A Holistic Approach to Arctic Marine Seismic Acquisition

Phil Fontana, Polarcus

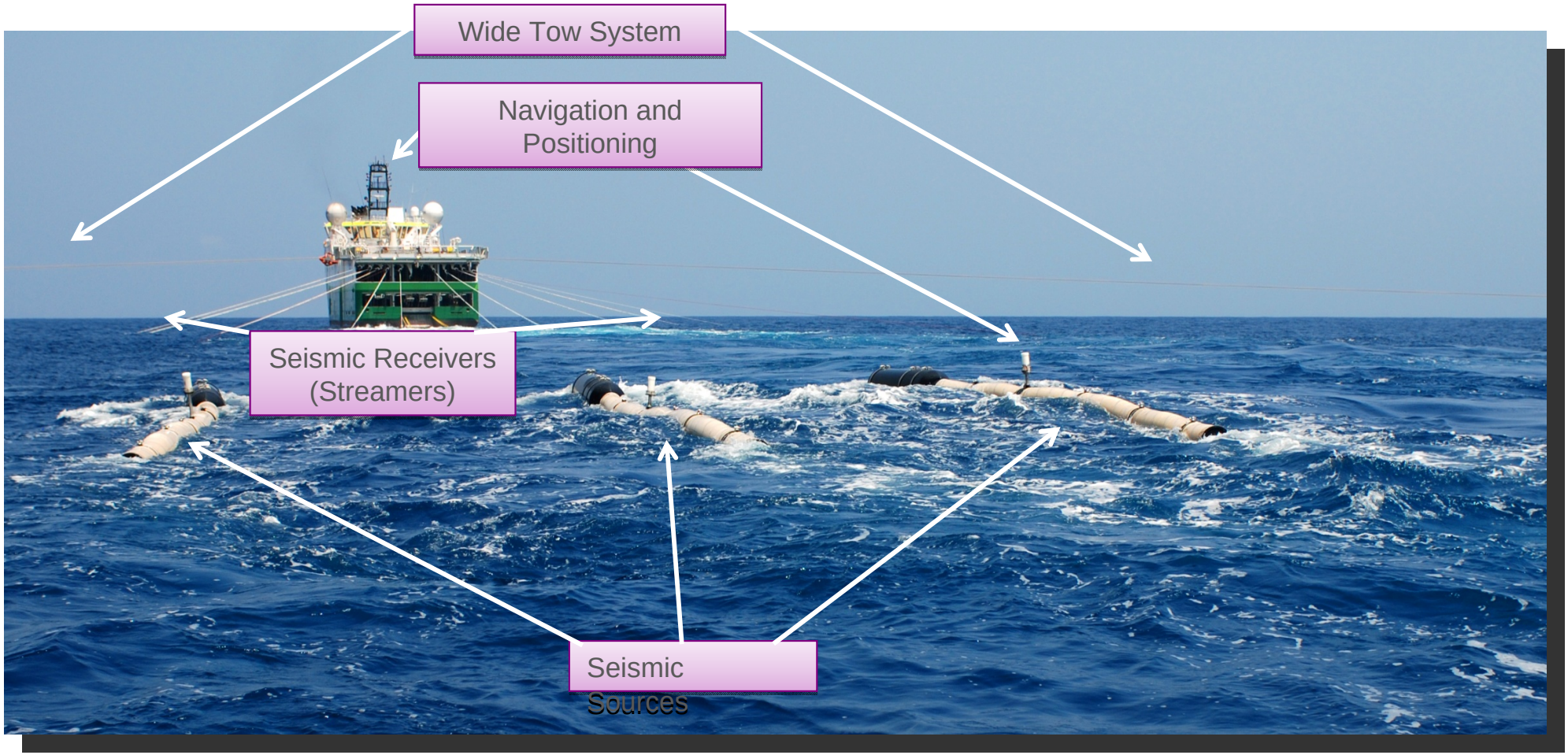
Finding Petroleum,
October 11, 2011
London

What do we mean by “Holistic Approach”?

