International Conference on Safe and Sustainable Shipping in the Challenging Arctic Environment 2015

Arctic Preservation: Exploring the Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

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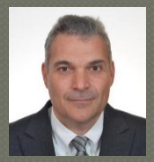

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SAFE AND SUSTAINABLE SHIPPING IN A CHANGING ARCTIC ENVIRONMENT
ShipArc
2015

Overview

- Not Mandatory
- Unique Position
- Stringent Requirements
- Sustainable Shipping
- Introduce Threat

Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

- Polar Region
- Effects of Oil on Ice
- Regulatory Status
- Viable Alternatives
- Other Considerations

Gaspar, H. M., Ehlers, S., Æsøy, V., Erceg, S., Balland, O., & Hildre, H. P. (2014, June). Challenges for Using LNG Fueled Ships for Arctic Routes. In *ASME 2014 33rd International Conference on Ocean, Offshore and Arctic Engineering* (pp. V010T07A034-V010T07A034). American Society of Mechanical Engineers.

Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

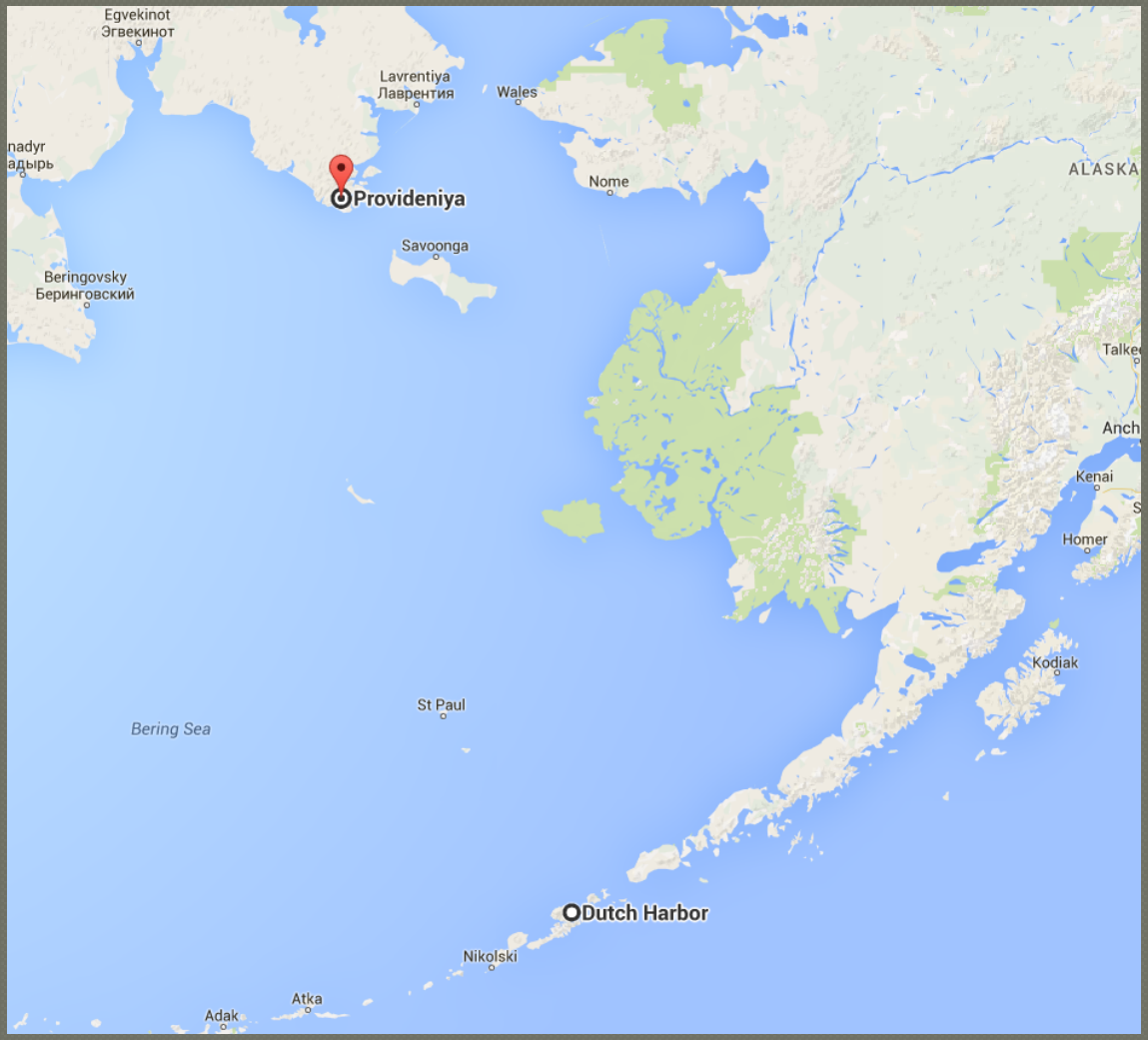
- Polar Region
  - Remote Region
  - Business Decision
  - Global Awareness
- Effects of Oil on Ice
- Regulatory Status
- Viable Alternatives
- Other Considerations

