisions of 30 CFR Part 250 Subpart D, and other applicable regulations and notices including those regarding the avoidance of potential drilling hazards, safety and pollution control.

Procedures for monitoring and reacting to ice in the prospect areas are provided in the Critical Operations and Curtailment Plan (COCP) and the Drilling Ice Management Plan (DIMP)

Drillship Principal Dimensions

Dimensions	"Noble Discoverer"	
Length Overall	514 ft	156.7 m
Transit Draft	27 ft	8.2 m
Drilling Draft	25.12 ft	7.67 m
Breadth	85 ft	26 m

Drill Rig Principal Dimensions

Dimensions	"Polar Pioneer"	
Length Overall	400 ft	122 m
Breadth over all	292 ft	89 m
Transit Draft	30 ft	9.15 m
Drilling Draft	75.44 ft	23 m
Survival Draft	62.32 ft	19 m

B. Ice Management Vessels

Ice management support to the drilling units will be provided by the *Fennica, Nordica, Tor Viking II and Aiviq.* The drill units will be supported by these IMVs from the beginning of the campaign until the vessel departs the area. A description of these vessels is provided in Attachment 2.

Ice Management Vessel Principal Dimensions

Dimensions	Fennica & Nordica DNV Icebreaker Polar-10	Tor Viking II DNV Icebreaker Ice-10	Aiviq ABS A-3 Icebreaker
Length Overall	380 ft (116 m)	275 ft (83.7 m)	361 ft (109.9 m)
Draft	27 ft (8.4 m)	20 ft (6.0 m)	Ice Max 25 ft (7.62 m)
Breadth	85 ft (26 m)	59 ft (18.0 m)	80 ft (24.38 m)
Bollard Pull	230 tonnes	200 tonnes	200 tonnes

1. Primary Ice Management Vessels

The *Fennica* and the *Nordica* are designated as the primary IMVs. Both vessels are classed by DNV as +1A1 Tug Supply Vessel Icebreaker Polar-10. Designed for ice management, maintenance and service of offshore oil wells, the 380-ft (116-m) *Fennica* and *Nordica* are multi-purpose vessels specialized in marine construction and icebreaking. The *Fennica* and *Nordica* are equipped with diesel-electric propulsion systems and their innovative combination of capabilities, based on extensive design and engineering work, facilitates use of these systems in arctic conditions.

2. Secondary Ice Management Vessels / Anchor Handlers

The *Aiviq* is designated as a secondary IMV and anchor handler. The Aiviq is classed by ABS as ✠ A1, A3 (Icebreaker). Designed for ice management, anchor handling, and maintenance and service of offshore oil wells, the 361-ft (109.9-m) *Aiviq* is a multi-purpose vessel specialized in anchor handling and icebreaking.

The *Tor Viking II* is designated as a secondary IMV and anchor handler. The *Tor Viking II* is classed by DNV as +1A1 Supply Tug Icebreaker Ice-10. Designed for ice management, anchor handling, and maintenance and service of offshore oil wells, the 275-ft (83.7-m) *Tor Viking II* is a multipurpose vessel specialized in anchor handling and icebreaking.

Guidance Note: Ice Management Vessels supporting the drilling units may be deployed to assist other vessels or assigned to assist other Shell drilling units as operations and ice conditions dictate. Diverting ice management resources away from the drilling units may require a curtailment of activities. The decision to curtail activities as a result of diverting ice management resources away from the drilling vessel shall be made jointly by the Shell Drilling Supervisor and the Drilling Vessel Master/OIM. The onshore Shell Wells Operations Team Leader (in consultation with the drilling contractor's Rig Manager) will endorse the plan or set priorities if agreement cannot be reached at the field level.

IV. SHELL ICE AND WEATHER ADVISORY CENTER

SIWAC is an integrated forecasting service staffed 24/7 by industry-leading specialists under Shell contract in Anchorage, Alaska. SIWAC's primary function is to provide present and forecast ice and weather conditions directly to field operations and planning managers during the operational season. SIWAC provides information to decision makers and field principals to help them minimize risks when operating in the presence of ice. To provide quality and accurate information, SIWAC depends on skilled forecasters, subscription and public satellite imagery, numerical models, field observations, Geographic Information System (GIS) software tools, and a robust communication network.

A. SIWAC ICE DATA INPUTS

Ice forecasts are developed and issued daily. The Lead Ice Analyst compiles available data from subscription, specialized, and public services in ArcMAP (GIS Software) such as:

- MDA RadarSat 2 imagery
- MODIS satellite
- Canadian Ice Services
- National Ice Center
- Contract weather services
- Field observations
- IceNav images

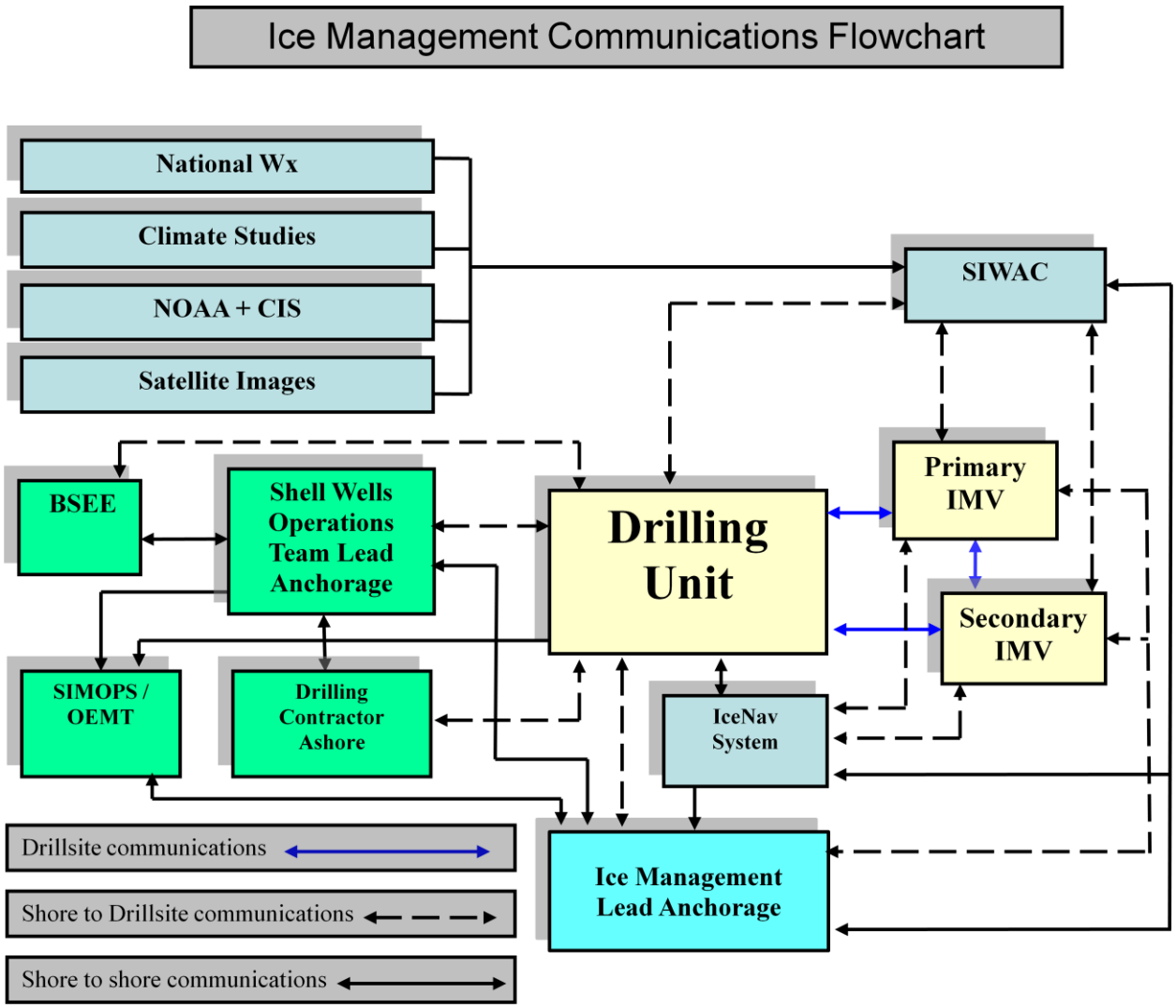
B. Data Transmission

Effective communication of SIWAC ice and weather guidance and reciprocal feedback and field observations requires a robust and capable data network. The drilling units and IMVs are equipped with high-speed data and voice satellite service that has been proven to perform well in the U.S. Chukchi and Beaufort Seas.

Data, including satellite imagery and observations, are relayed through a file transfer protocol (FTP) site between SIWAC and the field vessels using automated processes. This keeps both the field and forecasters continuously refreshed with the latest information. In addition, SIWAC maintains a secure website that allows direct, on demand access to all forecast reports and data products. Additional information about SIWAC is provided in Appendix 3.

Ice Information Flow Chart

NOTE: This graphic depicts the constant two-way communication that would occur between the various components of the system.



Guidance Note:

Additional information regarding ice may be requested by the Master of the drilling units. Any means appropriate to the circumstances, shall be used to provide this information. Where this information is to be obtained by aerial reconnaissance, the Ice Management Lead in Anchorage will liaise with Shell Logistics to provide the appropriate resources.

V. ICE ALERT LEVELS AND PROCEDURES

These procedures define five Alert Levels that are linked to the time that hazardous ice is forecast to be at the drilling location, and the time required to secure the well and move the drilling unit off location if it becomes necessary. Roles, responsibilities, and actions required are specified according to the Alert Level.

A. Ice Alert Levels

ALERT LEVEL	TIME CALCULATION	STATUS
Green	Alert Time is greater than 24 hours	Normal operations
Blue	Alert Time is greater than 12 hours Less than 24 hours	Initiate risk assessment Validate secure times (ST) & move time (MT)
Yellow	Alert Time is greater than 6 hours Less than 12 hours	Limited well operations in line with COCP, Commence securing well
Red	Alert Time is less than 6 hours	Well securing operations completed. Commence anchor recovery operations.
Black	Drillsite evacuated	Move drilling unit to a safe location

HT = Hazard Time
MT = Move Time
ST = Secure Time
T-Time (Total Time) = ST + MT
AT = Alert Time
AT = HT – T-Time

Guidance Note:

If the Alert Time (AT) value becomes negative at any time well securement and drillsite evacuation contingency plans will be initiated. Ice Alert Roles and Responsibilities
The following tables summarize roles, responsibilities and actions required for key on-site personnel for each Ice Alert Level.

ROLES AND RESPONSIBILITIES FOR ALL ALERT LEVELS

Drilling Unit Master / OIM	Shell Ice Advisor Drilling Unit	Shell IMV Ice Advisor	IMV Master	Rig Manager – Noble Drilling OIM – Transocean Drilling Unit	Shell Drilling Supervisor Drilling Unit
The Master / OIM is the person in charge (PIC) of the drilling unit. He is the final authority in regards to safety of the vessel, crew and compliment. All changes of Alert Level are issued by the Master / OIM. The responsibility to evacuate the drillsite in response to a hazard rests with the Master / OIM. Evaluates information from SIWAC, IAs and Vessel Management Team (VMT). Establishes MT in conjunction with the AHTS Masters. Establishes Ice Alert Level on advice from IA and is responsible for ice management operations. Ensures Alert Level status is broadcast to fleet and internally throughout drilling unit at intervals dependent on Alert Level or at change of Alert Level.	Collates and evaluates information from the SIWAC, IMV IAs and VMT. Advises Master / OIM on establishing Ice Alert Level. Directs ice management operations as required. Correlates Secure Time (ST) and Move Time (MT) with information from rig operations. Establishes Hazard Time (HT) in conjunction with IMVs and advises Master / OIM and VMT. Works in conjunction with IAs on IMVs to develop and establish effective ice management strategies and advises Master / OIM. Ensures current ice drift is broadcast to fleet, and liaises with SIWAC.	The IA is Shell's IM representative onboard the IMVs and is the primary contact for all communications with the Master / OIM. He advises the IMV Master in executing the ice management strategies. Works in conjunction with Master of IMVs to determine the local ice conditions and hazardous ice. Works in conjunction with drilling unit IA and IMV Master to develop and implement effective ice management strategies. Provides feedback on effectiveness of strategy and reports any anomalies pertaining to ice.	The Master is the PIC of the IMV. He is the final authority in regards to safety of the vessel, crew and complement. Evaluates advice from SIWAC and IAs (drilling unit and IMVs). Works in conjunction with IA on drilling unit and IA of IMV to develop and execute effective ice management strategies within the capability of the vessel. Provides feedback on effectiveness of the strategy to the IA on the IMV. Reports to IMV IA any condition which inhibits vessel performance.	The Rig Manager / OIM is the drilling contractor on-site supervisor responsible for all drilling-related operations aboard the drilling unit. Establishes (ST) and informs VMT of (ST) and well conditions. Validates drilling team is aware of their duties under present Ice Alert status. Validates well secure contingency plans.	The Drilling Supervisor is the senior on-site Shell supervisor with responsibility for overseeing drilling and well operations and for initiating spill response as the Onsite Incident Commander for spills originating from the well site. Validates well ST in conjunction with the Rig Manager / OIM. Informs Master / OIM regarding ongoing and upcoming critical operations and curtailment plans. Communicates status of well and Ice Alert level to Shell shore management and SIMOPS coordinator Under the authority of the Shell Wells Operations Team Lead, the Shell Drilling Supervisor may raise the Ice alert level at any time. He may order the suspension of drilling operations, and securing of the well.