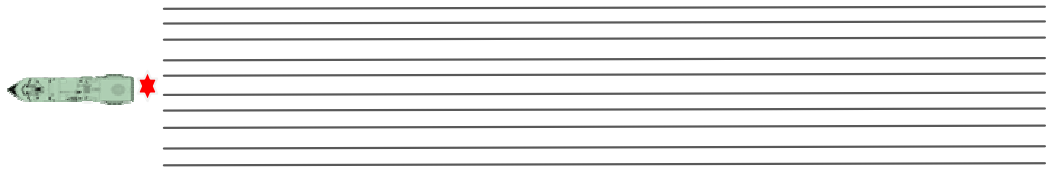
- Maximize geophysical flexibility
- Minimize environmental “footprint”
- Provide platforms and procedures for safe and efficient seismic operations

*** Disclaimer

Seismic Technologies and Geophysical Flexibility

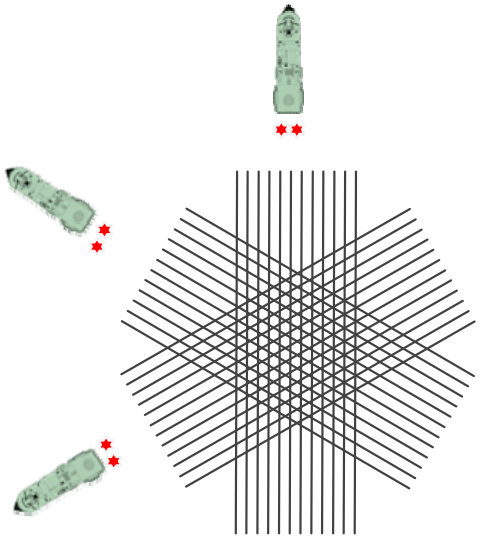


Towed marine seismic techniques



Wide-azimuth 3D

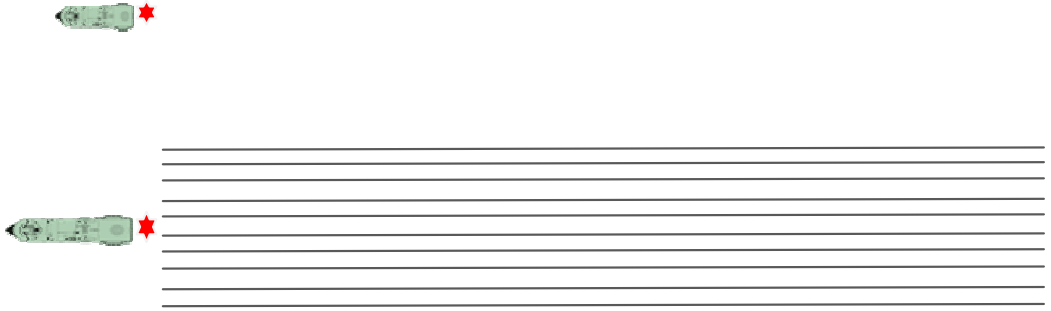
"WAZ"

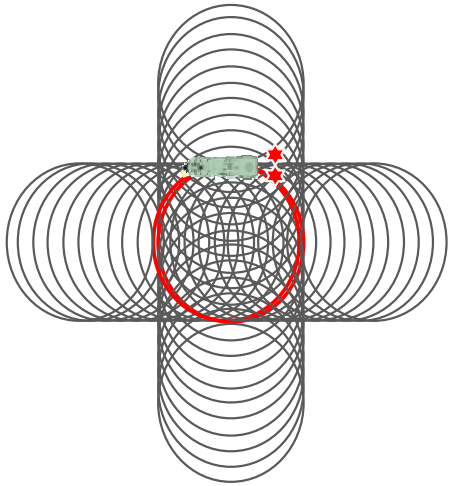


Multi-azimuth 3D

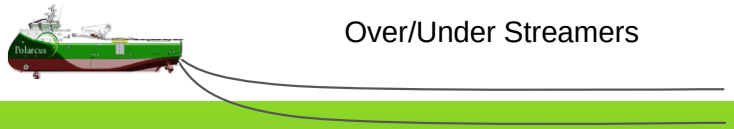
"MAZ"

(Second pass)