Polar Regions

Pristine Environment

Remote Region

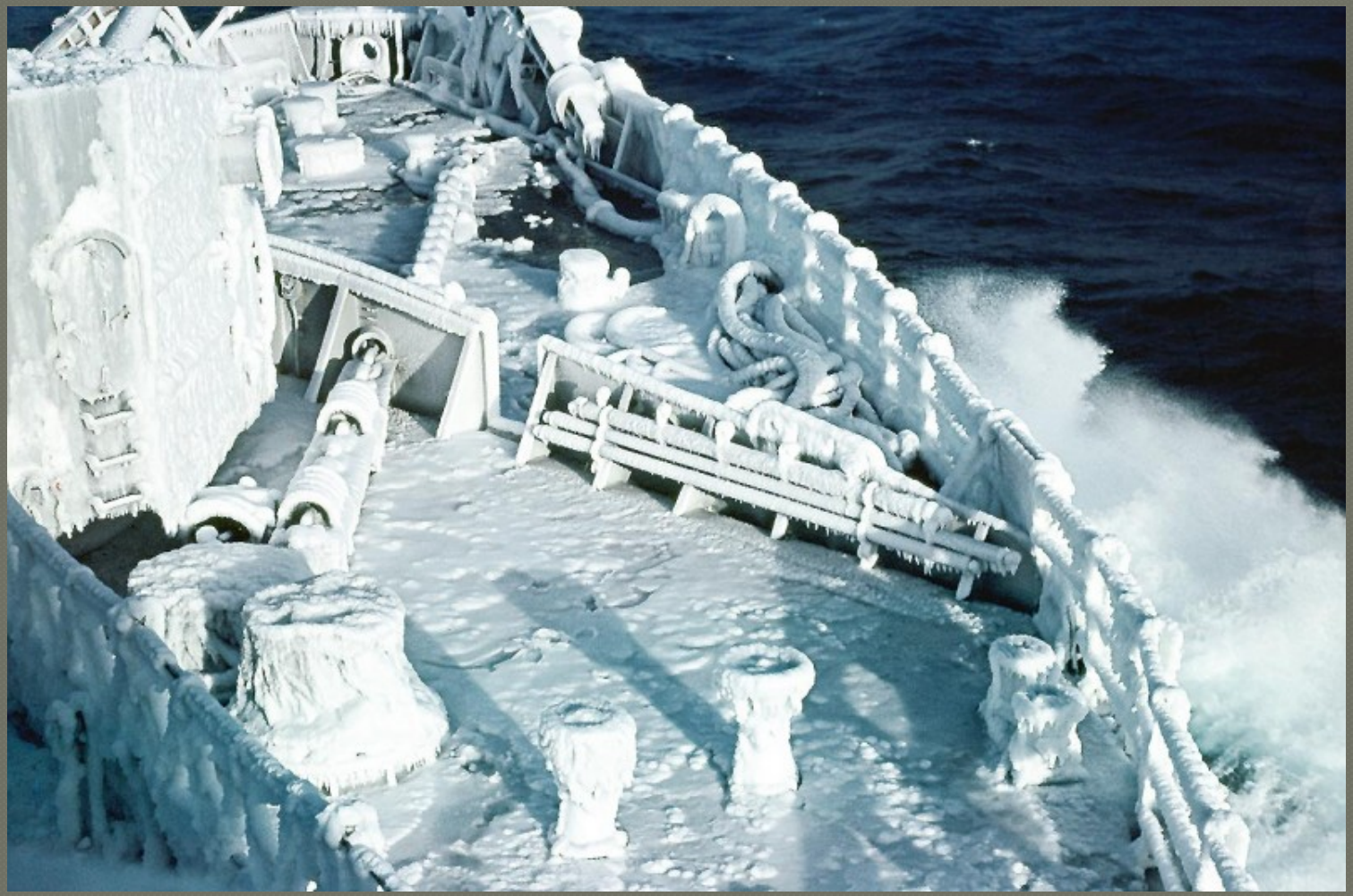
Deepwater Ports in Bering Sea

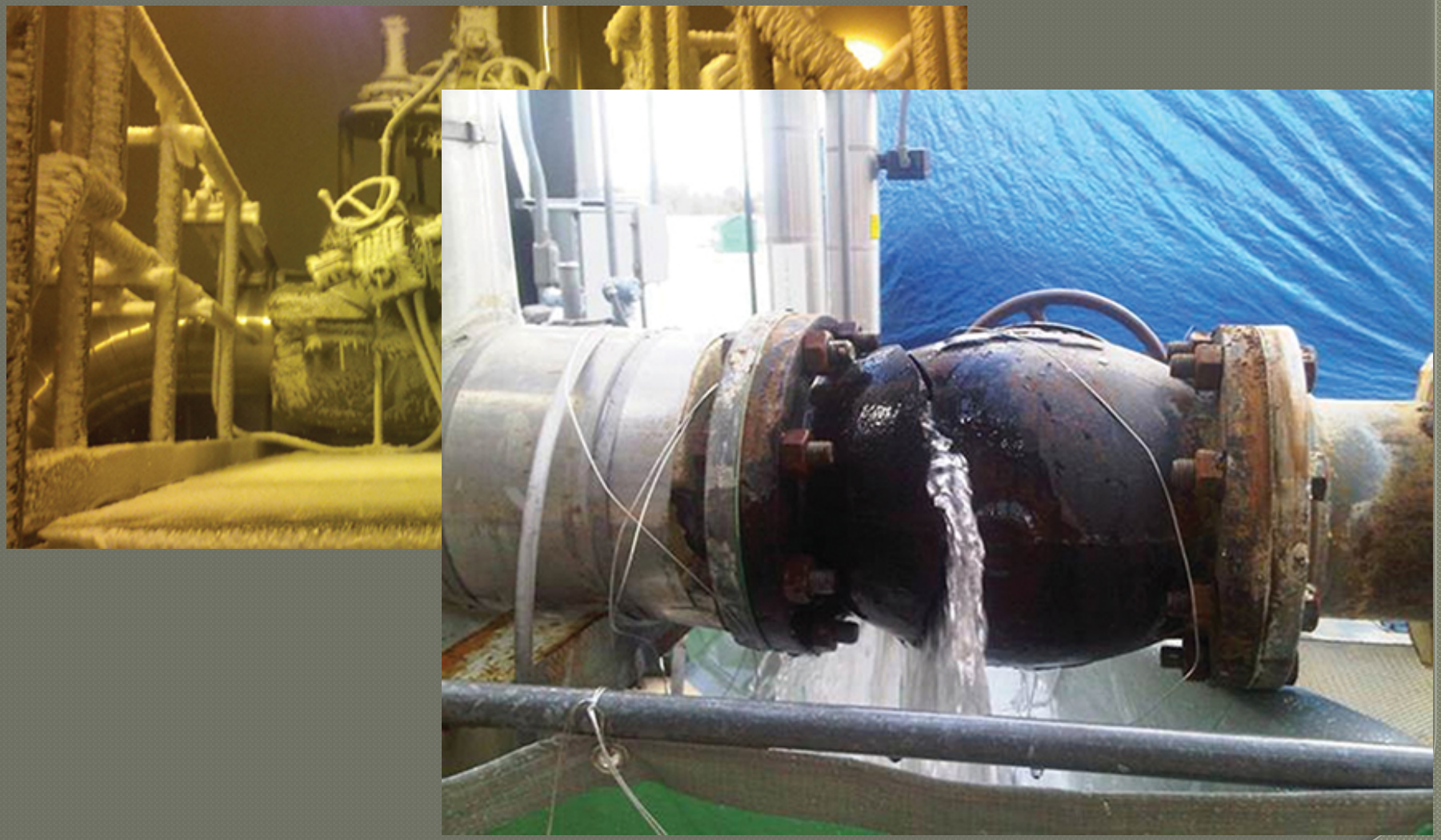