Alert	Condition	VMT Meeting Frequency	Drilling Unit	Shell Ice Advisor Drilling Unit	Shell IMV Ice Advisor	IMV Master	Rig Manager – Noble Drilling OIM – Transocean Drilling Unit	Shell Drilling Supervisor Drilling Unit
Green	Alert Time is greater than 24 hours.	Every 24 hours, or more frequently as needed.	Discharges duties as per accountabilities	Discharges duties as per accountabilities.	Discharges duties as per accountabilities.	Discharges duties as per accountabilities.	Discharges duties as per accountabilities.	Discharges duties as per accountabilities.
Blue	Alert Time is greater than 12 hours and less than 24 hours.	Every 12 hours, or more frequently as needed.	Ensures readiness to execute contingency plans. Ensures primary IMV is available to execute Ice Management strategies for the given ice regime. Ensures AHTS / IMV readiness for ice management and anchor handling operations.	Establishes Ice Management Strategies in conjunction with IMVs and IA onboard IMVs. Directs ice management operations	Proposes appropriate Ice Management Strategies based on real time assessment of the Ice Regime and advises IMV Master and drilling unit IA. Validates readiness of IMV to execute ice management strategy.	Executes Ice Management Strategies in conjunction with IA on IMVs. Establishes and states readiness of IMV to execute ice management strategy.	Establishes ST and assesses upcoming well operations for changes to ST with regard to COCP. Informs VMT of ST and well conditions. Validates securing contingency plans.	Validates ST in conjunction with the Rig Manager / OIM. Informs Master / OIM regarding ongoing and upcoming critical operations and COCP. Reports Alert changes to Shell shore-based management and SIMOPS coordinator
Yellow	Alert Time is greater than 6 hours, and less than 12 hours.	Every 6 hours, or more frequently as needed.	Establishes and Validates MT. Establishes departure strategy. Ensures Alert status is broadcast to fleet and internally at 1-hour intervals or at change of Alert Level.	Establishes HT, and advises Master / OIM and VMT. Works in conjunction with IA on IMVs to initiate ice management strategies. Directs ice management operations Ensures current ice drift is broadcast to fleet.	Implements ice management strategies as directed by drilling unit IA in conjunction with IMV Master. Provides feedback on effectiveness of strategy.	Executes ice management strategies as directed by drilling unit IA. Provides feedback on effectiveness of the strategy.	Commences securing well in accordance with agreed plan. Informs VMT of progress.	Monitors Well Securing Operations and effectiveness of ice management operations. Communicates overall drilling unit status to Shell shore management and SIMOPS coordinator

Red	Alert Time is less than 6 hours.	Every hour.	Initiates departure plans following confirmation from Rig Manager / OIM that the Lower Marine Riser Package (LMRP) has been retrieved and secured and guide wires are released. Ensures Alert status is broadcast to fleet and internally. Directs AHTS activities.	Assesses effectiveness of Ice Management Strategy in line with ongoing operations. Directs ice management operations and assists Master / OIM as needed. Ensures current ice drift is broadcast to fleet during anchor recovery operations.	Continues to implement ice management strategies in support of drilling unit and anchor recovery operations.	Executes ice management strategies as directed by drilling unit IA. Conducts activities associated with releasing the drilling unit from moorings as directed by Master or OIM.	Confirms well is secured and that LMRP is disconnected, retrieved and secured. Commences securing drill floor for departure from site.	Monitors rig securing operations and departure plan. Communicates status to Shell shore management and SIMOPS coordinator Organizes additional support as needed for site departure operations (for example logistics).
Black	Drill site evacuated	As needed.	Directs operations leading to safe departure from drill site to pre-agreed safe area. Complies with all regulatory reporting requirements (internal and external). Works with VMT and IA and IMVs to establish further course of action.	Continues to monitor ice conditions. Works in conjunction with IMV IAs to plan a route to safe area and passes routing to Master. Provides Master / OIM and VMT with information to aid further decision making.	Advises IMV Master on operations leading to safe transit from drill site to pre-agreed safe area. Provides information to drilling unit Master /OIM to aid further decision making.	Works under direction of the drilling unit Master and IMV IA during transit.	Confirms drill floor and associated areas are secured and ready to depart drill site. Provides information to Master / OIM and VMT to aid further decision making.	Informs Shell shore management and SIMOPS coordinator of evacuation. Complies with all regulatory reporting requirements (internal and external). Provides information to Master / OIM and VMT to aid further decision making.

VI. ICE MANAGEMENT PHILOSOPHY

An effective Drilling Ice Management Plan is designed to enable execution of the exploration program, with the appropriate barriers in place to manage and mitigate against risks associated with ice. Additionally, it also identifies the worst case scenario that is caused by the failure of barriers and addresses the procedures to deal with consequences of escalation.

The worst case scenario for the purpose of the DIMP is the forced and uncontrolled departure of the drilling unit from the drillsite by incursion of hazardous ice. This section addresses the activities associated with ice management as a barrier to this worst case scenario. The strategy to prevent this event is to have the following elements as effective barriers:

- proper equipment,
- skilled people,
- appropriate information, and
- work processes

The key elements identified above are discussed herein.

A. Proper Equipment

- The Primary IMVs will have the appropriate ice class with ice breaker capabilities and have been contracted to support the exploration campaign.
- IceNav: The drilling units and IMVs will be outfitted with IceNav Equipment (Enhanced radar imaging of ice and geo-synchronized satellite imagery).
- *Tor Viking II* and *Aiviq* are high specification anchor handling vessels and have been designated as the secondary IMVs and anchor handling vessels.
- Ice reconnaissance aircraft capability

B. Skilled People

- The drilling units and all IMVs will carry specialist IAs, in addition to the regular crew complement.
- The drilling units will have two IA's onboard for 24/7 coverage.
- The Primary IMVs will have two IA's onboard providing 24/7 coverage.
- The Secondary IMVs will have one IA onboard.
- The IAs supporting the exploration campaign will have documented experience of having performed ice management activities associated with supporting offshore exploration.
- SIWAC will be staffed with world-class industry-acknowledged experts in weather, satellite, and Ice Synoptic analysis.
- Qualified and experienced ice observers for ice reconnaissance flights.
- IMVs will have crews who are experienced operating in ice.

C. Appropriate Information

A multi-layered, systematic approach is taken to provide relevant information from SIWAC with a feedback loop from the vessels using:

- Wide Area Satellite Imagery
- High Resolution Satellite Imagery
- Meteorological Buoys
- Field Observation from IMV ice reconnaissance
- Numerical Models
- Local Radar
- Vessels are outfitted with Fit for Purpose Data and Communications link

D. Work Process

A systematic approach for risk mitigation is adopted by developing effective work processes.

- Development of effective ice management strategies based on available information (Global and Local)
- Deployment of assets to deliver strategy:
- Threat Sectors identified
- Assess manageability of ice feature (preferably by trial breaking as this is the only way to determine manageability)
- Appropriate management of ice feature (breaking/deflecting)
- Primary Icebreaker deployed at an effective perimeter to reduce floes to manageable size in advance of Hazardous Ice triggering an increase in Alert Level
- Scheduled VMT meetings (Frequency Dictated by Alert levels)
- Planning/Coordination meetings with specific focus on Ice Alert Levels

VII. WELL SUSPENSION PROCEDURES

Effectiveness of the DIMP is dependent upon being able to accurately establish HT, ST and MT. ST is time taken to secure the well, disconnect and retrieve the LMRP.

As part of securing the well, well suspension procedures have been established. These procedures will be contained within the drilling unit operating procedures. Return to the drill site following exit due to the threat of Hazardous Ice is covered in Section IX.

A. Well Suspension Options

Securing and suspending the well can be accomplished by several means. The base case is to suspend the well with mechanical and/or cement plugs. This method is to be used for Ice Alert Level calculations. Should ice or well conditions develop where ST must be reduced, the following contingencies and options or combination thereof can be chosen. The option or contingency will be dependent upon well conditions, environmental conditions and (or) equipment limitations. Shell will employ the most effective suspension procedure under the specific circumstances at the time.
Relevant information associated with well suspension will be documented in the daily drilling reports. The BSEE field representative will be apprised, and relevant records will be submitted to BSEE. Potential well suspension options are listed in the following table.

	Mechanical Plugging	Drill pipe Hang-off	Pull Out of Hole	Shearing Drill Pipe	Dropping String
Time Required / Preference	Requires most time. Is the base case procedure for securement and for Ice Alert Level calculation.	Less time than plugging.	Potentially less time, depending upon position in hole.	Least amount of time. Stuck pipe contingency.	Comparable to shearing drill pipe. Contingency to cope with mechanical hoisting failure.
Provides wellbore Isolation	Yes	Yes (blind/shears closed)	Yes (blind/shears closed)	Yes (blind/shears closed)	Yes (blind/shears closed)
Hang-off Sub (HOS) Required	No	Yes (Emergency Drill Pipe Hang-off Tool)	No	No	No
Packers / Bridge Plug Required	Yes	No	No	No	No
Potential to Leave String in Hole	Yes, if suspended below packer.	Yes	No	Yes, but access to pump through sheared string is questionable.	String in hole but requires fishing trip and overshot to circulate.
Remarks	Mechanical plugs are preferred method in cased hole.	In this case, no down hole plugging has been assumed.	This method is acceptable in situations where casing has been run and cemented, but not drilled out yet. Pipe can be pulled and blind/shears closed without further containment.	Contingency for stuck pipe situation.	Contingency to cope with mechanical hoisting failure.
Advantages	Provides complete wellbore isolation. Equipment readily available.	Provides wellbore isolation via blind/ shear rams. Equipment readily available. Can be done in a timely manner. Leaves kill string in place for potential well control requirements.	Requires less time in situations where casing has been run but not drilled out, or if already out of the hole as noted above, for logging or changing the Bottom Hole Assembly.	Quickest way to secure the well and prepare for move-off.	Next to shearing, quickest way to prepare rig for move-off. Also leaves the top of the string in the hole undamaged and ready for recovery or circulating via overshot and packoff.
Disadvantages	Takes longer. Packers require additional tripping. Cementing requires mixing/ pumping time and introduces potential for contamination.	No down hole wellbore isolation.	Not a preferred method with open hole conditions because no pipe is left in the hole for potential well control methods. No down hole wellbore isolation.	Potential to leave a deformed pipe profile complicating fishing and circulating operations.	No down hole isolation is accomplished. Requires fishing trip to reestablish down hole circulation.

VIII. MOORING SYSTEM RECOVERY / DISCONNECTION

A. Conditions Present to Initiate Mooring System Disconnection or Recovery

This section addresses mooring disconnection / recovery operations if ice conditions have triggered an Ice Alert Level of yellow and escalated to a red. The following discussion assumes the well has been secured and all recoverable well related equipment has been retrieved and secured.

B. Disconnection / Recovery Options

Mooring System disconnection / recovery can be accomplished by several means. The base case is to recover moorings in the conventional manner. This method and the resultant MT is to be used for the determination of the Ice Alert Level. In the event conditions develop where the drilling unit must reduce MT, the selection of a specific contingency option and the execution of the procedures rests with the drilling unit Master / OIM who informs the VMT. Potential options and contingencies are listed in the table below.

Guidance Note: Conventional recovery for the Noble Discoverer refers to the disconnection of the drilling unit mooring lines from the pre-laid anchor system by an anchor handler. For the Polar Pioneer conventional recovery refers to recovery and racking of the complete anchor system

C. Mooring System Release / Recovery

		Contingency Mooring Release Options	
	Conventional Mooring Recovery	**Rig Anchor Release (RAR)**	**Running off Wires**
Time Required / Preference	Requires most time. Is the base case procedure for recovery	Less time than conventional recovery	Contingency plan if RARs fail to activate.
Advantages	System is intact. Ready for redeployment.	Reduced MT	Allows disconnection of mooring system in event of RAR failure.
Disadvantages	None	Increased redeployment time. Requires back up equipment. Relies on actuation by acoustic release.	Complicates redeployment. High potential for seabed fouling. Potential to compromise the mooring system.

Guidance Note: The drilling units will have a RAR release command unit onboard. A second RAR release command unit will be onboard the IMV / anchor handler.

IX. MOVING ONTO OR RETURNING TO THE DRILLSITE

The authority to move on to or return to the drillsite will be issued by the Shell Wells Operations Team Lead with the concurrence of the OEMT Shell Drilling Supervisor and Rig Manager / OIM. Relevant regulatory authorities will be notified in accordance with the requirements.

A thorough reconnaissance of ice regimes in the vicinity will be conducted and hazardous features plotted prior to commencing mooring operations.

An Ice Alert Level of green, together with a favorable ice condition forecast is required before mooring commences.

Recognizing HT will be the only argument available for the Alert Level calculation before mooring, a minimum HT of 60 hours and a minimum distance of 30 miles to Hazardous Ice is required to give a reasonable period of time to set moorings and stay within Green Alert at completion of mooring.

Upon authorization by the Shell Wells Operations Team Lead, the final decision to move on to or return to the drillsite is dependent upon the drilling unit Master or OIM who is advised by the VMT. The Master / OIM and VMT will assess the various operational, weather and ice parameters with input from the drilling unit IA supported by the IMV Masters and the IAs to determine the practicality of the decision. A decision to commence mooring operations assumes a realistic expectation that the drilling unit will be able to stay on location and commence drilling operations for a productive length of time. The OEMT will be informed of all decisions as they are made.

X. TRAINING

All personnel will be made aware of their roles and responsibilities within this DIMP through a training session on each vessel. This training will also include a Table Top Exercise, which will be executed prior to beginning operations, providing exposure to and test communications and procedures of the COCP, and the DIMP. Participants at the table top exercise will include:

- Shell and Wells leadership
- Rig Crews (both Drilling and Marine Contractor staff)
- Oil Spill Response (OSR) representative
- SIWAC representatives
- BSEE Operations representatives
- IMV Masters or Senior officers
- IAs
- Alaska Logistics (Marine and Aviation) Representatives
- SIMOPS Coordinators

Observations from the Table Top Exercise will be documented.

XI. ATTACHMENTS

Attachment 1 – Extract from Critical Operations Curtailment Plan

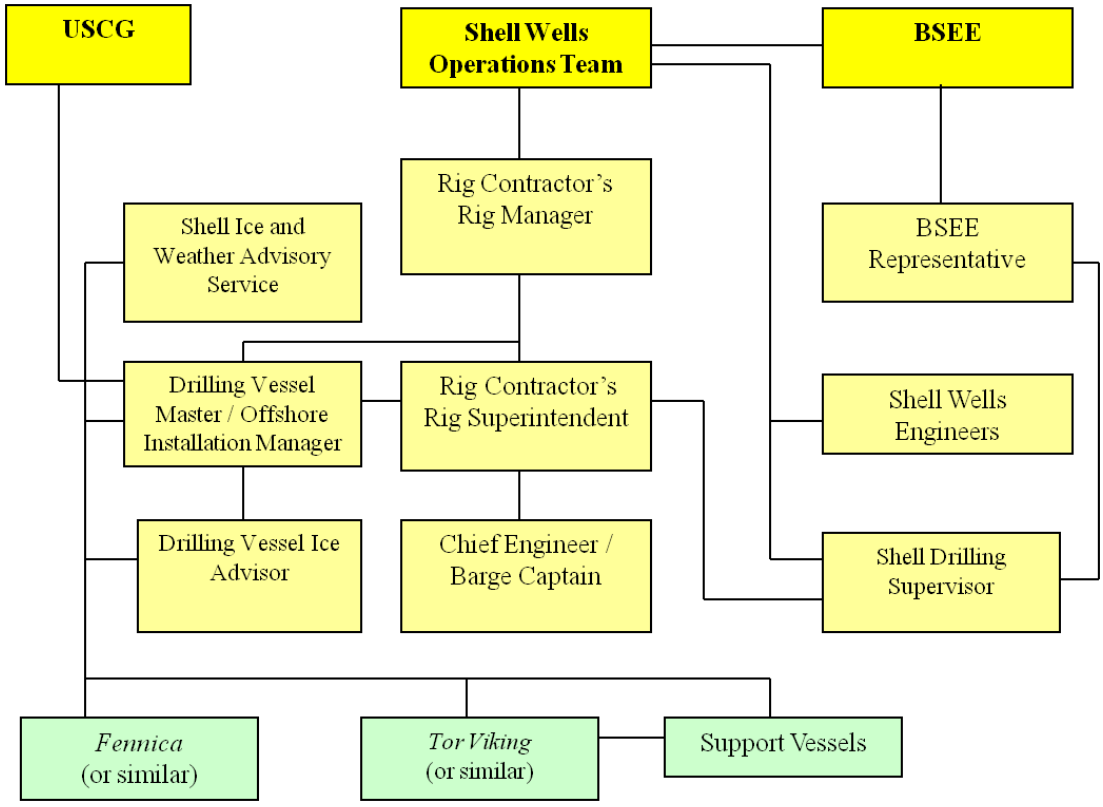
Per Section 8 of the COCP:

Notification of the decision for curtailments to Shell, USCG and BSEE agency representatives will be made as soon as practical, but in a manner that does not interfere with the safety of the crew, environment, or vessel. All operations curtailment decisions will be documented on the Shell Daily Operations Report and conveyed to the on-site BSEE representative as they develop. Operations curtailment decisions will also be formally conveyed to BSEE on a weekly basis via the Well Activity Report and at the end of the well operations as part of the End of Operations Report. The following chart illustrates the lines of communication in the field and from the field to the shore base.