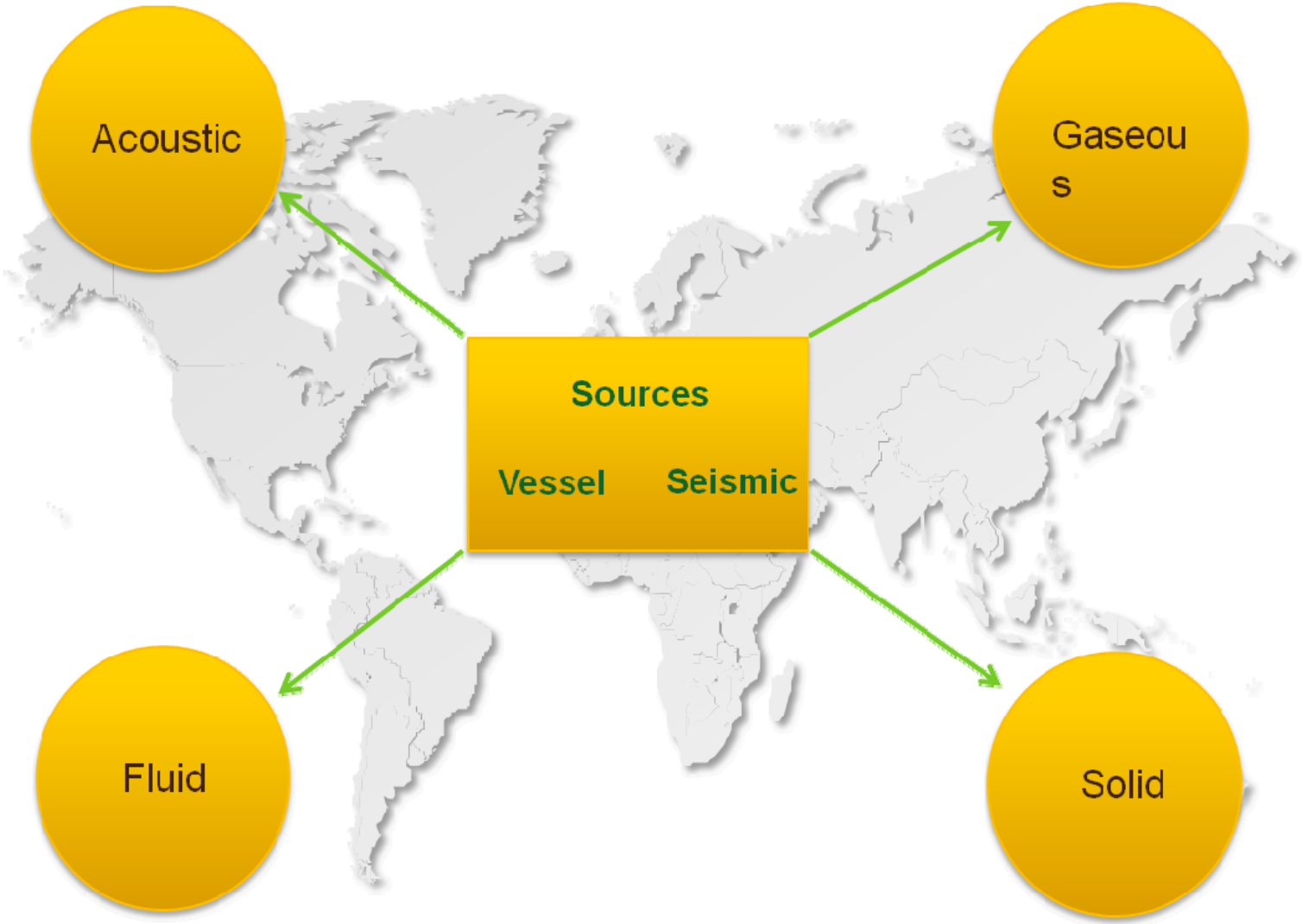
Full Azimuth Circle Shooting



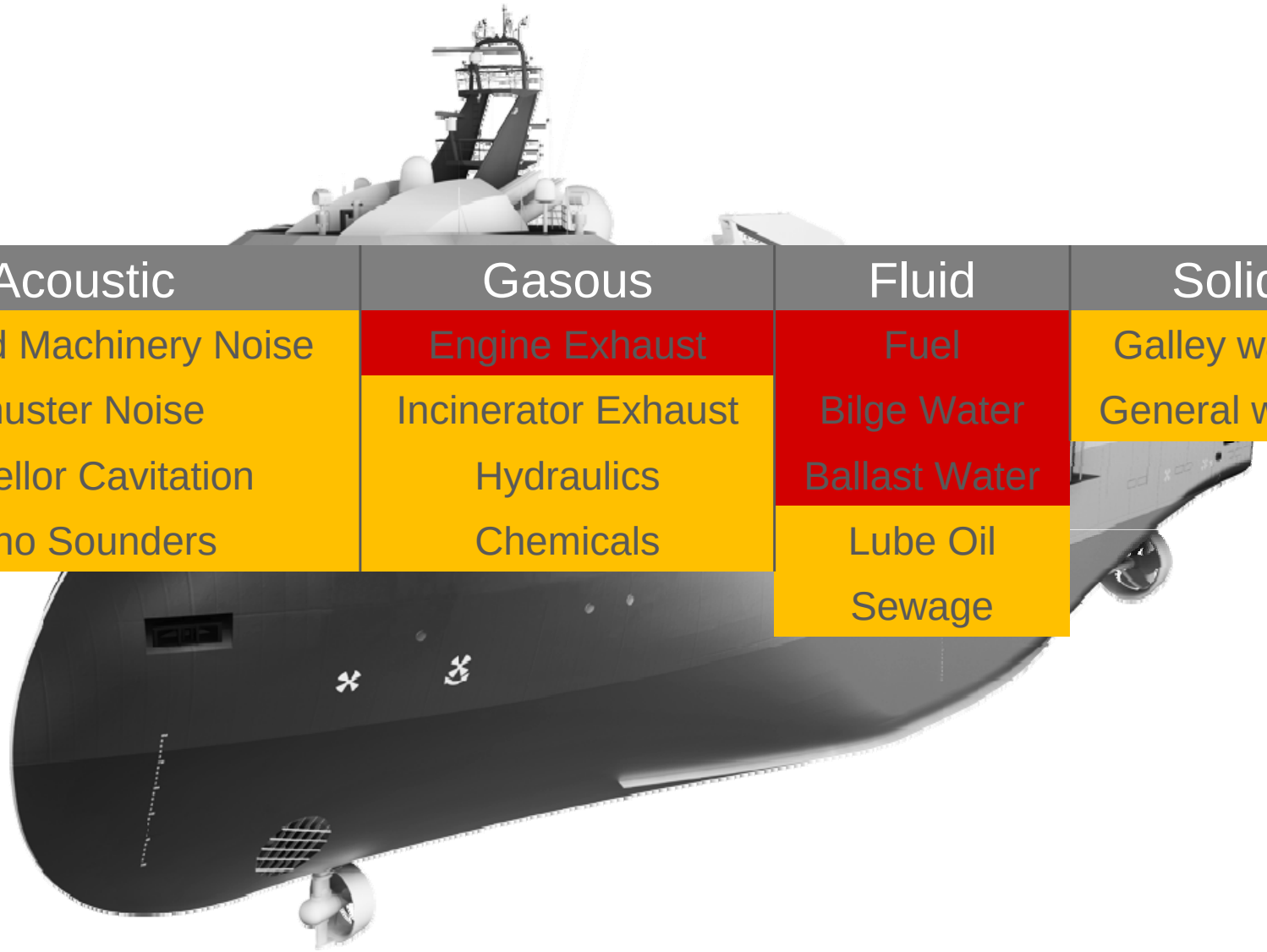
Over/Under Streamers

Slanted Streamers

Environmental “Footprint”



Seismic Vessel Components



Acoustic	Gasous	Fluid	Solid
Radiated Machinery Noise	Engine Exhaust	Fuel	Galley waste
Thuster Noise	Incinerator Exhaust	Bilge Water	General waste
Propellor Cavitation	Hydraulics	Ballast Water	
Echo Sounders	Chemicals	Lube Oil	
		Sewage	