Business Decision

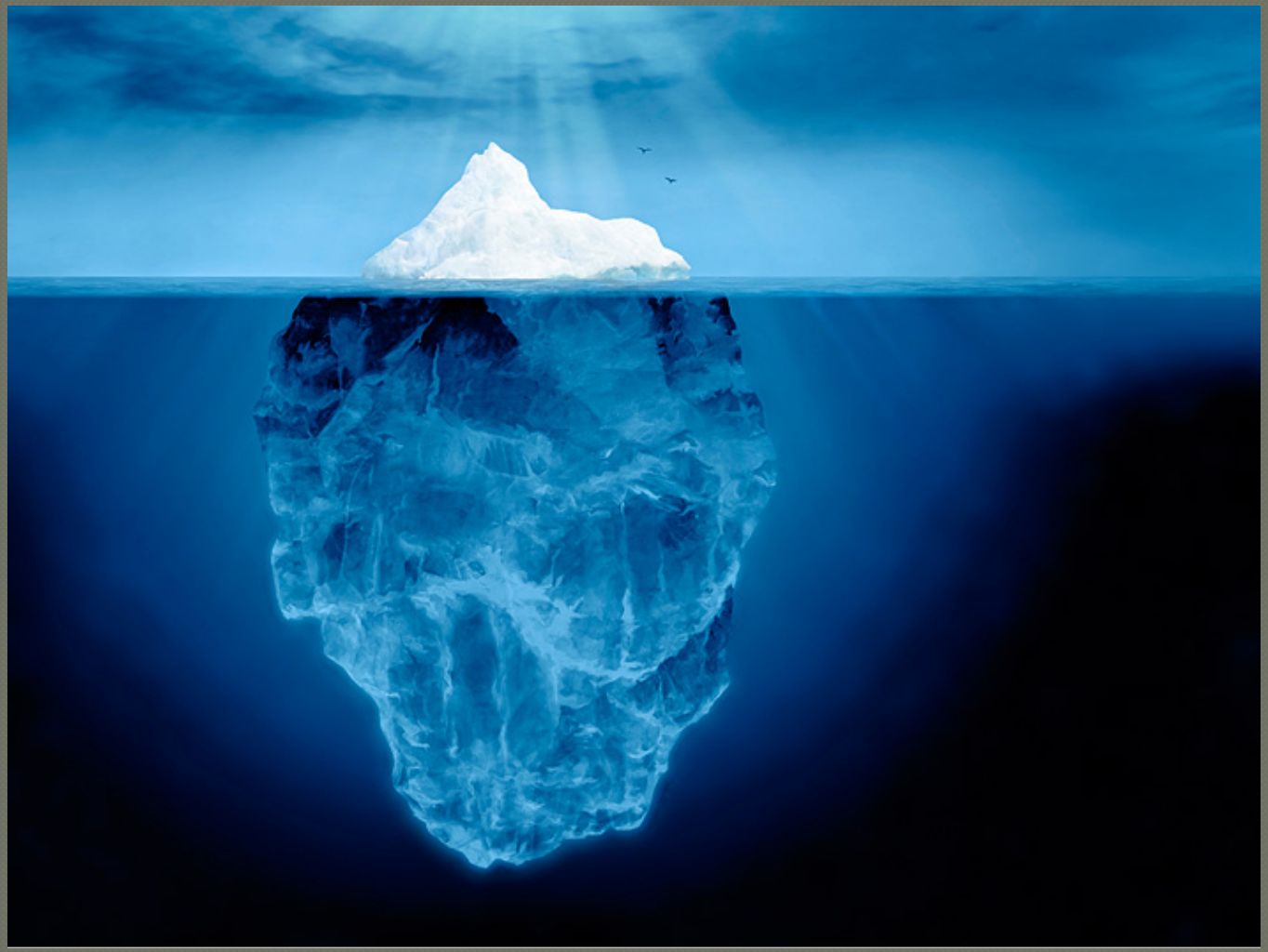
- Panama Canal ~ 7,000 miles
- Incentive – Cost (Time, Crew, Fuel & More Cargo Carriage)
- Arctic Routes Infancy:
  - 30 cargo vessels traversed the Northern Sea Route
  - 21 vessels in the North West Passage
- 15 years ~ 500 annual transits (DNV 2020)