Guidance Note:

Well Suspension procedures are described in step by step detail in a document called Secure Times and Procedures contained within Shell Applications for Permit to Drill (APD) which have been submitted to BSEE under portions of 30 CFR 250 and less so under 30 CFR 550. These Secure Times and Procedures were submitted to BOEM under 30 CFR 550.213(g)

The following chart illustrates the lines of communication in the field and from the field to the shore base.



Attachment 2 – Vessel Description

"*Noble Discoverer* Specifications"

***NOBLE DISCOVERER* SPECIFICATIONS**	
TYPE- DESIGN	Drillship - Sonat Offshore Drilling *Discoverer* Class
SHAPE	Monohull with sponsons added for ice-resistance1
SHIP BUILDERS & YEAR	Namura Zonshno Shipyard, Osaka, Japan - hull number 355
YEAR OF HULL CONSTRUCTION	1965
YEAR OF CONVERSION	1976
DATE OF LAST DRY-DOCKING	2014

***NOBLE DISCOVERER* DIMENSIONS**		
LENGTH	514 ft	156.7 m
LENGTH BETWEEN PERPINDICULARS (LBP)	486 ft	148.2 m
WIDTH	85 ft	26 m
MAXIMUM (MAX) HEIGHT (ABOVE KEEL)	274 ft	83.7 m
HEIGHT OF DERRICK ABOVE RIG FLOOR	175 ft	53.3 m

***NOBLE DISCOVERER* MOORING EQUIPMENT**	
Anchor pattern symmetric 8 point system. The unit is fitted with Sonat Offshore Drilling patented roller turret mooring system giving the unit the ability to maintain favorable heading without an interruption of the drilling operations.	
ANCHORS	Stevpris New Generation 7,000 kilograms (kg) each (ea) 15,400 pounds (lb) ea.
ANCHOR LINES	Chain Wire Combination
SIZE/GRADE	2.75-in. wire 3-in. ORQ Chain
LENGTH	2,750 ft (838 m) wire + 1,150 ft (351 m) chain (useable) per anchor

***NOBLE DISCOVERER* OPERATING WATER DEPTH**	
MAX WATER DEPTH	1,000 ft (305 m) with present equipment (can be outfitted to 2,500 ft [762 m])

MAX DRILLING DEPTH	20,000 ft	6,098 m

DRAW WORKS	EMSCO E-2,100 - 1,600 horsepower (hp)
ROTARY	National C-495 with 49 ½ -in. opening
MUD PUMPS	2 ea. Continental Emsco Model FB-1600 Triplex Mud Pumps
DERRICK	Pyramid 170 ft. with 1,300,000 lb nominal capacity
PIPE RACKING	BJ 3-arm system
DRILL STING COMPENSATOR	Shaffer 400,000 lb with 18-ft (5.5 m) stroke
RISER TENSIONS	8 ea. 80,000 lb Shaffer 50-ft (15.2 m) stroke tensioners
CROWN BLOCK	Pyramid with 9 ea. 60-in. (1.5 m) diameter sheaves rated at 1,330,000 lb
TRAVELING BLOCK	Continental - Emsco RA60-6
BLOWOUT PREVENTER (BOP)	Cameron Type U 18 ¾ -in. (48 cm) x 10,000 pounds per square in. (psi)
RISER	Cameron RCK type, 21-in. (53 cm)
TOP DRIVE	Varco TDS-3S, with GE-752 motor, 500 ton
BOP HANDLING	Hydraulic skid based system, drill floor

***NOBLE DISCOVERER* DISPLACEMENT**	
FULL LOAD	20,253 metric tons (mt)
DRILLING	18,780 mt (Drilling, max load, deep hole, deep water)

***NOBLE DISCOVERER* DRAUGHT**		
DRAFT AT LOAD LINE	27 ft	8.20 m
TRANSIT	27 ft (fully loaded, operating , departure)	8.20 m
DRILLING	25.16 ft	7.67 m

***NOBLE DISCOVERER* HELIDECK**	
MAXIMUM HELICOPTER SIZE	Sikorsky 92N
FUEL STORAGE	2 ea. 720-gallon tanks

***NOBLE DISCOVERER* ACCOMODATIONS**	
NUMBER OF BEDS	**140**
SEWAGE TREATMENT UNIT	Hamworthy ST-10

***NOBLE DISCOVERER* PROPULSION EQUIPMENT**	
PROPELLER	1 ea 15 ft 7-in. (4.8 m) diameter, fixed blade
PROPULSION DRIVE UNIT	Marine Diesel, 6 cylinder, 2 cycle, Crosshead type
HORSEPOWER	7,200 hp @ 135 revolutions per minute (RPM)
TRANSIT SPEED	8 knots

GENERAL STORAGE CAPACITIES	
SACK STORAGE AREA	934 cubic meters (m^3)
BULK STORAGE	
Bentonite / Barite	180 m^3 - 4 tanks
Bulk Cement	180 m^3 - 4 tanks
LIQUID MUD	
Active	1,200 barrels (bbl)
Reserve	1,200 barrels (bbl)
Total	1,200 barrels (bbl
POTABLE WATER	1,670 bbl / 265.5 m^3 (aft peak can be used as add. pot water tank)
DRILL WATER	5,798 bbl / 921.7 m^3
FUEL OIL	6,497 bbl / 1,033 m^3

[1] Sponsons designed and constructed to meet requirements of Det Norske Veritas (DNV Additional Class Notation ICE-05

"*Polar Pioneer* Specifications"

Transocean

POLAR PIONEER

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POLAR PIONEER
Executive Summary

INTRODUCTION TO POLAR PIONEER

- The POLAR PIONEER is a 4th generation semi-submersible rig of the Polar (Sonat)/Hitachi Design, built in 1985 by Hitachi Zosen, Ariake, Japan.
- The rig is specially designed and constructed for operation in cold, harsh, sub-zero environments.
- The rig is classified by the Norske Veritas and complies to the regulations of the flag state (NMD of Norway), UK Department of Energy and UK Health and Safety Executive and international requirements of IMO-MODU Codes and SOLAS.
- POLAR PIONEER can operate in water depths from 70 m to 500 m and is equipped with 15,000 psi well control equipment. The BOP and the choke system is specially fitted for handling High Temperature/High pressure wells.

GENERAL INFORMATION

Port of registry	Majuro, Marshall Island
Unit classification	Det Norske Veritas Classification A/S . Maltese Cross 1A1-Column Stabilised Unit
Additional class notifications	Drill, HELDK, POSMOOR(ATA), CRANE, E0, Non-selfpropelled
Rated drilling depth	7,600 m (25,000 ft) RKB
Maximum water depth	500
Minimum water depth	70 m
Rig design	Polar (Sonat)/Hitachi
Year of construction	1985
Yard	Hitachi Zosen, Ariake, Japan
No of thrusters	4 each of 2,450 kW
Transit speed towed	6 knots
Transit speed w/ thruster	6 knots
Fuel consumption, transit	40 tonne/day
Fuel consumption, drilling	25 tonne/day
Total drilling variable load	3,514 tonnes
Tot. survival variable load	3,514 tonnes
Total transit variable load	3,514 tonnes
Accommodation	110 beds
Ballast system	Four ballast/pump rooms, one in each end of the pontoons.
Helicopter deck	Arranged for S-61N and Chinook helicopter w/ refuling station.

STORAGE CAPACITIES

Diesel oil	1795 m^3
Helicopter fuel	10 m^3
Drilling water	1771 m^3
Potable water	770 m^3
Active/reserve liquid mud (on deck)	202/263 m^3
Reserve liquid mud (OBM in pontoons)	500m ^{3}
Brine/Completion fluid	457m ^{3}
Low toxic oil	770 m ^{3}
Bulk bentonite/barite	1,i76 tonnes/560 m^3
Bulk cement	690tonnes/460 m^3
Sack storage	All mud and mud additives suppled in 40 x 3 m^3 containers for automatic feeding.
Pipe/casing racks area	2330 tonnes/745 m^2
Pipe/Riser racks	2430/811m^2
BOP storage	220 tonnes /25m^2
Miscellaneous storage area	150 m^2

MARINE AND STATION KEEPING FACILITIES

Power Plant, diesels	Five Bergen Diesel KVG-18 of 2,750 kW each, in two separate engine rooms. Total power: 13,750 kW
Power Plant, Generators	Five each Nebb,of 6000V, 2750 kW, in two separate engine rooms.
Power distribution	Sixteen ABB SCR's, 8680 kW
Emergency Power	Dieselgenerator 1 x MTU 12-396 of 1137 kW w/ separate 440V switchboard.
Posision keeping/Thrusters	8-point anchor spred plus four azimuths thrusters, each of 2,400 kW
Positioning System	Acoustic, Kongsberg K-Pos DPM 11 - Positioning Mooring System

AUXILIARY EQUIPMENT

Cranes	One each Brattvaag Crane Port : 30 mt @ 14 m outlay , max sea 2,0 m Hs 15 mt @ 40 m outlay, max sea 0,5 m Hs One each Liebherr BOS 4200 - 50 Litronic Crane Stb.: 50 mt @ 18 m outlay ,max sea 2,2 m Hs, 25 m/s wind 11,2 mt @ 56 m outlay, max sea 1,0 m Hs
Lifesaving equipment	As per SOLA and NMD
Fire fighting equipment	As per SOLA and NMD
Boilers	Two Aalborg Industries MISSION TM OS, 2 x 6000 kg/h
Watermakers	Three Nirex JWP-36-125 75 mt/day
Sewage/Pollotion Control	Closed drain system for OBM and cutting transport system for OBM cuttings.

DRILLING EQUIPMENT

Derrick	453 mt (1000,000 lbs) nom. Cap.
Racking platform	Capacity:6 5/8" DP: 110 stds. Capacity:5" DP: 65 stds. Capacity 9 1/2" DC: 9 stds.
Drillpipe handling syst, remote controled equipm	Vertical handling with upper and lower racking arm and for bringing tubulars from rack to drill floor
Drawworks	Continental Emsco C3, 3000 hp, 1.5" drilling line, Baylor 7838 eddy current brake
Crown block	650 tons (590 mt)
Travelling block	650 tons (590 mt)
Hook	650 tons (590 mt)
Drill string motion	MH-CBC 270-25, Stroke 7.6 m
Compensator (Crown Mounted)	Capacity – compensated: 277 mt Capacity – locked: 453 mt
Active Heave Compensator	Mercur/MH. 15 tons – 7,6 m stroke
Rotary table	Cont. Emsco T4950-65, 49 1/2"
Top drive	Maritime Hydraulics/DDM 650-HY Rated capacity 590 mt
Iron Roughneck	MH Type 1898 Range 3-1/2"thru 9-3/4". Remote controlled
Mud pumps. 3 each.	5000 psi WP. Cont. Emsco FB1600 7"x12" with 2 x GE 752 R motors. Each rated to 1200 kW cont. service
Shale Shakers	5 each Thule VMS 100

SUBSEA/WELL CONTROL EQUIPMENT

BOP stack	Hydril 18 3/4" 15,000 psi WP. Rated for H2S service. Consisting of: • WH Connector , type Vetco H4 ExF 18-3/4" 15K. • Two double "Hydril" MPL Ram Bops 18-3/4" 15K with 22" Shear Ram Bonnets • One Annular Preventer, type Hydril GX, 10,000 psi WP. • Cameron 18-3/4" 10K Mod 70 Riser Connector. • Eight K & C Failsafe valves, type CIW, DF, 3-1/16", 15000 psi WP
BOP Control System	Valvcon Hydraulic control system and an acoustic emergency control system
Marine Riser	Hughes 21" OD x 20"ID Model, HMF, 3 1/2" ID Kill and Choke lines, WP 15,000 psi, 4" ID Booster line, WP 3000 psi , Sufficient riser for 450 m water depth
Telescopic Joint	Two ea Hughes HMF, telescoping joint , double seals, support ring with integrated kill/choke and booster lines.
Choke and Kill System	WOM 15,000 psi, 2-9/16", one manual, two remote controlled chokes, fitted with temp gauges for HP/HT wells.
Buoyancy Modules	Make: Eccofloat, for 15 joints.
Diverter BOP	Hughes KFDS, 49 1/2" opening
Riser tensioners	Eight tensioners, each rated for 100 kips

Last Update: 30.06.09

POLAR PIONEER
Capabilities and Marine Equipment

INTRODUCTION TO POLAR PIONEER

- The POLAR PIONEER is a 4th generation semi-submersible rig of the of Polar (Sonat)/Hitachi Design, built in 1985 by Hitachi Zosen, Ariake, Japan.
- The rig is specially designed and constructed to operate in cold, harsh, sub-zero environments.
- The rig is classified by the Norske Veritas complies and to the regulations of the flag state (NMD of Norway), UK Department of Energy and UK Health and Safety Executive and international requirements of IMO-MODU Codes and SOLAS.

POLAR PIONEER can operate in water depths from 70 m to 500 m and is equipped with 15,000 psi well control equipment. The BOP and the choke system is specially fitted for handling High Temperature/High Pressure wells.