Environmental Mitigation by Vessel Design

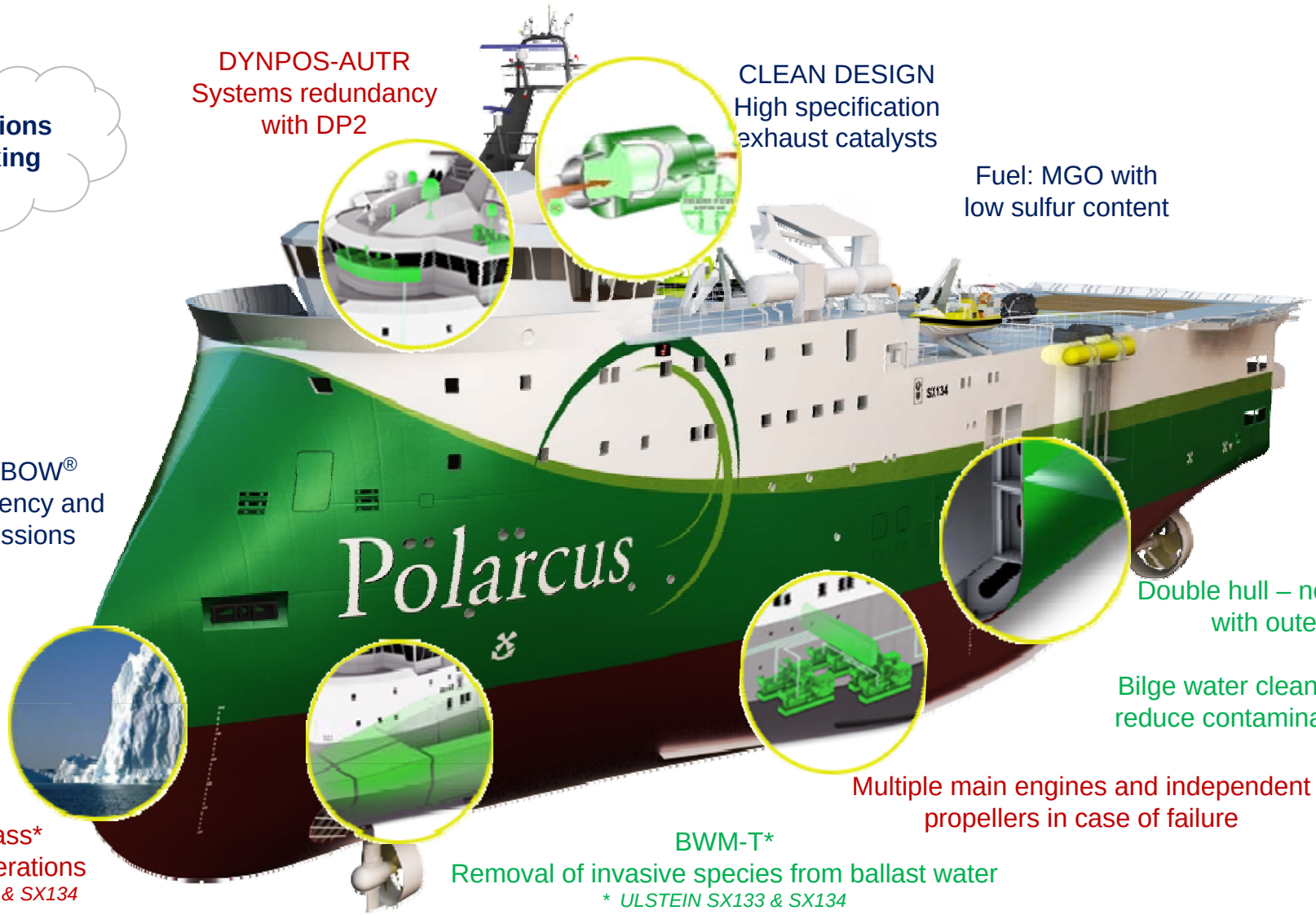
Emissions Indexing

DYNPOS-AUTR
Systems redundancy with DP2

CLEAN DESIGN
High specification exhaust catalysts

Fuel: MGO with low sulfur content

ULSTEIN X-BOW®
Improved efficiency and reduced emissions



Double hull – no oil contact with outer skin

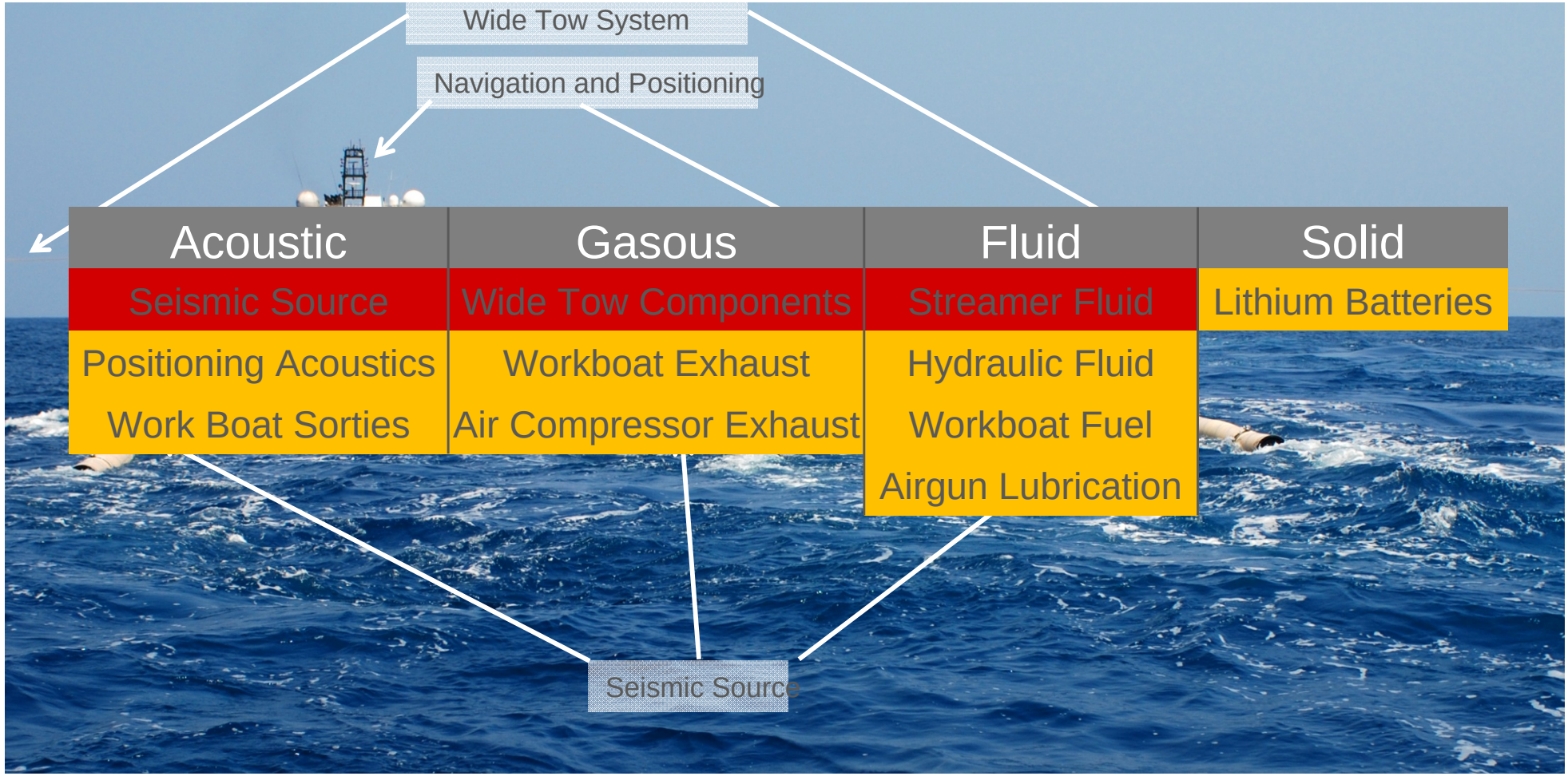
Bilge water cleaning system to reduce contaminants to <5ppm

Multiple main engines and independent propellers in case of failure

ICE-1A Class*
Safe Arctic operations
** ULSTEIN SX133 & SX134*

BWM-T*
Removal of invasive species from ballast water
** ULSTEIN SX133 & SX134*

Seismic System Components



Seismic System Mitigations

- Smaller source output
- Targeted source output
  - Broadband vs Narrowband
- Solid Streamers
- Hydrodynamic efficiency of wide tow systems
- Minimize time on prospect / Maximize acquired data volume

Platforms for Safe and Efficient Arctic Operations

Classification Society	Ice Class				
Finnish-Swedish Ice Class Rules	**IA Super**	**IA**	**IB**	**IC**	**Category II**
Russian Maritime Register of Shipping (Rules 1995)	UL	L1	L2	L3	L4
Russian Maritime Register of Shipping (Rules 1999)	LU5	LU4	LU3	LU2	LU1
American Bureau of Shipping	IAA	IA	IB	IC	D0
Bureau Veritas	IA SUPER	IA	IB	IC	ID
CASPPR, 1972	A	B	C	D	E
China Classification Society	Ice Class B1*	Ice Class B1	Ice Class B2	Ice Class B3	Ice Class B
Det Norske Veritas	ICE-1A*	ICE-1A	ICE-1B	ICE-1C	ICE-C
Germanischer Lloyd	E4	E3	E2	E1	E
Korean Register of Shipping	ISS	IS1	IS2	IS3	IS4
Lloyd's Register of Shipping	1AS	1A	1B	1C	1D
Nippon Kaiji Kyokai	IA Super	IA	IB	IC	ID
Registro Italiano Navale	IAS	IA	IB	IC	ID