Harsh Environment





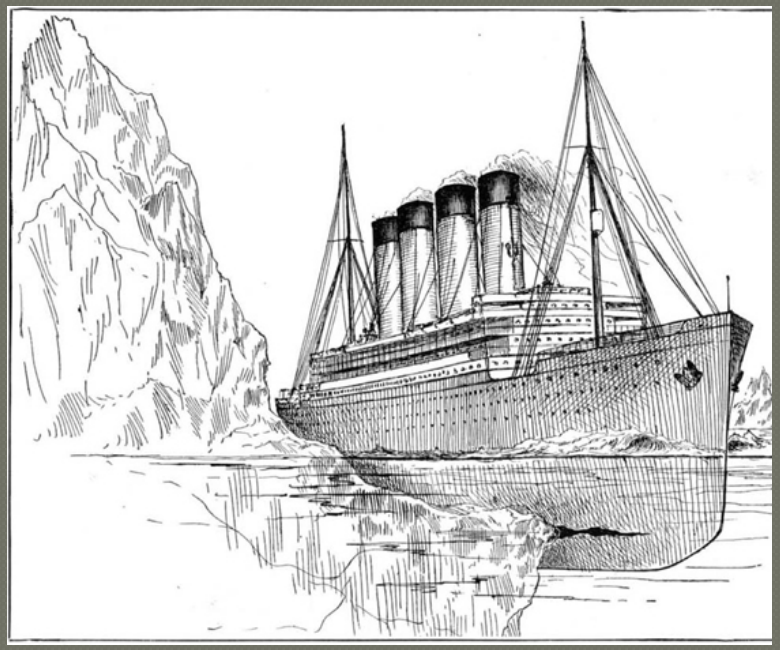
Hidden Dangers - Icebergs



Public Interest

Costly Clean-up

- EXXON VALDEZ – $3.8 billion clean-up (1989)
- Deep Water Horizon - $12 billion
- COSCO BUSAN - $44 million (2007) 1,200bbls



Temp. Accommodations

Global Awareness

- Comprised of eight member countries:
  - Canada
  - Denmark
  - Finland
  - Iceland
  - Norway
  - Russia
  - Sweden
  - United States

Strategies/Partnerships

- **Cooperation on Marine Oil Pollution Preparedness & Response in the Arctic (May 2013)**
  - Agreement for Notifications, Assistance, Command & Control, Joint Training & Exercises, etc.
- **International Arctic Research Center (IARC)**
- **International Arctic Systems for Observing the Atmosphere (IASOA)**
- **Arctic Council**
  - Participants
    - Arctic Athabaskan Council (AAC)
    - Aleut International Association (AIA)
    - Gwich'in Council International (GCI)
    - Inuit Circumpolar Council (ICC)
    - Russian Association of Indigenous Peoples of the North (RAIPON)
  - Working Groups
    - Arctic Contaminants Action Program (ACAP)
    - Arctic Monitoring and Assessment Programme (AMAP)
    - Conservation of Arctic Flora and Fauna (CAFF)
    - Emergency Prevention, Preparedness and Response (EPPR)
    - Protection of the Arctic Marine Environment (PAME)
    - Sustainable Development Working Group (SDWG)

Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

- Polar Region
- Effects of Oil on Ice
  - Capability
  - Reliability
    - Response Personnel Safety
- Regulatory Status
- Viable Alternatives
- Other Considerations

MV Explorer 2007

- November 23, 2007
  -
  -
  -
  -
  -

Oil Spilled in Ice

Mechanical Efforts

- Spreading/Weathering of oil in ice & cold temperatures of the sea and air is reduced, creating a larger 'window-of-opportunity'.

- Significant Challenges
  - Inadequate equipment,
  - limited response inventories
  - lack of funding.

Significant Challenges

Significant Challenges

Dispersant use in Ice

- Oil
  - Blanketing Effect
- Dispersant
  - Wave Action

UNLIKELY TECHNIQUE

Insitu Burning (ISB) in Ice

- Need Ideal Conditions
- Low Heat Reaction Results in Poor Combustion
- Soot Particles Settle on Ice

Resource Availability

- Low Population
- Limited Ports or Storage Depots
- No Economic Interest to Stage Resources
- Limited Ice breaking capability
  - USCG has only two which are over 40 years old
- Jurisdiction/Sovereignty
  - Want the land, but not the problem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U. S. COAST GUARD

Reliability

- Equipment Failures in Harsh Condition
- Safety of Personnel
  - Potentially 24-hour Darkness
  - Especially for a prolonged evolution
- Svalbard Spill Experiment, Norway 2006
  - 3,400 liters of crude under ice:
    - 24 Days passed before oil migrate to the surface

Personal Protective Equipment

Research Funding

- Many experiments in recent years
- Equipment Innovations
- Inventory Build up
- Training Personnel

U.S. only dedicates $8 mil in research funding annually. Much of the same strategies are used since Exxon Valdez.