GENERAL INFORMATION

Unit Name	POLAR PIONEER
Unit Owner and Operator	Transocean Offshore Inc.
Flag/Port of registry	Majuro, Marshall Island
Unit classification	Det Norske Veritas Classification A/S . Maltese Cross 1A1-Column Stabilised Unit.,
Additional class notifications	Drill, HELDK, POSMOOR(ATA), CRANE, E0, ICE T. NON-SELFPROPELLED
Rated drilling depth	7,600 m RKB
Maximum water depth	500 m
Minimum operating water depth	70 m
Rig design	Polar (Sonat)/Hitachi
Year of construction	1985
Yard	Hitachi Zosen, Ariaki, Japan
Year placed in service	1985
Unit shape/unit design	8 x columns x 2 pontoon supported semi- submersible
No of thrusters	4 each of 2,450 kW
Transit speed towed	6 knots
Transit speed thrusters	6 knots
Positioning system (anchor, DP, combined)	Eight point anchor/chain system, automatic thruster assisted (ATA)
Main deck width	71m. Breath all over: 89m
Main deck length	85m. Length all over: 122m
Depth keel to main deck	41.65 m
Draughts, Drilling	23 m - Displacement: 46,440 tonnes
Draught, Survival	19 m - Displacement: 43,312 tonnes
Draught, Transit	9.15 m - Displacement: 32,554 tonnes
Total drilling variable load, ex. anchor tension	3.514 tonnes
Total survival variable load	3.514 tonnes
Total transit variable load	3.514 tonnes
Accommodation	Maximum 110 people in two-men cabins
Helideck designed for	Chinook and Sikorski S61N

ENVIRONMENTAL CRITERIA FOR OPERATION

ENVIRONMENTAL CONDITIONS	SURVIVAL CONDITIONS	LIMITING OPERATION CONDITION DRILLING
Wind speed	55 m/s 10 min average	30 m/s
Wave height	H_{max} 32 m)	Hmax 13.8 m
Mean wave period	11-15 s	12 s
Current speed	1.6 m/s	0.75 m/s

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POLAR PIONEER
Capabilities and Marine Equipment

STORAGE CAPABILITIES AND MARINE EQUIPMENT

Storage capacities

Diesel oil	1,795 m^3
Helicopter fuel	10 m^3
Fuel consumption, transit	40 tonne/day
Fuel consumption, drilling	25 tonne/day
Drilling water	1771 m^3
Potable water	770 m^3
Active/Reserve liquid mud(on deck)	202 m^3 /263 m^3
Reserve liquid mud (in pontoons)	500 m^3
Brine/low toxic oil storage	457 m^3/770 m^3
Bulk bentonite/barite	560 m^3
Bulk cement	360 m^3
Sack storage	All mud and addetives supplied in 40x3m^3 cont. for auto-feeding
Pipe racks area	2330tonnes/745m^2
Riser racks	2430tonnes/811m^2
BOP storage	220 tonnes /25m^2
Miscellaneous storage area	150 m^2

Rig power plant

Complete power system comprising of diesel driven generator sets supplying AC and DC power. In the drilling mode sufficient power are available to control and power simultaneously two mud pumps and top drive both at full load and the drawworks at half load with thrusters working to assist positioning unit and with one diesel engine generator as a stand-by.

Diesel engine plant

5 each diesel engines, in two engine rooms
Make Bergen Diesel.
Type KVG-18, each 2750 kW
Total output, 13,750 kW at 720 rpm.
Independent fuel supply to each engine and automatic engine shut down in case of 'racing'.

AC - Generator

One generator set, capable of taking the peak demand, with a second as a 100% stand-by.

Quantity	5
Make	NEBB
Type,	WAB 900 G10 HW
At rotation speed of	720 RPM
Continuous output	2,750 kW
Output Voltage	6,000 V

Emergency generator

One emergency generator set of 1137 kW
complete with its own switch board and wiring. The emergency system is completely independent of the main system and powers all emergency lightning and functions .

SCR system

Number of SCRs	16
Make/Type	ABB
Maximum power	8,680 kW
Output Voltage	600 V

Transformer system

Quantity	2
Make/Type	National Ind.
Continuous power	4,000 KVA
Output Voltage	6000, 440, 220, 230 V
Frequency	60 Hz

Propulsion/thrusters

4 each azimuth thrusters.

Type	Liaaen TNCP 105/75-280
Motors	NEBB
Output	2400 kW

Positioning System

Subsea Acoustic	Transponder System
Type	Kongsberg K-Pos DPM 11 - Positioning Mooring System
Pos. ref	Kongsberg Simrad HPR 309
Type	Furuno GPS/WAAS Navigator GP32

Mooring System

8 point spread, 45^0 between the anchor lines.
4 double Pusnes, 750cu windlasses.
8 Anchors, type Stevepris MK6, 15 tonnes.
8 Anchor Chains, Type K4, 84 mm, 737 tonnes breaking strength, 151 kg/m, 2000 m each..
The mooring system is thruster assisted.

Telecommunication equipment

- VHF-AM aeronautical radio equipment. Minimum output power 15 W. Frequency continuously selectable.
- Aeronautical Non-Directional Beacon. Minimum output power 50 W.
- Sailor Compact-GMDSS station (GMDSS/DSC) VHF/MF/HF.
- V-SAT, telefon/fax/data.
- Iridium Scansat-7701 Sat. telephone

Evacuation Systems

Survival craft

Make	Umoe Scat-Harding A/S
Type	28 MCR & 28 MCB - Fire protected
Quantity	2 + 2
Capacity persons	2 x 50 / 2 x 60

Life rafts

Make/Type	Viking KF
Number on board	6
Capacity each	20

Rescue boat x 2

1. Make/type: MP-741 Springer
2. Make/type: Watercraft WH FPB 650 DJ

Weather limitations on launching; Wave height 2.5 m. Wind 21 knots.

Safety Equipment

The unit is equipped with safety equipment according to IMO Code, and Norwegian Regulations.

Firefigting Equipment

The unit is equipped with fire fighting equipment according to IMO Code and Norwegian Regulations.

Fire and gas detection Equipment

The unit is equipped with fire and gas detection equipment according to IMO Code and Norwegian Regulations.

Last Update: 30.06.09

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POLAR PIONEER
Drilling Equipment

AUXILIARY EQUIPMENT

Revolving cranes

One each Brattvaag Crane
Port : 30 mt @ 14 m outlay , max sea 2,0 m Hs
15 mt @ 40 m outlay, max sea 0,5 m Hs
One each Liebherr BOS 4200 - 50 Litronic Crane
Stb.: 50 mt @ 18 m outlay ,max sea 2,2 m Hs, 25 m/s wind.
11,2 mt @ 56 m outlay, max sea 1,0 m Hs
The cranes are fitted with instrumentation, safety devices and alarms according to Norwegian regulations.

Overhead deck cranes for pipe handling in accordance with Norwegian Regulations

3 each Pipe Rack Overhead Crane for tubular handling. Make: Miko, Cap: 20 tonnes SWL.
Equipped with lifting arrangements.
1 each Riser Rack Overhead Crane for Riser handling.
Make: Miko. Cap: 23 tonnes SWL.

Pneumatic winches

Make	Atlas Copco
Type	A32TB
Capacity in Tonnes	3.2/5
Wire diameter in mm	19
No on drillfloor	1
No on cellar deck	4
No in tension system	8
No in derrick	1
On top of BOP crane	1
Make	Ingersoll Rand
Type	FA5i
Capacity in Tonnes	5
No on drillfloor	2

'Man-riding' winches

Satisfies NPD requirement for man riding winches

Make	Vestnorsk Engineering A/S
Locations	2 each on Drill Floor 2 each on Cellar Deck

Auxiliary machinery

3 each Water maker, Cap: 75 mt/day total
2 each , Sunrod CPH-60, Steam generators, 13,000 kg /hr
3 each Rig air compressors and 2 each bulk air compressors .
Cap. of each: 21.5 m^3/min at 8.6 bar pressure

Winterization for operation in Harsh Environmental Conditions

All escape routes are electrically heat traced.
Helicopter Deck is electrically heat traced.
All compartments are heated so that no compartment or void to have a temperature below 2^{O}C for an external temperature of -20^{O} C.
Drillfloor shielded and heated by six spot heaters , each with cap. of 35 kW, total output 210 kW.
Cellar Deck enclosed on all sides and heated by five spot heaters, total heating cap. 175 kW. Moonpool partly closed with sliding deck
Riser and Casing Deck (forward) fully enclosed .
Pipe Deck (aft) fully enclosed
Hot water taps for removal of snow and ice are available through a heat exchanger of 4,000 kg/h steam, which is connected to the general service line.

Derrick/mast

Make/type	Maritime Hydraulics
Height	51,80 m
Width of base	12 x 12 m
Width of top	5,49 x 5,49 m
Gross nominal cap.	453 mt
Number of lines	12
Setback capacity, total	255 tonnes
Hookload capacity with full setback:	409 mt

Racking platform

Make/type	MH996
Capacity of 6 5/8" DP	110 std
Capacity of 5" DP	65 std in addition to 6 5/8" DP
Capacity of 9.5" DC	9 stds

Pipe handling control cabins

Drawworks

Make/type	Continental Emsco C3
Drum type	Lebus, Grooved
Spinning cathead type	Cont. Emsco GB
Breakout cathead type	Cont. Emsco GB
Crown safety device	Crown-O-Matic & IE TBC
Sandline	NA
Drum diameter	915 mm
Max. lift cap 12 lines	453 mt
Max. lift cap 10 lines	448 mt
No. of electric motors	3
Electric motor make	NEBB
Output power	2,230 kW

Hydraulic operated emergency disk brakes

Auxiliary brake

Make/Model	Baylor Elmagco mod. 7820
Independent back-up system	Battery pack

Kinetic Energy Monitoring system

Make/type	Innduative Electronics

Crown block

Make/type	MH
Rated capacity	590 mt
No of sheaves	7
Sheave diameter	1524 mm
Sheave grooved for line	38 mm

Travelling block

Make/type	MH
Rated capacity	590 mt
No of sheaves	6
Sheave diameter	1524 mm

Drill string motion compensator (Crown Mounted)

Make	Maritime Hydraulics
Type	CBC 270-25
Stroke in m	7,6 m
Capacity - compensated	269 mt
Capacity - locked	453 mt

Active heave compensator

Make	Mercur/Maritime Hydraulics
Type	Hydraulic
Stroke	7,6 m
Capacity	max hydraulic force +- 15 mt

Rotary table

Make/type	Cont. Emsco T4950-65 Maximum opening
	1257,3 (49 1/2")
Rated capacity in mt	590

Driven by an independent electric motor,

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POLAR PIONEER
Drilling Equipment

two speed gearbox
Electric motor type/make NEBB
Output power in kW 746
Maximum continuous torque 50,000 ft lbs.

Master Bushings (split type)
Make/Type : Varco MPCH
Full range of inserts bowls to suit all contractor's tubulars and for running all standard casing sizes.

Drillpipe rack to drillfloor handling system
MHI/Miko Pipe Handling System; overhead cranes bringing tubulars into remote operated skid way, which delivers piping to the drillfloor. Satisfies latest NPD requirement.

Top drive
Make/Type : Maritime Hydraulics / DDM 650-HY
Rated capacity : 590 mt
Working pressure in bar : 350 (5000 psi)
Remote operated kelly cock : 1 ea
Hydraulic Driven by motor : 4 ea (4 x 500 ccm)
Make : Rexroth (MH)
Output torque in Nm : 54012 @ 132 rpm
Gearbox, no of gears : 3
Maximum rotary speed, RPM : 206 @ 33488 Nm
Mudline diameter in inch :3

Drill pipe
Rig is capable of handling tubulars in range from 3 ½" to 6 5/8"

Hevi-wate drill pipe
5 ½" OD, 5 ½ FH connections
5" x 50 lbs/ft, NC 50 connections

Drill collars
Rig is equipped with
9 1/2" OD, 2 13/16" ID, 7 5/8" Reg Connections,. Spiraled
8-1/4" OD, 2 13/16" ID, 6 5/8" Reg Connections, Spiraled,
6 1/2" OD, 2 13/16" ID, NC50 Connections, Spiraled

Cross-over subs
Enough cross-over subs to make up all drill and fishing string configurations of contractor's equipment.

Handling tools
Elevators and slips to handle all the Contractor's tubulars, and casing elevators and casing slips to handle standard casing strings.
Manual tongs to handle all Contractor's tubulars and standard casing strings.

Iron roughneck
Make Maritime Hydraulics
Type 1898
Range size 3-1/2" thru 9-1/2"
Remote controlled

Fishing equipment
Fishing equipment for all of the Contractor's downhole equipment.

Diverter BOP
Make : Reagan Offshore International
Model : KFDS
Size inch : 10" x 24"
WP : 35 bar
OD outlets : 49-1/2" top & bottom of housing
Insert packer size inch : 12"
Diverter flowlines : 2 each
OD of flowlines inch : 19

BOP stack
One Hydril 18 3/4" BOP stack, Working Pressure 103400 kPa (15,000 psi). Rated for H_2S service containing:

- Well head Connector, Vetco H4
- Two double "Hydril-Dual Cam" rams containing: Four ram type preventers with MPL ram locks, of which three preventers for drill pipe and one with single-piece shearing blind rams
- Acoustic control System
- 1060 litres subsea accumulators

Pipe rams available
Rams available to dress BOP with shear/blind ram and variable rams to suit ranges from 3 ½" to 7 5/8" OD
Rams dressed for Sour service

Lower Marine Riser Package
(from bottom to top:)
Hydraulic connector, Make Camerson Mod 70, Size 18-3/4", WP kPa 68900 (10,000 psi)
Bag type preventer, Make Hydril, Type "GX", Size inch 18-3/4", WP kPa 68900 (10,000 psi)
Flex joint, Make Oil State, Type Flex Joint Assy 18-3/4"

Choke and kill valves
8 each, CIW DF, 3-1/16"
WP kPa 103,400 (15,000 psi)

BOP stack handling system
The BOP is moved by skidding arrangement from storage area to moonpool and under the rotary table.
Overhead crane of 220 mt above storage for handling BOP & LMRP.
The system is fitted with a mechanical stabilising device, permitting running the BOP in 1.5^0 of roll and pitch.

Marine riser
Rig is equipped with marine riser for 450 m water depth
Make: Hughes Offshore
Model: HMF
21" OD x 20"ID
3 ½" ID Kill and Choke lines, WP 15,000 psi,
4" ID Booster line, WP 3000 psi

Telescopic joint
2 ea Hughes Offshore HMF, telescoping joint , double seals, support ring for tensioning lines and 3" bore kill and choke hoses, and booster line with WP corresponding to BOP.
Hydraulic locking of inner barrel..

Buoyancy modules
Make: Eccofloat Type RG 24
Quantity: elements for 15 joints

BOP control System
Valcon Hydraulic control system with pilot controlled subsea valves electric/pneumatic powerpack, 40 x 15 gal bottles, total capacity 2835 litres surface accumulators, 2 remote control stations and complete emergency electric and pneumatic power back-up of all control functions

Acoustic emergency BOP control system
An acoustic emergency control system , type Simrad
HPR 309, with six functions to be used in the event the BOP functions are inoperable due to a failure of the hydraulic control system.
Description of functions Controls:
LMRP Connector, 2 Pipe Rams, Shear Rams.

Choke manifold
WOM choke manifold, rated to 15,000 psi, with two Cameron remote operated chokes and 1 Cameron manually operate choke. The choke manifold is rated for H_2S service.