Vessel ICE Classifications

ICE-1A*	Extreme ice conditions.	Ice floes of thickness 1.0 m are anticipated
ICE-1A	Severe ice conditions.	Ice floes of thickness 0.8 m are anticipated
ICE-1B	Medium ice conditions.	Ice floes of thickness 0.6 m are anticipated
ICE-1C	Light ice conditions.	Ice floes of thickness 0.4 m are anticipated
ICE-C	Light ice conditions	

Vessel ICE-C Classification

Class notation for ships operating in light ice conditions.

Purpose

Vessels without ice strengthening are not intended for operation in ice -infested waters. Vessels with additional strengthening of the fore ship in accordance with the requirements of ICE -C notation can operate in light ice conditions. **They are not intended to operate in waters with solid ice where higher ice classes are required.**

Benefits

You get a vessel which can operate in light first - year ice and call into ports which occasionally experience some ice.

Features

This class notation verifies that the vessel can operate in light ice conditions and thus call into ports which occasionally experience some light first -year ice.
The forward region of the ship is strengthened with thicker plates and heavier stiffeners and frames in the defined ice belt region.

Vessel ICE-A Classification

Class notation for ships operating in ice conditions of 0.8 m level ice thickness.

Purpose

The notation verfies that the vessel has sufficient strength, engine power and equipment to operate in the specified northern Baltic ice conditions or similar areas.

Benefits

You get a vessel which can operate in the Northern Baltic or similar areas in the winter season. Assistance from Ice Breakers is assumed when navigating in ice-bound waters.

Features

DNV's Baltic rules are applicable to ships operating in broken channels made by icebreakers in first-year ice or in open waters with small ice floes.

The following areas are subject to requirements:

- Hull – ice belt
- Machinery output
- Shaft – System
- Propeller
- Mooring
- Heating of ballast tanks
- Sea chest
- Rudder and steering gear
- Corrosion protection

Polarcus Vessels' ICE Classifications

ICE-1C Rated Vessels

Polarcus Nadia

Polarcus Naila

ICE-1A and 1A* Rated Vessels and Winterized Capabilities ☑

Polarcus Asima

Polarcus Alima

Polarcus Samur

M/V Vyacheslav Tikhonov**

Polarcus Adira (Q2 2012)

Polarcus Amani (Q2 2012)

What do we mean by “Holistic Approach”?

- ☑ •Maximize geophysical flexibility
- ☑ •Minimize environmental “footprint”
- ☑ •Provide platforms for safe and efficient seismic operations
- •Provide procedural framework to integrate all elements of the maritime and seismic compontents

Arctic Project

- Existing seismic technologies limit towed multi-streamer acquisition to ice free areas
- Ice rated vessel advantages are many.
  - Early arrival into and late departure from seasonally ice free regions = increased operational window

Arctic Project Goal

Match vessel arctic operating capabilities and individual experience with competent arctic operating procedures to ensure

- Safe passage through sea ice
- Safe operations in ice free Arctic conditions

Identified Procedures and Gap Analysis
Polarcus and DNV Inititive

Maritime	Seismic	Operations
Anti-Icing & Deicing	Back Deck Operations*	Medical Care Onboard
Ice Navigation	Seismic Hardware Performance*	Medical Evacuation
Deck and Engine Equip	Seismic Navigation	Oil Spill Procedure
Em. Preparedness	Workboat Operations	Personnel Transfer
Helicopter Operations	Marine Mammal Mitigation	Support Vessel
Maritime Training		Transit Planning
Arctic-Cold Weather		Waste Management
Awareness and PPE		Awareness Training
Ice Monitoring		

•22 high level procedures + *11 sub-procedures

Arctic Project Summary

- **Arctic Manual Created**

- **New Procedures Created**:
  - Ice Monitoring
  - Anti-Icing Precautions and De-icing
  - Ice Navigation
  - Medical Care Onboard
  - Medevac
  - Oil Spill Response
  - Marine Mammal Mitigation
  - Arctic / Cold Weather Awareness and PPE

- **New Checklists Created**:
  - Entering an ice area Checklist
  - Operating in ice area

- **One New Awareness Training Module Created**:
  - Cold Weather Awareness Training (self guided)