Research Efforts

Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

- Polar Region
- Effects of Oil on Ice
- Regulatory Status
  - MARPOL Amendment
  - Polar Code
  - IGF Code
  - ECCs
- Viable Alternatives
- Other Considerations

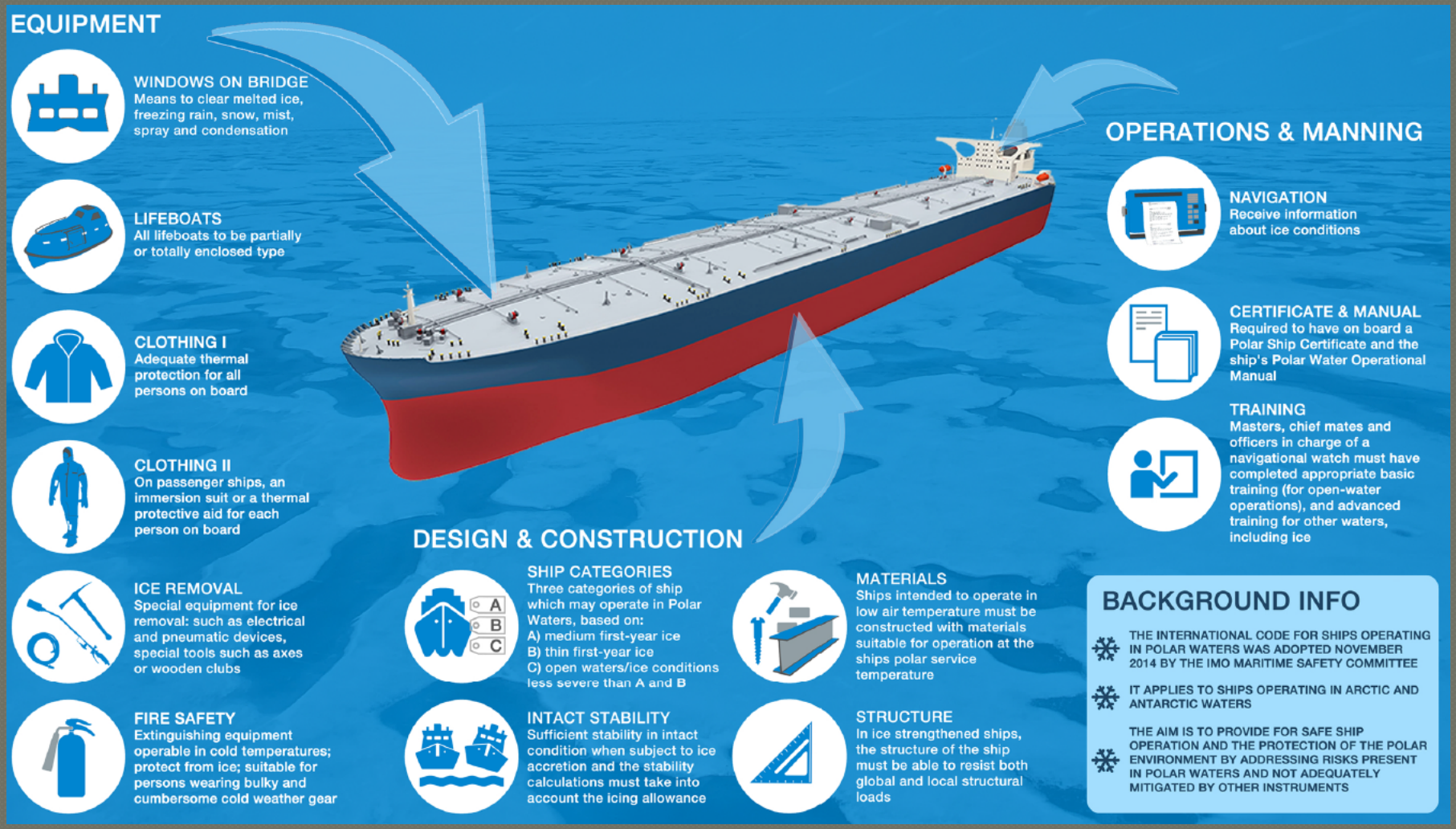
Regulatory Status

- Aug 2011, MARPOL Annex I Chapter 9
  - Carriage of heavy grade oils in bulk, as cargo or fuel, are prohibited in the sea area beyond 60□ S latitude.
- Nov 2014, IMO member states adopted the International Code for Ships Operating in Polar Waters (Polar Code).
- Jun 2015, IMO member states adopted the Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code).
- Both the Polar Code and IGF Code come into force January 2017. Coincidence?