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POLAR PIONEER
Drilling Equipment

Riser tensioners
One marine riser tensioning system of 8 eight tensioners c/w control panel, air receivers, sheaves and wireline to give a total stroke of 15,25 m. The system is independent, having its own electrically powered compressors and chemical or refrigeration air drying unit.
8 each, make Wichman, Capacity each, 45 mt (100 kips).
Maximum cylinder stroke, 3.81 m. Total wireline travel 15,2 m
Wireline size inch, 1-3/4.

Guideline and Podline system
Guideline tensioning system complete with control panel, air receivers, sheaves and 3/4" wirelines to give a total of 12 m line travel, having a capacity of 6.8 ton each with line storage drums behind tensioners.
4 + 2 each, make Wichman, Capacity each kN 71 (16 kips)

Mud pumps
3 each mud pumps of 5000 psi WP Cont. Emsco FB1600 7"x12" with 2 x DC motors. Each pump rated to 1472 kW continuous service. The mud pumps are fed by 3 each supercharge pumps, each of 30 kW.

Mud storage capacity
2 each active mud tanks, each of 80 m^3, total 160 m^3 on deck.
4 each reserve mud tanks total of 226 m^3 on deck.
2 each mud storage tanks, total of 430 m^3 in column.
1 each base oil tanks of 770 m^3 in pontoon.
2 each brine tanks, total of 750 m^3 in pontoon.

Mud mixing system
STEP Offshore Mud Mixing System
3 each mud mixing pumps, 75 kW each.
2 each sack mixing stations with a total of 3 hoppers.
The hoppers are served by 3 surge tanks , two of 23 m^3 and one of 14 m^2 capacity.

Mud treatment system
5 each Thule VMS 100 Shale Shakers, total flowrate 4.5 m^3 /min.
16 cone Demco desilter system, fed by 75 kW supply pump. Cap. each 1,400 gpm.
1 each Brandt degasser, Cap. 3785 m^3/h.
1 each Swaco mud/gas separator an 8" nom diam vent line to top of derrick.
2 each mud centrifuges.

Cementing system
Twin Halliburton Electric powered cementing unit for 1035 bar (15,000 psi) service.
Twin batch tanks 12 m^3 each. Recalculation Averaging Mixer with capacity of 1,27 m^3/min (8 BPM) depending on slurry density.

Oil Based Mud arrangement
2 each removable Conveyor Screws are installed for transportation of cuttings from shaker into containment tanks. Space available on deck for installation of 3d party Cutting Containment System

Radar
2 each Furuno FAR-2127BB

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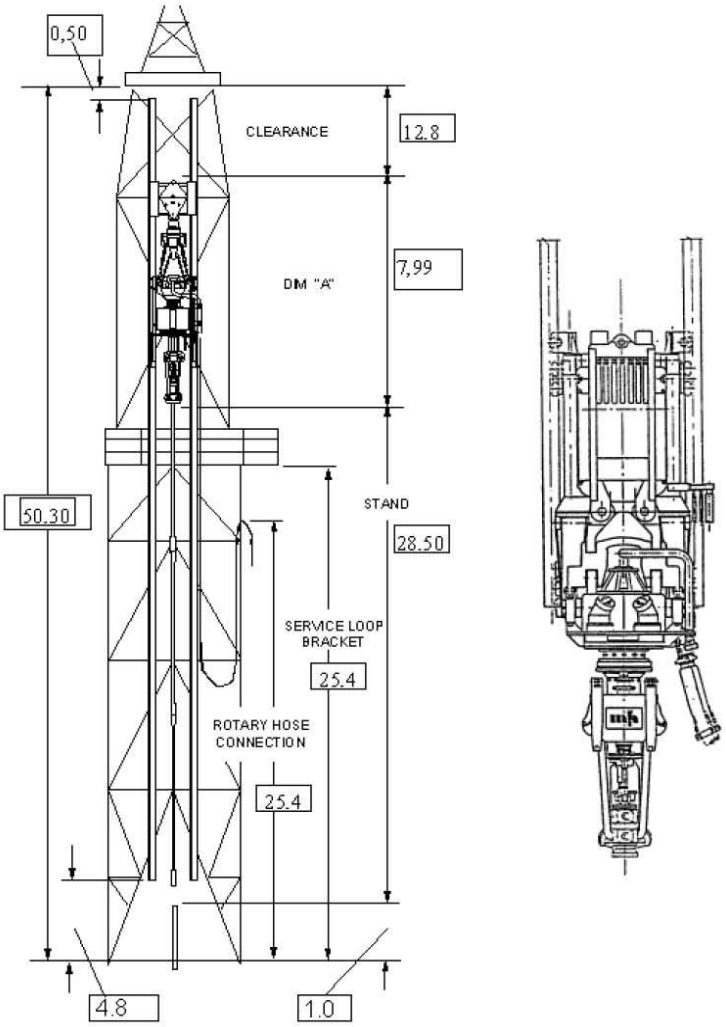
POLAR PIONEER
Hoisting Data

DERRICK HEIGHT INTERFACE REQUIREMENTS

TOP DRIVE (Make) : Maritime Hydraulic
TOP DRIVE (Type) : DDM 650 HY
All measurements in meters.



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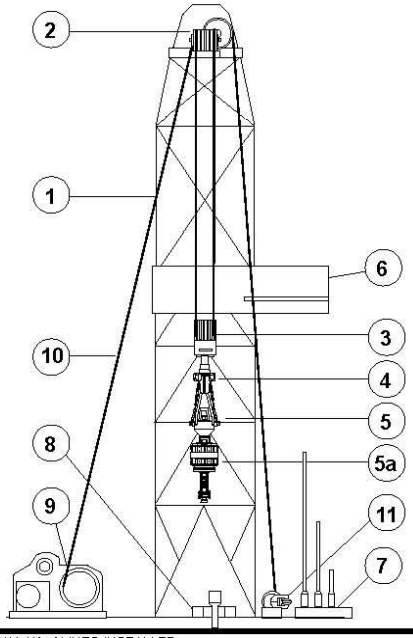
POLAR PIONEER
Hoisting Data

RIG COMPONENT HOISTING CHARACTERISTICS



MAX. LOAD CONSIDERING MAX. N° of LINES INSTALLED			
ITEM	DESCRIPTION	STATIC CAPACITY	Remarks
1	DERRICK Gross nominal capacity (mt.)	453	
	Hook load capacity (mt.)	409	Net string wt
	With max. number of lines (nr.)	12	
2	CROWN BLOCK Rated load capacity (mt.)	590	
3	TRAVELLING BLOCK Rated load capacity (mt.)	590	
4	HOOK BLOCK Rated load	NA	Not installed
5	SWIVEL HEAD Rated load capacity (mt.)	NA	Not installed
5 a	TOP DRIVE Rated load capacity (mt.)	590	
6	RAKING PLATFORM Rated load capacity (DP, DC)	5500 m DP	Total 255 mt on both setbacks
7	RIG FLOOR SET BACK Rated load capacity (mt.)	255	
8	ROTARY CASING CAPACITY Rated load capacity (mt.)	800	
9	DRAWWORK: main drum Rated load capacity (mt.)	590	Low / Low using 14 lines.
10	DRILLING LINE Rated load capacity (mt.)	97,6	Breaking load.
11	DEAD LINE ANCHOR Rated load capacity (mt.)	44,6	
	Max. load that rig can handle	453	Using 12 lines and with Safety factor 2 for the drilline.
	Due to the weakest equipment (to be specified)		Drilline.

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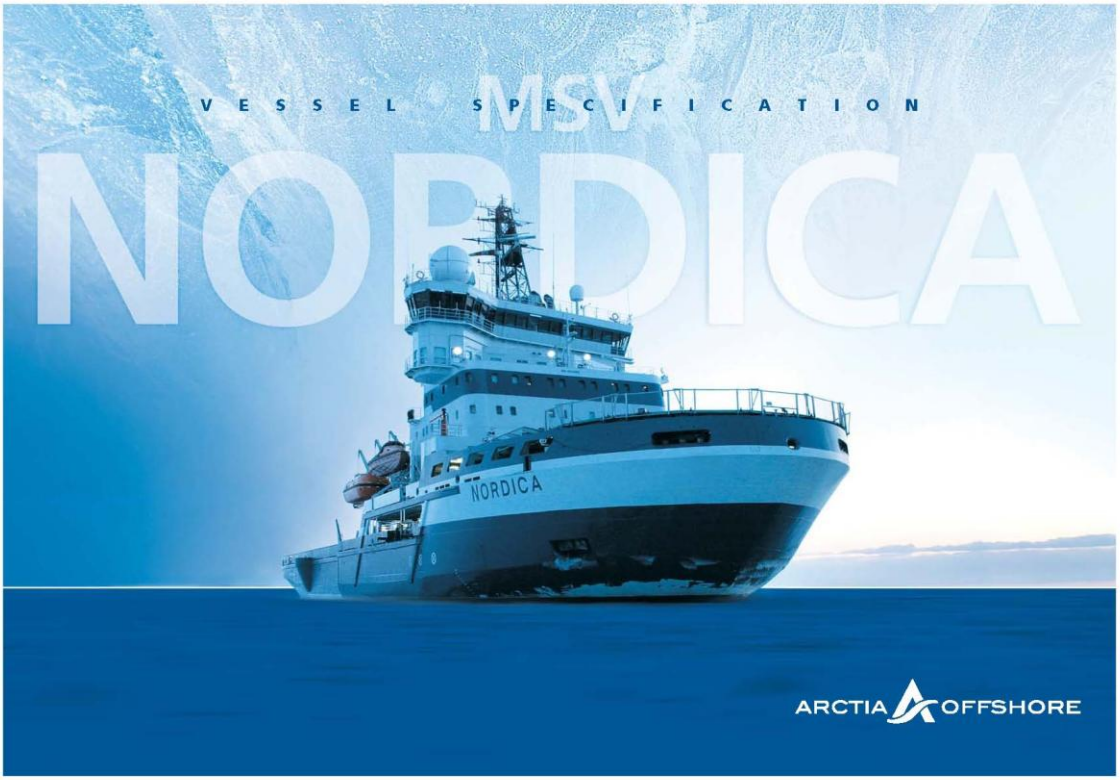
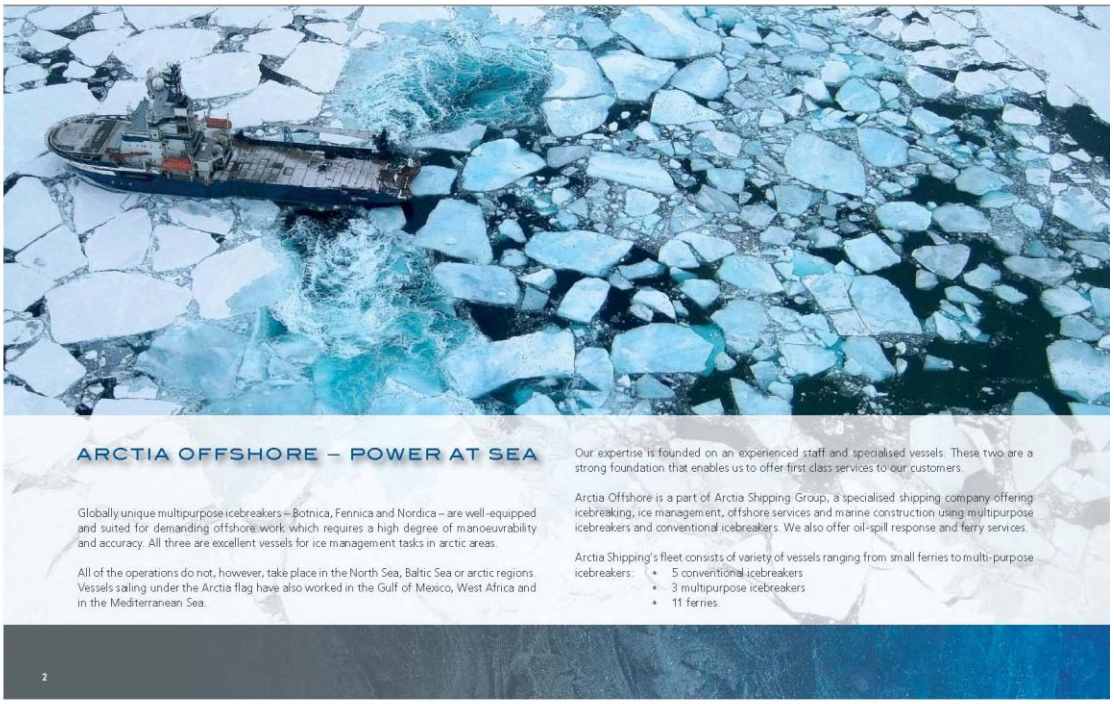
"Nordica" Specifications





MSV NORDICA

MSV NORDICA SHORT VESSEL DESCRIPTION

The Nordica is a multifunctional vessel based on a modified icebreaker design with diesel-electric propulsion. The vessel is specially designed for a wide range of offshore related work.

The vessel is designed to carry out offshore installation tasks and can be equipped for laying pipes, cables and umbilicals. The optional 160T SWL crane is well suited for deploying trenching machines and ploughs. Her large bollard pull and strong winches make the Nordica ideal for ploughing operations and towing.

With the main components such as winches and cranes already installed, a change of function can be achieved rapidly. Nordica meets all the stringent rules and regulations for offshore work.

ICEBREAKING

The Nordica is a part of Arctia Offshore's icebreaker fleet, one of the most powerful in the world. Icebreaking services include ice management, assistance, towing, securing vessel traffic safety, and traffic control for vessels proceeding in icy conditions.

Nordica's icebreaking capability is excellent. The 15 MW dieselgenerators produce power for two Aqua-master azimuth-thrusters to make the vessel easily manoeuvrable. The Nordica is excellent for DP work, all kinds of marine operations and in harsh icy conditions for towing merchant vessels.

VESSEL DETAILS

IMO No.	9056985
Call Sign	OJAE
MMSI	230 275 000
Type of Vessel	Ice Breaker & Multipurpose Support
Flag State	Finland
Port of Registry	Helsinki
Owners	Arctia Offshore
Built	1994
Lightweight	7.935 T
Deadweight (approx.)	4.800 T
Displacement	12.800 T
LOA	116.0 m
LWL	96.7 m
Breadth Moulded	26.0 m
Depth Moulded	12.5 m
Draught (Scantling)	8.4 m

CLASSIFICATION

DNV	1A1 POLAR10 Icebreaker Tug Supply Vessel SF HELDK EPR EØ DYNPOS-AUTR

CAPACITIES AND CONSUMABLES

Fuel Oil (Dual Fuel)	1690 m³ HFO 817 m³ DO
Lubricating Oil	85 m³
Fresh Water	400 m³
Water Ballast	2200 m³
F.W. Making Capability	25 T / day
Consumables, 8.4 m Draught:	
Type of Fuel (Dual Fuel)	HFO / DO
Fuel Consumption, 13 knots	abt. 42 T / day
Fuel Consumption, 11 knots	abt. 30 T / day
Fuel Consumption, DP	abt. 15 T / day
Duration, 13 knots	abt. 45 days
Duration, 11 knots	abt. 67 days

Duration times on DP depend on distance and speed of transit, to location.