- **Seventeen Existing Procedures 'Arctified'**

DNV Handover Ceremony

- Arctic Shipping Summit
- Helsinki, Finland
- April 12th – 14th 2011

Statement No
DNV/OSL 20110404-01-QS

DNV

DET NORSKE VERITAS

QUALIFICATION STATEMENT

This is to qualify Polarcus Arctic Operational Procedures according to DNV's qualified expert opinion on industry Best Practice and relevant standards

NAME OF COMPANY:	Polarcus DMCC
ADDRESS OF COMPANY:	Almas Tower, Level 32, Jumeirah Lake Towers P.O. Box 283373, Dubai, U.A.E. Tel.: +971 (4) 4360 800 Fax.: +971 (4) 4360 808
REVIEW PERIOD:	07 October 2010 to 04 April 2011
QUALIFICATION REVIEW SCOPE:	The Arctic poses demanding challenges to marine seismic operations. Environmental conditions stress the ship, equipment and crew; limit the operational window for seismic operations; and pose dangers to in-water acquisition equipment. A set of the best quality operational procedures are essential to mitigate these risks and to safeguard life, property and the environment. DNV was engaged by Polarcus to assess the completeness and quality of Polarcus' in-house developed Arctic Operational Procedures and suggest areas of improvements. The first drafts of all the relevant procedures were submitted to DNV. These were reviewed against applicable conventions, regulations, guidelines and standards, as well as industry leading practice. Later, a two-day alignment workshop was facilitated by DNV, whereby DNV's review findings were anchored, further aligned with Polarcus' in-house competence, and areas of improvement were agreed upon. Subsequent to Polarcus submission of the final draft of the procedures, DNV conducted a final review to ensure the agreed amendments were incorporated. Appendix 1 lists the procedures reviewed and the key conventions, regulations, guidelines and standards used in our review.
THIS IS TO STATE THAT:	DNV finds that Polarcus has identified and addressed the key issues and has completed a set of operating procedures that currently reflect the best standards for Arctic Operations as found in relevant conventions, regulations, guidelines, standards and best practice.

PLACE: Oslo DATE: 08 April 2011

Morten Mejlænder-Larsen
Segment Director - Arctic Operations and Technology
Det Norske Veritas AS

FAQ

How will we acquire seismic in ice?

- The short answer is that we will not
- With existing technologies, multi-streamer acquisition with its large areal footprint is limited to ice free or possibly bergy water conditions with sea ice concentrations of 1/10 (10%) or less
- Taking a vessel into ice. Even with suitable ice ratings and preparation, there is significant risk involved. Extensive passage planning in close coordination with third party Ice Service information providers possibly including additional experienced 'Ice Navigation' personnel could be critical elements.
- We plan to acquire seismic in potentially very cold, remote regions with sparse infrastructure and sail through ice to get there
- Operating in close proximity to ice. In some situations (West Greenland, North Slope AK) we would operate near an ice edge or limit of seasonal ice retreat. It is probable that bergs and bergy bits will be present. Ice Management using daily forecasts + enhanced radars + additional watch keepers will be important.

FAQ

What about medical support?

- Polarcus is taking the position that we will consult our medical provider services for recommendation for any additional resources (again, this too will be location dependent). These additional resources could include a doctor as well as paramedic and equipment for the hospital. As we are not the experts, we will rely on those with the knowledge to advise us
- The Arctic Council (seven Arctic nations) intend to have a comprehensive international Arctic SAR capability by May 2011.

What about marine mammals?

- Marine mammal mitigation methods will be region specific. The US and Canada have their own regulations and the JNCC will likely be the guide for other regions. To date there does not exist a joint marine mammal guideline to encompass the Arctic region

FAQ

And finally…

- Assessing additional equipment/resource requirements to suit the geographical location. Agree not all that different than what is currently done, however the higher latitudes, potential extreme cold and ice + remoteness will present difficulties (low orbit comm sats, curtains for back deck, hull pinger retracted, acquisition without tailbuoys, additional medical personnel, ice strengthening for workboat and frc, etc, etc…)

Voyage of the Polarcus Alima

Polarcus ALIMA was the first seismic vessel through NSR – Hammerfest to New Zealand

	NSR	Panama Canal	Saving
Distance	9555 Nm	11,745 Nm	2190 Nm
Duration	32 Days	40 Days	8 Days
Fuel	1274 m^3	1566 m^3	292 m^3
CO2 Emitted	3660 T	4500 T	840 T