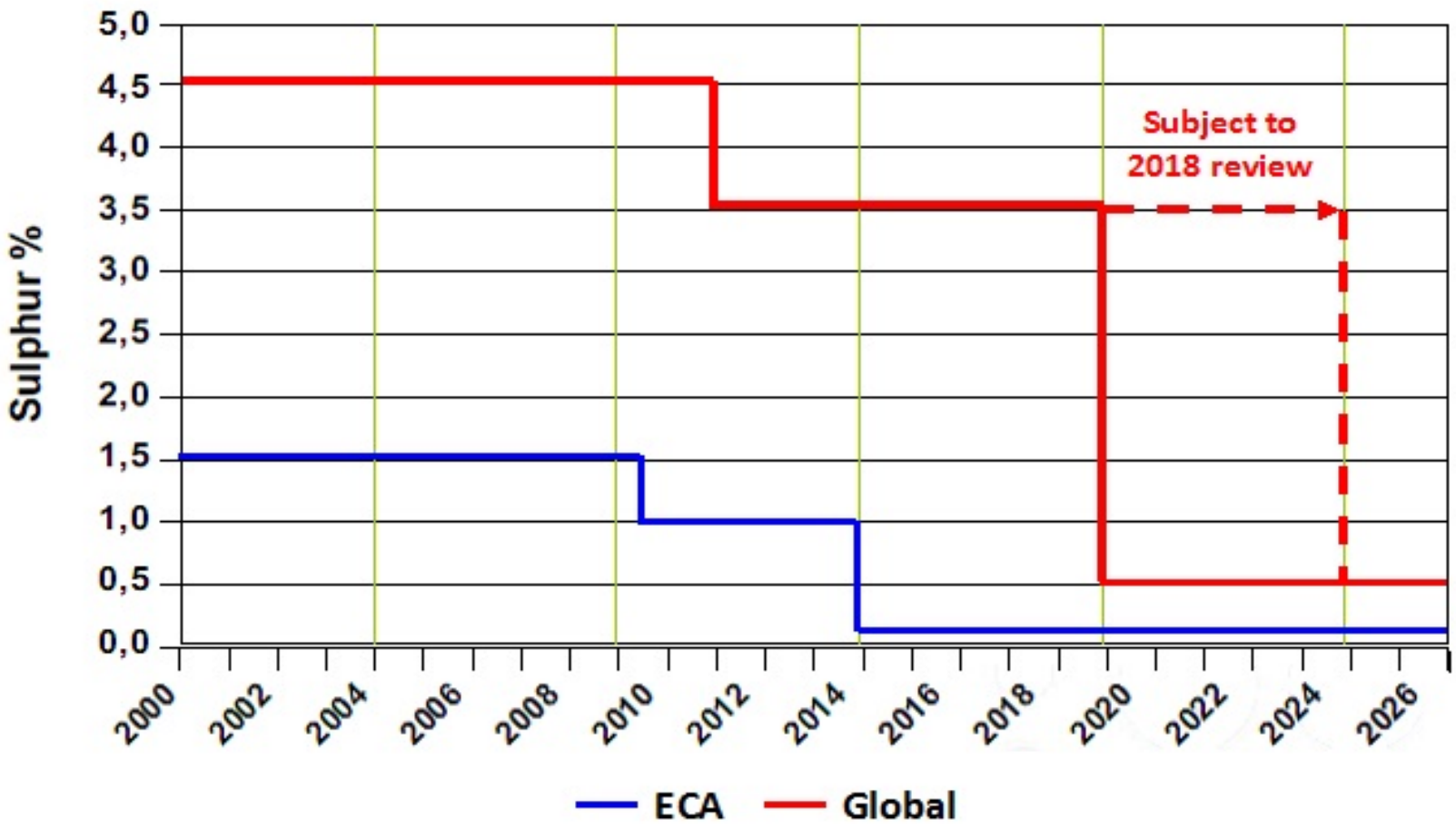
Polar Code

PART II-A - POLLUTION PREVENTION MEASURES
CHAPTER 1 – PREVENTION OF POLLUTION BY OIL
1.2 – Structural Requirements

- Independent fuel tanks
- Independent storage tanks: Sludge/Bilge
- All Oil Tankers – Double Hull/Bottom
  - Now Includes <5,000 dwt
- Tanks with a capacity <30m^3 are excluded