3

ICE BREAKING CAPABILITIES

Maximum ice thickness	where vessel is capable to maintain speed is 1.8 m
Speed	of 8 knots at 0.8 m level ice

PROPULSION

Power	16 V 32 / 6000 kW Wärtsilä Vasa x 2 12 V 32 / 4500 kW Wärtsilä Vasa x 2
Propeller Type	Fixed pitch variable rpm
Nozzle Fitted	2 pcs (for aquamasters)
El Prop Motor	2
Type	2 pcs ABB Strömberg Drives
Rating	Both rated at 7500 kW

BOW THRUSTERS

Number	3
Make	Brunvoll
Type	FU-80 LTC-2250
Power	1150 kW
Propeller Type	Variable Pitch

SWITCHBOARDS

Make	ABB distribution
Type	6.3 kV prod. 6989C S001
Transformers	2 x 2000 kva 6300 / 400 V 50 Hz + 1250 kva 6300 / 400 V 50 Hz

GENERATORS (MAIN)

Number	4
Make	ABB Strömbberg Drives
Type	2 x HSG 1120 MP8 2 x HSG 900 LR8
Rating	8.314 kVA / 6.3 kV / 750 rpm 6.235 kVA / 6.3 kV / 750 rpm

GENERATORS (HARBOUR SET)

Number	1
Make	Wärtsilä
Type	VASA 4R22
Rating	710 kW / 1000 rpm
Generator	
Type	ALPC 500 AG
Rating	840 kVA / 400V

GENERATORS (EMERGENCY)

Number	1
Make	Caterpillar
Type	3412
Rating	300kW / 1500 rpm / 400 v / 50 Hz

BOLLARD PULL

Bollard pull / Aqua master	234 T

ROLL REDUCTION

INTERING	
Active roll reduction tank	720 m³

4

DYNAMIC POSITIONING

DP –AND AUTOMATION HARDWARE	
Type (DP)	Kongsberg K-POS DP-22 (Installed 2009)
Operator stations (OS)	2 pcs
Dual redundant controller	1 pc (one cabinet with separated controllers)
Redundant joystick (cJoy)	1 pc (with own independent cJoy -controller)
Process/fi eld stations (FS)	8 pcs (for thrusters and power/propulsion plant)
Network Distribtion Units	6 pcs
Type (Automation)	Kongsberg K-Chief (Installed 2009)
Operator Stations	5 pcs
Automation / K-Chief stations are part of the K-POS -system	

REFERENCE SYSTEMS / EQUIPMENTS	
The DP -system is supported by the following reference systems:	
Hydro acoustic	1 pc Kongsberg HiPaP 500
Tautwire	1 pc Kongsberg LTW MK15/500
Satellite positioning	3 pcs Kongsberg DPS -type receivers
	4-5 Differential signals
	(IALA, Inmarsat-B, SPOT, Glonass)
	High Precision corrections possible
	upon separate agreement
Artemis	1 pc MK-4 (of explosion proof type)
Fanbeam	1 pc Fanbeam optional
Vertical Reference	3 pcs Kongsberg MRU2 and MRU5 -types
Gyro	3 pcs Ixsea Octans (Fiber Optic Gyros)
Anemometer	2 pcs GILL Ultrasonic wind sensors

MAIN OPERATING MODES	
Joystick Mode	Manual Positioning using the three-axis joystick
Mixed Joystick / Auto Mode	Selecting any of the three degrees of vessel movement, as manual and / or auto
Auto Heading Mode	Selecting vessel heading at auto control
Auto Position Mode	Station keeping at selected heading and position
Follow Target Mode	Automatic following of moving target
Auto Track (low speed) Mode	Track keeping in low speed
Auto Track (high speed) Mode	Track keeping in medium or high speed
Alongships External Force	Manual input of force in tonnes by the joystick is used e.g. towing and cable laying
Compensation by Joystick	

BRIDGE EQUIPMENT

THE VESSEL'S INTEGRATED NAVIGATION SYSTEM IS EQUIPPED WITH
Multi-Sensor radar and positioning system
Type approved Dual ECDIS system

SYSTEM PROVIDES
Flexible route planning, steering and monitoring
Continuous calculations of own position and display on ECDIS
Continuous target tracking by radars and AIS
Continuous target presentation by ECDIS

EXTERNAL COMMUNICATION SYSTEM

GMDSS portable VHF	3 pcs + VHF portable 1 pc
Helicopter Communication, fixed	2 pcs aviation VHF
Helicopter comms. Portable VHF Aero	4 pcs
Distress Transponders	4 pcs 9 GHz
	(2 on the bridge,
	2 on the lifeboats)
EPIRB	2 pcs
(Emergency Position Indicating Radio Beacon)	

COMPRISING
GMDSS - A3 radio station
Telenor SEALINK 2 on Dual band
Inmarsat Fleet 77
Aviation VHF (fixed + portables)
Additional VHF/UHF radios

SEARCHLIGHT
The following Xenon remote controlled search lights are provided:
2 x 1600 W (360 dgr)
3 x 1000 W (360 dgr)

INTERNAL COMMUNICATION SYSTEM

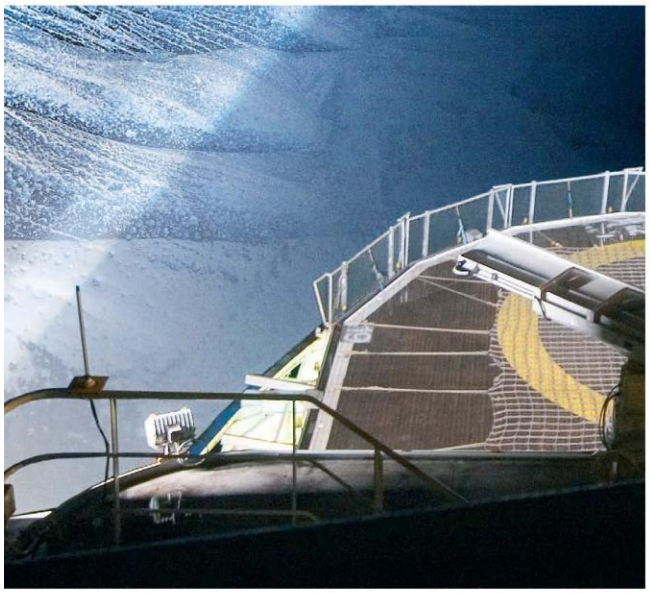
AUTOMATIC TELEPHONE SYSTEM
The telephone system consists of automatic exchange and phone sets.
In addition to the land lines there are mobile cellular and ship's satellite communi- cation system connected to the PABX. All cabins fitted with telephones.
NB! The following numbers are subject to change depending upon current project and location.
4 pcs outside telephone lines available for Project / Client
Radio / TV cable network
Radio / TV cable network receives terrestrial radio / TV broadcasts as well as satellite broadcasts, which are further distributed to the ship's cable network and TV sets.

TO SHIP		FAX	
Ku Band	+ 47 5140 7124	Inmarsat fleet	+ 870 1600 544 511
Ku Band	+ 47 5140 7125	GSM	+ 358 408 860 855
Ku Band / Project	+ 47 5140 7126	Norsat VSAT / via Finland	
GSM / via Finland	+ 358 400 246 551		+ 358 306 207 815
Via Finland	+ 358 306 207 800		

DATA NET (CLIENT)
The Data Network is a cat. 5 10 / 100 TX Ethernet.
The network is connected to the Norsat KU band communication system onboard.
(May change between projects)

THE NETWORK HAS OUTLETS ON THE FOLLOWING LOCATIONS ONBOARD		
Bridge		
Operation Center	4th	Bridge deck
Conference Room	2nd	deck
Owners cabins		
Aft Deck		
Hospital	2nd	Bridge deck

MSV NORDICA



HELIDECK

Helideck 'D'Value	19 m / 8.6 T
Rated	Super Puma L1 or similar
HMS	1 pc Kongsberg HMS 100

DECK LAYOUT

Shark Jaw	2 pcs (adapters 38 mm 86 mm 95 mm)
Air on Deck	16 connecting points, 300 m³ / h, 7 bar
Air Receiver	1000 l
Sea and Fresh Water	4 connecting points, 40 m³ / h, 7 bar

ELECTRICITY ON DECK

Power Outlets 400 V (± 10%) / 50 Hz, rated at 1100 kW	
2 pcs 16 A	7 pcs 125 A
2 pcs 32 A	4 pcs 250 A
4 pcs 63 A	2 pcs 630 A
(Additional MA-set available, output 440 V / 60 Hz / 2 x 160 A / rated at 320 kW)	
Power Outlets 230 V (± 5%) / 50 Hz, rated at 40 kW	
6 pcs 16 A (2 ph)	
2 pcs 32 A (3 ph)	

7

DECK CRANES

MAIN CRANE

Max single line lift capacity SWL 150 mt on outer lay (full drum)	
a. Lifting capacity	single line arr. SWL 25 mt / 35 m outreach
b. Lifting capacity	single line arr. 150 mt / 10 m outreach
Winch capacity	3000 m
Wire Size	OD Ø 77 mm
Main Hook Active Heave Compensation (AHC) capacity	
Performance	0-75 T single line
Performance	75-150 T single line 50% of above
Aux winch lifting capacity	single line SWL 20 mt / 36 m outreach
Winch capacity	2000 m
Wire Size	OD Ø 24 mm
Aux Hook Active Heave Compensation (AHC) capacity	
Performance	0-10 T single line
Performance	10-20 T single line 50% of above

SECONDARY CRANE (OPTIONAL)

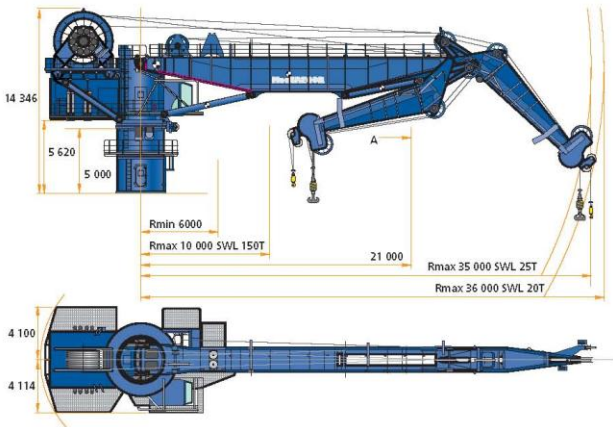
Manufacturer	MacGregor
Main hook	5 T / 15 m
Wire Length	80 m
Wire Size	22 mm
Drum Capacity	100 m

A- FRAME (OPTIONAL)

Safe Working Load	120 T
Clearance between legs	12 m
Hook height	15 m
Working Depth / appx.	300 m

MAIN DIMENSIONS [MAIN CRANE]

Max radius		36 000 SWL 20T
Overal width	W	8 214 [mm]
Height to top of king	H2	14 346 [mm]
Height of pedestal		5 000 [mm]
Boom angle in parked position	1	0 [°]



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WINCHING CAPACITIES

DECK LOADING		
Deck Area	approx. 1100m²	
Capacity	10 T / m² (Defined loading area)	
	First Layer	**Outmost Layer**
ANCHOR HANDLING DRUM	1084 mm	2030 mm
Maker	Aquamaster-Rauma	
Type	TAW 3000 / 3000E	
Drive	Electric, 2 DC motors each 225 kW	
Pay out / in speed	Stepless from 0 to max speed	
Cable lifters	2, for 84 mm Ø stud link chain, 1 on each drum	
a) At low gear stalling pull 2 min	3750 kN	1765 kN
Nominal load S1	3000 kN	1412 kN
At speed	0-8 m / min	0-17 m / min
Maximum Speed	18 m / min	38 m / min
At load	1325 kN	623 kN
Safety Clutch	66 m / min	140 m / min
Max speed	2.1 knots	4.5 knots
b) At high gear stalling pull 2 min	1656 kN	779 kN
Nominal load S1	1325 kN	623 kN
At speed	0-18 m / min	0-38 m / min
Maximum Speed	40 m / min	85 m / min
At load	585 kN	275 kN
Safety Clutch	148 m / min	314 m / min
Max speed	4.7 knots	10 knots
c) Band Brake static holding load	4500 kN	2118 kN

TOWING

TOWING	In auto-tension mode or with brake engaged Interfaced to DP	
	First Layer	**Outmost Layer**
TOWING DRUM	1283 mm	2577 mm
a) At low gear stalling pull	3750 kN	1867 kN
Nominal load S1	3000 kN	1495 kN
At speed	0-8 m / min	0-16 m / min
Maximum Speed	18 m / min	36 m / min
At load	1325 kN	660 kN
Safety Clutch	66 m / min	133 m / min
Max speed	2.1 knots	4.3 knots
b) At high gear stalling pull 2 min	1656 kN	824 kN
Nominal load S1	1325 kN	660 kN
At speed	0-18 m / min	0-36 m / min
Maximum Speed	40 m / min	80 m / min
At load	585 kN	291 kN
Safety Clutch	148 m / min	296 m / min
Max speed	4.7 knots	9.6 knots
c) Band Brake static holding load	4500 kN	2240 kN

ACCOMMODATION

Total Accommodation	77 Persons incl. crew (normally 47 client beds)
Day Room / Mess for client:	
Day Room	5th Bridge deck
Messroom and coffeeshop	Upper deck
Laundry Room	2nd deck (+ Laundry stations on different decks)
Gymnasium	1st Bridge deck
Sauna	2nd deck
Kiosk	Upper deck
Operation Center	4th Bridge deck
Saloon Room	5th Bridge deck
Client Office / Conference Room	1 x 20 m² Office 2nd deck
Reception (deck office)	Upper deck
Hospital	2nd Bridge deck

MSV NORDICA

SURVEY FACILITIES

The MSV NORDICA has no permanent ROV system on board, but it does have the capability for an ROV system should the project require it.

MANNING

Master	1
Chief Officer / DPO	1
First Officer / DPO	1
Second Officer / DPO jr.	2
Chief Engineer	1
1st Engineer	2
Electrical Engineer	1
Electrician	1
Boatswain	1
Deck Repairman	2
Engine Repairman	2
Motorman	1
Cook Steward	1
1st Cook	2
2nd Cook	2
Catering Assistants	3
Crane tech.	1
Crane ops.	2

Total Marine Crew about 27 persons, however this may change between projects.

LIFE SAVING, FIREALARM AND RESCUE EQUIPMENT

Lifeboats	2 pcs, 82 persons each
Type	Waterman 371
Dimensions	L 9.35 m / B 3.26 m / draught 1.22 m
Weight including Equipment	4730 kg
Engine	Sabb N4.295
Regulation	NMD
Lifeboat Davit	Davit int.type D-NP.120
MOB Boat	1 pc, 6 persons, S-side
Type	Waterman 372
Dimensions	L 7.10 m / B 2.72 m / draught 1.20 m
Engine	Sabb N4.295
Speed	21 knots
Regulation	NMD
MOB Boat Davit	Davit D-RTS-40
Life rafts	2 x 25 and 6 x 20 persons
Type	Viking Life -saving
Life raft davit	2 pcs Davit D-RB.21
Fire Alarm system	1 pc Autronica BK-30 IB44

DETAILS BELIEVED TO BE CORRECT BUT NOT GUARANTEED.

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"Fennica" Specifications

ARCTIA OFFSHORE – POWER AT SEA

Globally unique multipurpose icebreakers – Botnica, Fennica and Nordica – are well-equipped and suited for demanding offshore work which requires a high degree of manoeuvrability and accuracy. All three are excellent vessels for ice management tasks in arctic areas.

All of the operations do not, however, take place in the North Sea, Baltic Sea or arctic regions. Vessels sailing under the Arctia flag have also worked in the Gulf of Mexico, West Africa and in the Mediterranean Sea.

Our expertise is founded on an experienced staff and specialised vessels. These two are a strong foundation that enables us to offer first class services to our customers.

Arctia Offshore is a part of Arctia Shipping Group, a specialised shipping company offering icebreaking, ice management, offshore services and marine construction using multipurpose icebreakers and conventional icebreakers. We also offer oil-spill response and ferry services.

Arctia Shipping's fleet consists of variety of vessels ranging from small ferries to multi-purpose icebreakers:

- 5 conventional icebreakers
- 3 multipurpose icebreakers
- 11 ferries.

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MSV FENNICA

MSV FENNICA SHORT VESSEL DESCRIPTION

The Fennica is a multifunctional vessel based on a modified icebreaker design with diesel-electric propulsion. The vessel is specially designed for a wide range of offshore related work.

The vessel is designed to carry out offshore installation tasks and can be equipped for laying pipes, cables and umbilicals. The optional 120T SWL A-frame is well suited for deploying trenching machines and ploughs. Her large bollard pull and strong winches make the Fennica ideal for ploughing operations and towing.

With the main components such as winches, cranes and A-frame already installed, a change of function can be achieved rapidly. Fennica meets all the stringent rules and regulations for offshore work.

ICEBREAKING

The Fennica is a part of Arctia Offshore's icebreaker fleet, one of the most powerful in the world. Icebreaking services include ice management, assistance, towing, securing vessel traffic safety, and traffic control for vessels proceeding in icy conditions.

Fennica's icebreaking capability is excellent. The 15 MW dieselgenerators produce power for two Aqua-master azimuth-thrusters to make the vessel easily manoeuvrable. The Fennica is excellent for DP work, all kinds of marine operations and in harsh icy conditions for towing merchant vessels.

VESSEL DETAILS

IMO No.	9043615
Call Sign	OJAD
Type of Vessel	Ice Breaker & Multipurpose Support
Flag State	Finland
Port of Registry	Helsinki
Owners	Arctia Offshore
Built	1993
Lightweight	7.935 T
Deadweight (approx.)	4.800 T
Displacement	12.800 T
LOA	116.0 m
LWL	96.7 m
Breadth Moulded	26.0 m
Depth Moulded	12.5 m
Draught (Scantling)	8.4 m

CLASSIFICATION

DNV	1A1 POLAR10 Icebreaker Tug Supply Vessel
	SF HELDK EPR EØ DYNPOS-AUTR
Helideck	

CAPACITIES AND CONSUMABLES

Fuel Oil (Dual Fuel)	approx. 1690 m³ HFO
	approx. 817 m³ DO
Lubricating Oil	approx. 85 m³
Fresh Water	approx. 400 m³
Water Ballast	approx. 2200 m³
F.W. Making Capability	approx. 25 T/ day
Consumables / 8.4 m Draught:	
Type of Fuel (Dual Fuel)	HFO / DO
Fuel Consumption / 13 knots	42 T / day
Fuel Consumption@ 11 knots	30 T / day
Fuel Consumption / DP	15 T / day
Duration / 13 knots	45 days
Duration / 11 knots	67 days

Duration times on DP depend on distance and speed of transit, to location.

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PROPULSION

Power	16 V 32 / 6000 kW Wärtsilä Vasa x 2 12 V 32 / 4500 kW Wärtsilä Vasa x 2
Propeller Type	Fixed pitch, variable rpm
Nozzle Fitted	2 pcs (for aquamasters)
El.Prop Motor	2
Type	2 pcs ABB Strömberg Drives
Rating	Both rated at 7500 kW

BOW THRUSTERS

Number	3
Make	Brunvoll
Type	FU-80 LTC-2250
Power	1150 kW
Propeller Type	Variable Pitch

SWITCHBOARDS

Make	ABB distribution
Type	6.3 kV prod. 6989C S001
Transformers	2 x 2000 kva 6300 / 400 V 50 Hz +

GENERATOR (MAIN)

Number	4
Make	ABB Strömbberg Drives
Type	2 x HSG 1120 MP8 2 x HSG 900 LR8
Rating	8.314 kVA / 6.3kV / 750 rpm 6.235 kVA / 6.3kV / 750 rpm

GENERATORS (HARBOUR SET)

Diesel		
Number		1
Make		Wärtsilä
Type		VASA 4R22
Rating		710 kW / 1000 rpm
Generator	Type	ALPC 500 AG
	Rating	840 kVA / 400VGENERATORs (EMERGENCY)

GENERATORS (EMERGENCY)

Number	1
Make	Caterpillar
Type	3412
Rating	300kW / 1500 rpm / 400 v / 50 Hz

BOLLARD PULL

Bollard pull / Aqua master	About 230 tonnes

ROLL REDUCTION

INTERING	
Active roll reduction tank	720 m³

DYNAMIC POSITIONING

DP–AND AUTOMATION HARDWARE	
Type (DP)	Kongsberg K-POS DP-22 (Installed 2009)
Operator stations (OS)	2 pcs
Dual redundant controller	1 pc (one cabinet with separated controllers)
Redundant joystick (cJoy)	1 pc (with own independent cJoy -controller)
Process/fi eld stations (FS)	8 pcs (for thrusters and power/propulsion plant)
Network Distribtion Units	6 pcs
Type (Automation)	Kongsberg K-Chief (Installed 2009)
Operator Stations	5 pcs
Automation / K-Chief stations are part of the K-POS -system	

REFERENCE SYSTEMS / EQUIPMENTS	
The DP -system is supported by the following reference systems:	
Hydro acoustic	1 pc Kongsberg HiPaP 500
Tautwire	1 pc Kongsberg LTW MK15/500
Satellite positioning	3 pcs Kongsberg DPS -type receivers 4-5 Differential signals (IALA, Inmarsat-B, SPOT, Glonass) High Precision corrections possible upon separate agreement
Artemis	1 pc MK-4 (of explosion proof type)
Fanbeam	1 pc Fanbeam optional
Vertical Reference	3 pcs Kongsberg MRU2 and MRU5 -types
Gyro	3 pcs Ixsea Octans (Fiber Optic Gyros)
Anemometer	2 pcs GILL Ultrasonic wind sensors

MAIN OPERATING MODES	
Joystick Mode	Manual Positioning using the three-axis joystick
Mixed Joystick / Auto Mode	Selecting any of the three degrees of vessel movement, as manual and / or auto
Auto Heading Mode	Selecting vessel heading at auto control
Auto Position Mode	Station keeping at selected heading and position
Follow Target Mode	Automatic following of moving target
Auto Track (low speed) Mode	Track keeping in low speed
Auto Track (high speed) Mode	Track keeping in medium or high speed
Alongships External Force	Manual input of force in tonnes by the joystick is used e.g. towing and cable laying
Compensation by Joystick	

BRIDGE EQUIPMENT

THE VESSEL'S INTEGRATED NAVIGATION SYSTEM IS EQUIPPED WITH
- Multi-Sensor radar and positioning system
- Type approved Dual ECDIS system, ECDIS planning Station

SYSTEM PROVIDES
- Flexible route planning, steering and monitoring
- Continuous calculations of own position and display on ECDIS
- Continuous target tracking by radars and AIS
- Continuous target presentation by ECDIS

EXTERNAL COMMUNICATION SYSTEM

GMDSS portable VHF	3 pcs + VHF portable 1 pc
Helicopter Communication, fixed	2 pcs aviation VHF
Helicopter comms Portable VHF Aero	3 pcs
Distress Transponders	4 pcs 9 GHz (2 on the bridge, 2 on the lifeboats)
EPIRB (Emergency Position Indicating Radio Beacon)	2 pcs

COMPRISING
- GMDSS - A4 radio station
- Telenor SEALINK 2 on Dual band
- Inmarsat Fleet 77
- Aviation VHF (fixed + portables)
- Additional VHF/UHF radios

SEARCHLIGHT
- The following Xenon remote controlled search lights are provided:
- 2 x 1600 W (360 dgr)
- 3 x 1000 W (360 dgr)

INTERNAL COMMUNICATION SYSTEM

AUTOMATIC TELEPHONE SYSTEM
- The telephone system consists of automatic exchange and phone sets.
- In addition to the land lines there are mobile cellular and ship's satellite communication system connected to the PABX. All cabins fitted with telephones.

NB! The following numbers are subject to change depending upon current project and location.
- 4 pcs outside telephone lines available for Project / Client
- Radio / TV cable network
- Radio / TV cable network receives terrestrial radio / TV broadcasts as well as satellite broadcasts, which are further distributed to the ship's cable network and TV sets.

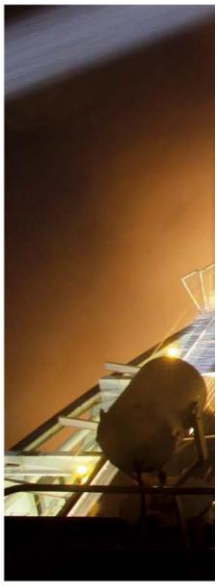
TO SHIP		FAX	
GSM	+ 358 400 107 157	GSM	+ 358 401 107 159
GSM	+ 358 400 107 159	VSAT	+ 358 30 620 7715
VSAT	+ 358 30 620 7700	SAT B	+ 870 32 302 4520
SAT B	+ 870 32 302 4511		

DATA NET (CLIENT)

- The Data Network is a cat. 5 10 / 100 TX Ethernet.
- The network is connected to the VSAT Satellite communication system onboard.
- (May change between projects)

THE NETWORK HAS OUTLETS ON THE FOLLOWING LOCATIONS ONBOARD

Bridge		
Operation Center	4th	Bridge deck
Conference Room	2nd	deck
Owners cabins		
Aft Deck		
Hospital	2nd	Bridge deck



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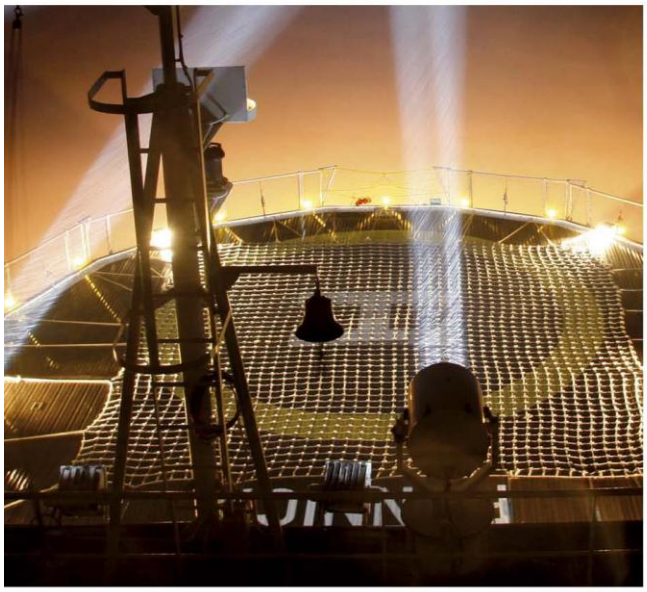
MSV FENNICA



HELIDECK

Helideck 'D'Value	19 m / 8.6 T
Rated	Super Puma L1 or similar
HMS	1 ps Kongsberg HMS 100

DECK LAYOUT

Shark Jaw	2 pcs (adapters 38 mm 86 mm 95 mm)
Air on Deck	16 connecting points 300 m³ / h, 7 bar
Air Receiver	1000 l
Sea and Fresh Water	4 connecting points 40 m³ / h, 7 bar
MS3 Panel Outlets	4 pcs 63 A
	8 pcs 125 A
	4 pcs 250 A
	2 pcs 200 A

ELECTRICITY ON DECK

Power Outlets 400 V (± 10%) / 50 Hz, rated at 1100 kW

2 pcs 16 A	7 pcs 125 A
2 pcs 32 A	4 pcs 250 A
4 pcs 63 A	2 pcs 630 A

(Additional MA-set available, output 440 V / 60 Hz / 2 x 160 A / rated at 320 kW)

Power Outlets 230 V (± 5%) / 50 Hz, rated at 40 kW
- 6 pcs 16 A (2 ph)
- 2 pcs 32 A (3 ph)

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DECK CRANES

MAIN CRANE	
Manufacturer	HYDRALIFT A.S.A.
Main hook	30 T Double fall / 11 m radius
	15 T Single fall / 20 m radius
Wire Length	510 m
Working depth	approx. 350 m / Single fall
	approx. 180 m / Double fall
Wire Size	32 m
SECONDARY CRANE	
Manufacturer	MacGregor
Main hook	5 T, 14 m / 1.5 T, 30 m
Wire Length	100 m
Wire Size	22 mm
Drum Capacity	100 m
A- FRAME (OPTIONAL)	
Safe Working Load	120 T
Clearance between legs	12 m
Hook height	15 m
Working Depth/appx.	300 m

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MSV FENNICA

WINCHING CAPACITIES

DECK LOADING	
Deck Area	approx. 1100 m²
Capacity	10 T / m² (defined loading area)

	First Layer	Outmost Layer
ANCHOR HANDLING DRUM	1084 mm	2030 mm
Maker	Aquamaster-Rauma	
Type	TAW 3000/3000E	
Drive	Electric, 2 DC motors each 225 kW	
Pay out/in speed	Stepless from 0 to max speed	
Cable lifters	2, for 84 mm Ø stud link chain, 1 on each drum	
a) At low gear stalling pull 2 min	3750 kN	1765 kN
Nominal load S1	3000 kN	1412 kN
At speed	0-8 m / min	0-17 m / min
Maximum Speed	18 m / min	38 m / min
At load	1325 kN	623 kN
Safety Clutch	66 m / min	140 m / min
Max speed	2.1 knots	4.5 knots
b) At high gear stalling pull 2 min	1656 kN	779 kN
Nominal load S1	1325 kN	623 kN
At speed	0-18 m / min	0-38 m / min
Maximum Speed	40 m / min	85 m / min
At load	585 kN	275 kN
Safety Clutch	148 m / min	314 m / min
Max speed	4.7 knots	10 knots
c) Band Brake static holding load	4500 kN	2118 kN

TOWING

Towing	In auto-tension mode or with brake engaged Interfaced to DP

	First Layer	Outmost Layer
TOWING DRUM	1283 mm	2577 mm
a) At low gear stalling pull	3750 kN	1867 kN
Nominal load S1	3000 kN	1495 kN
At speed	0-8 m / min	0-16 m / min
Maximum Speed	18 m / min	36 m / min
At load	1325 kN	660 kN
Safety Clutch	66 m / min	133 m / min
Max speed	2.1 knots	4.3 knots
b) At high gear stalling pull 2 min	1656 kN	824 kN
Nominal load S1	1325 kN	660 kN
At speed	0-18 m / min	0-36 m / min
Maximum Speed	40 m / min	80 m / min
At load	585 kN	291 kN
Safety Clutch	148 m / min	296 m / min
Max speed	4.7 knots	9.6 knots
c) Band Brake static holding load	4500 kN	2240 kN

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ACCOMMODATION

Total Accommodation	77 Persons incl. crew (normally 48 client beds)
Day Room / Mess for client:	
Day Room	5th Bridge deck
Messroom and coffeeshop	Upper deck
Laundry Room	2nd deck (+ Laundry stations on different decks)
Gymnasium	1st Bridge deck
Sauna	2nd deck
Kiosk	Upper deck
Operation Center	4th Bridge deck
Saloon Room	5th Bridge deck
Client Office / Conference Room	1 x 20 m² Office, 2nd deck
Reception (deck office)	Upper deck
Hospital	2nd Bridge deck

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MSV FENNICA

SURVEY FACILITIES

The MSV Fennica has no permanent ROV system on board, but it does have the capability for an ROV system should the project require it.