EQUIPMENT
WINDOWS ON BRIDGE
Means to clear melted ice, freezing rain, snow, mist, spray and condensation
LIFEBOATS
All lifeboats to be partially or totally enclosed type
CLOTHING I
Adequate thermal protection for all persons on board
CLOTHING II
On passenger ships, an immersion suit or a thermal protective aid for each person on board
ICE REMOVAL
Special equipment for ice removal: such as electrical and pneumatic devices, special tools such as axes or wooden clubs
FIRE SAFETY
Extinguishing equipment operable in cold temperatures; protect from ice; suitable for persons wearing bulky and cumbersome cold weather gear
OPERATIONS & MANNING
NAVIGATION
Receive information about ice conditions
CERTIFICATE & MANUAL
Required to have on board a Polar Ship Certificate and the ship's Polar Water Operational Manual
TRAINING
Masters, chief mates and officers in charge of a navigational watch must have completed appropriate basic training (for open-water operations), and advanced training for other waters, including ice
DESIGN & CONSTRUCTION
SHIP CATEGORIES
Three categories of ship which may operate in Polar Waters, based on:
A) medium first-year ice
B) thin first-year ice
C) open waters/ice conditions less severe than A and B
A
B
C
INTACT STABILITY
Sufficient stability in intact condition when subject to ice accretion and the stability calculations must take into account the icing allowance
MATERIALS
Ships intended to operate in low air temperature must be constructed with materials suitable for operation at the ships polar service temperature
STRUCTURE
In ice strengthened ships, the structure of the ship must be able to resist both global and local structural loads
BACKGROUND INFO
THE INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS WAS ADOPTED NOVEMBER 2014 BY THE IMO MARITIME SAFETY COMMITTEE
IT APPLIES TO SHIPS OPERATING IN ARCTIC AND ANTARCTIC WATERS
THE AIM IS TO PROVIDE FOR SAFE SHIP OPERATION AND THE PROTECTION OF THE POLAR ENVIRONMENT BY ADDRESSING RISKS PRESENT IN POLAR WATERS AND NOT ADEQUATELY MITIGATED BY OTHER INSTRUMENTS

Emission Control Areas



Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

- Polar Region
- Effects of Oil on Ice
- Regulatory Status
- Viable Alternatives
  - Liquefied Natural Gas
    - Properties & Effects
    - Clean Emissions
  - Other Fuels
- Other Considerations

Liquefied Natural Gas

- Cryogenic Storage -162 degrees Celsius
- Rapid Boil when exposed to atmosphere
  - Gaseous state is lighter than air
- Small flammability range 5-15%
  - Slow burn rate if ignited
- Non-Toxic & Non-Corrosive
- High Vaporization Rate

LNG Emissions

- LNG is scientifically proven to reduce emissions released into the atmosphere:
  - Reduces Green House Gases by 20%
  - Removes Sulfur Oxides totally
- Still cheaper than fossil fuels, even with the current market.

Finnish LNG Patrol Vessel - TURVA

Viking Grace – LNG Ferry

M/V Kvitbjorn – Short-Sea Cargo Ship

Nuclear - NS Yamal

Methanol - Stena Germanica

Benefits of Alternative Fuel to Mitigate Environmental Impact Risks

- Polar Region
- Effects of Oil on Ice
- Regulatory Status
- Viable Alternatives
- Other Considerations
  - Bunkers
  - Oil Drilling
  - Insurance / Tug Assist

Bunker Feasability

- Oil and LNG are not readily available in the Arctic
  - Oil of course has longer range capability

<u>Vancouver, Canada to Pori, Finland: 8,500 nm</u>

- Both ports intend to have infrastructure by 2017.
- M/V Kvitbjorn, a pure LNG short-sea cargo ship with 740m^3 fuel capacity, has a documented range of 3,200 nm without refueling.
- Tote recently converted a container vessel to dual fuel and is fitted with 2200m^3 LNG fuel capacity. Simple math would give 9,500 nm range.

- With the increase of emissions driven mandates, there will likely be a plethora of alternative bunkering solutions to accommodate all navigable regions.

- Tote – *Isla Bella* Deliver April 2015

Oil Drilling

- Exception:
  - Oil tankers may receive oil cargo from drill rigs provided that the vessel immediately and directly departs the region without delay.
  - Additional oil pollution response contingencies must be made active & ready during the laden outbound voyage with appropriate reporting mechanisms

Insurance / Tug Assist

- Existing ships;
  - Ensure full reimbursement for response costs, including damages as based on the maximum oil carriage capacity.
    - Similar to OPA 90 - Certificate of Financial Responsibility
  - Conditional transit approval;
    - All ships carrying oil in bulk must have a tug escort with sufficient capacity to perform adequate assist duties during transit.

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Thank You!

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