MANNING

Master	1
Chief Officer / DPO	1
First Officer / DPO	1
Second Officer / DPO jr.	2
Chief Engineer	1
1st Engineer	2
Electrical Engineer	1
Electrician	1
Boatswain	1
Deck Repairman	2
Engine Repairman	2
Motorman	1
Cook Steward	1
1st Cook	2
2nd Cook	2
Catering Assistants	3
Crane ops.	2

Total Marine Crew about 26 persons, however this may change between projects.

LIFE SAVING, FIREALARM AND RESCUE EQUIPMENT

Lifeboats	2 pcs, 82 persons each
Type	Waterman 371
Dimensions	L 9.35 m / B 3.26 m / draught 1.22 m
Weight including Equipment	4730 kg
Engine	Sabb N4.295
Regulation	NMD
Lifeboat Davit	Davit int.type D-NP.120
MOB Boat	1 pc, 6 persons, S-side
Type	Waterman 372
Dimensions	L 7.10 m / B 2.72 m / draught 1.20 m
Engine	Sabb N4.295
Speed	21 knots
Regulation	NMD
MOB Boat Davit	Davit D-RTS-40
Life rafts	6 x 25 and 2 x 20 persons
Type	Viking Life –saving
Life raft davit	2 pcs Davit D-RB.21
Fire Alarm system	1 pc Autronica BK-30 IB44 The vessel is equipped with an automatic fire detection system

DETAILS BELIEVED TO BE CORRECT BUT NOT GUARANTEED.

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"*Tor Viking II*" Specifications

AHTS/Icebreaker *Tor Viking II* - Main Characteristics

Design: KMAR 808 AHTS/ ICEBREAKER (Now; MOSSMAR)
Classification: DnV,+1A1, SUPPLY, SF, TUG ICEBREAKER ICE-10, DK(+) EO HELDK-SH DYNPOS-AUTR HL(2,8) W1-OC
Built / Delivered: Havyard Leirvik, Norway - 03/2000
Registered / Flag: Skärhamn, Sweden

Dimensions

Length Over All (LOA): 83.70 metres
Length between p.p.: 75.20 metres
Breadth, moulded: 18.00 metres
Depth, moulded: 8.50 metres
Draught (scantling): 7.20 metres
Draught (design): 6.00 metres
Freeboard (design): 2.50 metres
Dead Weight: 2,528 tonnes
Light Ship: 4,289 tonnes
Gross: 3,382 tonnes
Net: 1,145 tonnes

Capacities

Dry Bulk: 283 m^3 in 4 tanks - totaling 10,000 ft^3
Pot Water: 724 m^3
Drill Water / Ballast: 1,205 m^3
Brine: 400 m^3 – SG 2.5
Oil Based Mud: 612 m^3 – SG 2.8

Base Oil: 242 m^3
Fuel Oil: 1,190 m^3 Marine Gas Oil (Diesel)
Urea: 94 m^3
Diesel Overflow: 21 m^3 with alarm
Diesel Service / Settling: 2 x 20 m^3
Deck Load: Abt 1,350 ts
Deck Area: 603 m^2 / 40.20 m x 15.0 m
All products in dedicated tanks – no dual purpose tanks

Propulsion
Main Engine: MAK 18,300 BHP - 4 eng (father/son) 2 x 3,840 kW + 2 x 2,880 kW = 13,440 kW
Thrusters: Bow 1,200 BHP in tunnel (Electr) + 1,200 BHP 360 deg retractable = 2,400 BHP:
Stern 1,200 BHP in tunnel
Bollard Pull: Bollard Pull: 202 continuous (DnV certified) / Abt. 210 max pull
Speed/Consumption: 16 knots – Abt. 42.7 MT / 24 hrs at 6.0 metres draught , 12 knots – Abt. 25.0 MT

Towing & Anchor Handling Equipment
AHT Winch: Brattvaag towing/anchor handling winch 400 ts pull / 550 ts brake holding caps
AHT Drum: One of 1,400 mm dia. x 3,750 dia. x (1,250 mm + 1,250 mm) length
Wire Capacity: 2 x 1,900 metres of 77 mm wire or 2 x 1,650 metres of 83 mm wire
AH Drum: One of 1,400 mm dia. x 3,750 mm dia. x 3,000 mm length
Wire Capacity: 4,100 metres of 83 mm wire
Winch Control: TOWCON 2000 Automatic Control with printer
Pennant Reels: One off 2 x 1,500 m of 77 mm wire or 2 x 1,300 m of 83 mm wire capacity: One off 3,400 m of 77 mm wire or 1 x 3,100 m of 83 mm wire capacity
Large Reel Inner Core: 1,500 mm dia.
Cable Lifters: 2 x 76 mm and 2 x 84 mm onboard
Chain Lockers: 2 x 129 m 3 / giving abt 2 x 6,000 ft of 3 inch chain
Shark Jaws: 2 pairs of Karm Forks arranged for chain up to 165 mm dia. / 750 ts SWL
Inserts for handling of 65, 75, 85, 100, and 120 mm dia. wire/chain
Stern Roller: One of 3,5 metres dia. x 6.0 metres length – SWL 500 ts

Guide Pins: 2 pairs Karm Fork Hydraulic pins – SWL 170 ts

Deck Equipment
Capstans: 2 x 15 ts pull
Tugger Winches: 2 x 15 ts pull
Smit Brackets: One bracket on B Deck Forward – SWL 250 ts
Cranes: 1 hydraulic crane on fore cargo deck giving 6 / 12 ts at 20/10 m arm (360 deg)
: 1 telescopic crane on aft cargo deck giving 1.5 / 3 ts at 15/10 m arm (360 degr)
: 1 hydraulic crane on for-castle deck for stores etc.

Windlass: 1 hydraulic windlass / mooring winch. 2 declutch-able drums 46 mm K3 chain

Accommodation: Accommodation of a total of 23 persons, including crew.
All accommodation equipped with air-condition and humidification facilities.

Dynamic Positioning
The vessel is equipped with Kongsberg Simrad SDP 21 Redundant DP System – Green DP.

"*Aiviq*" Specifications

M/V AIVIQ

Specifications 03/12

REGISTRATION: Hull #247
Year Built: 2012, La Ship and North American Shipbuilding

Vessel Type: Ice Class A3 Anchor Handling Towing Supply Vessel

	U.S. MEASUREMENTS	METRIC EQUIVALENTS
DIMENSIONS	360'8" X 80' X 34'	109.9 m X 24.38 m X 10.36 m
Draft (Loadline):	28'1.6875"	8.58 m
Draft (Normal):	26'	7.92 m
Draft (Max. Ice):	25'	7.62 m
Draft (Min. Ice):	21'	6.4 m
Free Deck Space:	150' x 61'	45.72 m x 18.59 m
Clear Deck Area (Total):	9,150 sq. ft.	850 m^2
Clear Deck Area (Cargo):	4,880 sq. ft.	453 m^2
Deck Strength (Cargo):	1,024 lb/sq. ft.	4 MT/m^2
Deadweight Tonnage:	5,113 LT	5,195 MT
CAPACITIES		
Fuel Oil:	528,155 gals.	1,999 m^3
Liquid Mud/Brine/Rec. Oil:	10,160 barrels	1,615 m^3
Ballast/Rig Water:	562,684 gals.	2,130 m^3
Rig Water (Dedicated):	421,667 gals.	1,596 m^3
Glycol:	8,677 gals.	32.85 m^3
13 Service Tanks:	30,019 gals.	113.63 m^3
Dry Bulk:	8,840 cu. ft. @ 80 psi	250.4 m^3 @ 5.5 bars

MACHINERY	
Main Engines:	Four (4) CAT C280-12 diesels (5,444 BHP each)
Propulsion:	Two (2) 4,600 mm dia. CP propellers in nozzles
Bow Thrusters:	Two (2) Brunvoll FU100 2,450 mm 1,500 kW
	One (1) Rolls-Royce 2,000 kW fold down
Stern Thruster:	Two (2) Brunvoll FU80 LTA 2,000 mm 1,050 kW
Speed:	15 knots in SS3 open water
	5 knots in 1.0 m ice thickness
Bollard Pull:	200 MT
Generators:	Four (4) CAT 3512C 1,700 kW
	Two (2) 2,000 kW shaft generators
	Two (2) CAT C32 910 kW emergency generators

CLASSIFICATION	
ABS	Maltese Cross A1 (Hull)
ABS	Ice Class A3 (Icebreaker)
ABS	Maltese Cross A1 (Towing)
ABS	Maltese Cross AMS (Machinery)
ABS	Maltese Cross ACCU (Automation)
ABS	Maltese Cross FiFi 2 (Firefighting)
ABS	Maltese Cross DPS-2 (Dynamic Positioning)
ABS	Oil Recovery Capability Class 1
ABS	Safety Standby Vessel (300 Survivors)
ABS	HELIDK (SRF)
ABS	Protected Oil Tanks (POT)
ABS	CCO Polar (-40°C, -50°C) (HR 36)
ABS	AH Offshore Support Vessel
USCG	Subchapter I (Cargo)
SOLAS, MARPOL	Current

ACCOMMODATIONS:	64
	36 client, 28 crew

ADDITIONAL FEATURES/EQUIPMENT	
Firefighting:	Four (4) 1,800 m^3/hr fire monitors
Helideck:	Suitable for Sikorsky S92 (12.8 MT/21 m dia.)
Client/Crew Features:	Conference room, two (2) client lounges, crew lounge, client office, ship's office, exercise room, and three (3) laundry rooms
Standby/Rescue:	Rescue zones, decontamination area, change room, treatment room, recovery room, morgue, and medical medical storage

LIFESAVING EQUIPMENT
Two (2) 64-Man Arctic Class Enclosed Lifeboats with davits
Six (6) 25-Man Inflatable Life Rafts
One (1) 10-Man Fast Rescue Craft with davit
One (1) 15-Man Daughter Craft with davit
One Rescue Platform
Other gear as required by USCG and SOLAS

EDISON CHOUEST OFFSHORE
16201 East Main Street
Cut Off, LA 70345-3804
985-601-4444 Fax: 958-632-2282
www.chouest.com

Attachment 3 – Shell Ice and Weather Advisory Center

Operational Support Overview

Safe and efficient offshore operations in the Arctic are contingent upon quality and timely ice and weather forecasts. Using state of the art satellite technology, large areas of the Beaufort and Chukchi Seas are monitored remotely by the SIWAC to track movement of ice and make estimates of its type and concentration.

Synthetic Aperture Radar (SAR) instruments on board the RADARSAT 2 satellite are contracted to acquire necessary images of sea ice over areas of interest several times per week. These images are transmitted to ground stations, processed, and made available for analysis within hours of acquisition. Interpretation of the ice edge and features are performed by experienced specialists using powerful mapping software to produce ice charts that are considerably more detailed than those available from national ice centers. These charts are then distributed to operational personnel and planning managers and can be validated or ground-truthed using actual ice regime assessments from the IMV fleet.

Knowing the location and composition of the ice at any given moment is a valuable tool; however, it is not enough. It is important to forecast how the ice may change over time. A complementary component of ice forecasting is quality weather information. Weather conditions in the Arctic are among the most severe on the planet and change dramatically in a short time. National weather services do not provide measurements and forecasts that sufficiently resolve the conditions over small areas or short time spans in the Arctic offshore. Therefore, dedicated meteorologists with Arctic forecasting experience are employed full time to produce accurate snapshots of the current conditions and reliable forecasts of weather conditions into the future.

Using global weather models, such as ECMWF and GFS numerical weather model as a starting point, the meteorologists produce a high resolution grid in proprietary modeling software of weather parameters, such as atmospheric pressure, wind speed, and wave height, that have been corrected based on local observations from Shell's vessels at sea, meteorological buoys, and coastal weather stations. The result is a model that accurately reflects current and forecast weather conditions over short distances in the Beaufort and Chukchi Seas, making marine operations and vessel transits safer and more responsible. Without this innovative forecast effort, weather products from other sources tend to describe the average or general conditions that one could expect over large areas, such as the entire U.S. Beaufort Sea, which results in local conditions rarely matching what is forecast.

The wind vectors, which are a set of points indicating the speed and direction of the wind distributed over the Beaufort and Chukchi Seas, and other output from the weather model are applied to the ice charts in the mapping software. This allows the ice analyst to assess the effect of wind and weather systems on the future movement and development of the ice.

Attachment 4 – Ice Alert Logs
Ice Alert Level Log

ICE ALERT LEVEL LOG								
DRILLING UNIT								
Date	**Time**	**HT**	**ST**	**MT**	**T-Time**	**Remarks**	**Alert Level**	**Master**

Ice Alert Level Notification

Notice of Ice Alert Status Change

Drilling Unit	

Date	
Time	

Previous Ice Alert Level	

Ice Alert Arguments

Hazard Time (HT)	
Secure Time (ST)	
Move Time (MT)	
Alert Time (AT)	

New Ice Alert	

Present Ice and Weather Conditions

Forecast Ice and Weather Conditions

Comments

Approved By Master/OIM

Signature	
Date & Time	

Well Secure Time Log

WELL SECURE TIME LOG					
DRILLING UNIT					
Date	Time	Well Secure Time (ST)	Initials Rig Manager / OIM	Remarks	Initials Shell Drilling Supervisor