ARCTIC MARINE OPERATIONS

Navigation Safety and Communications

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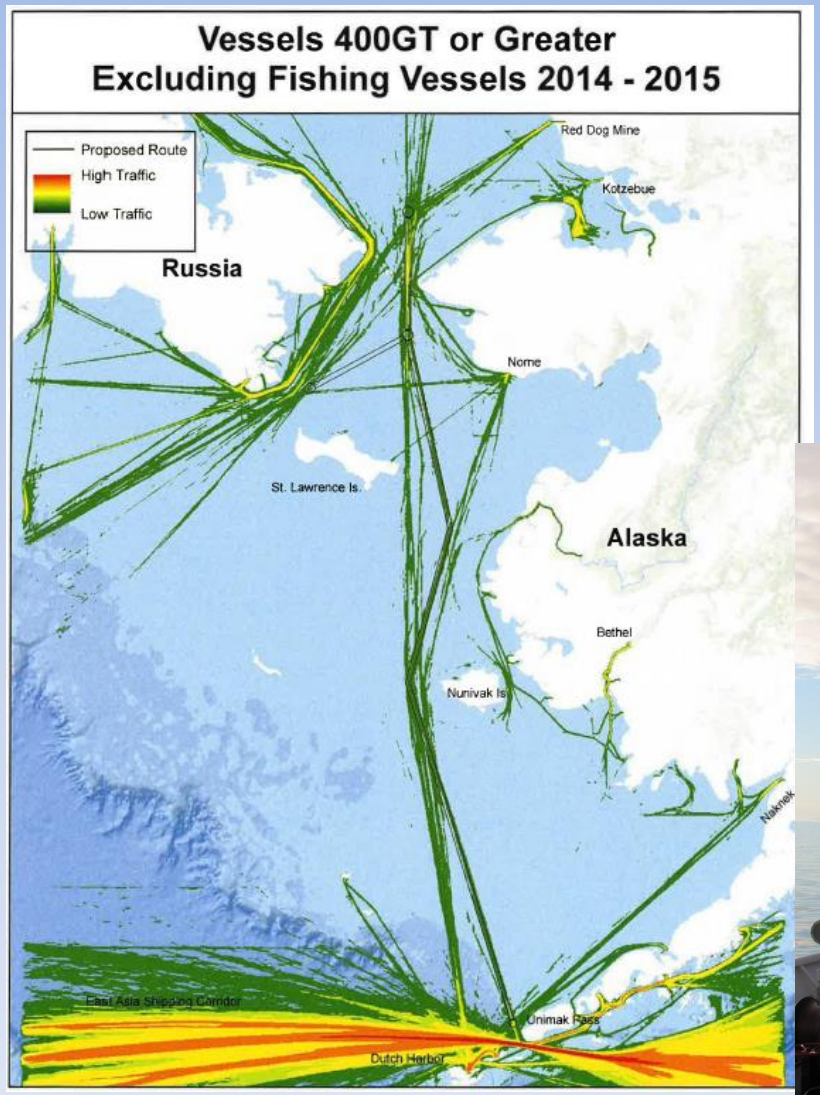
Marine Operations Center – Atlantic

Former CO, NOAA Ship Fairweather (S-220)

Space Weather Workshop April 2, 2019

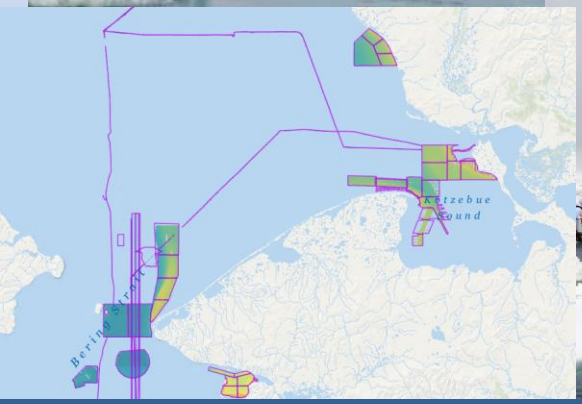
Arctic Maritime Users



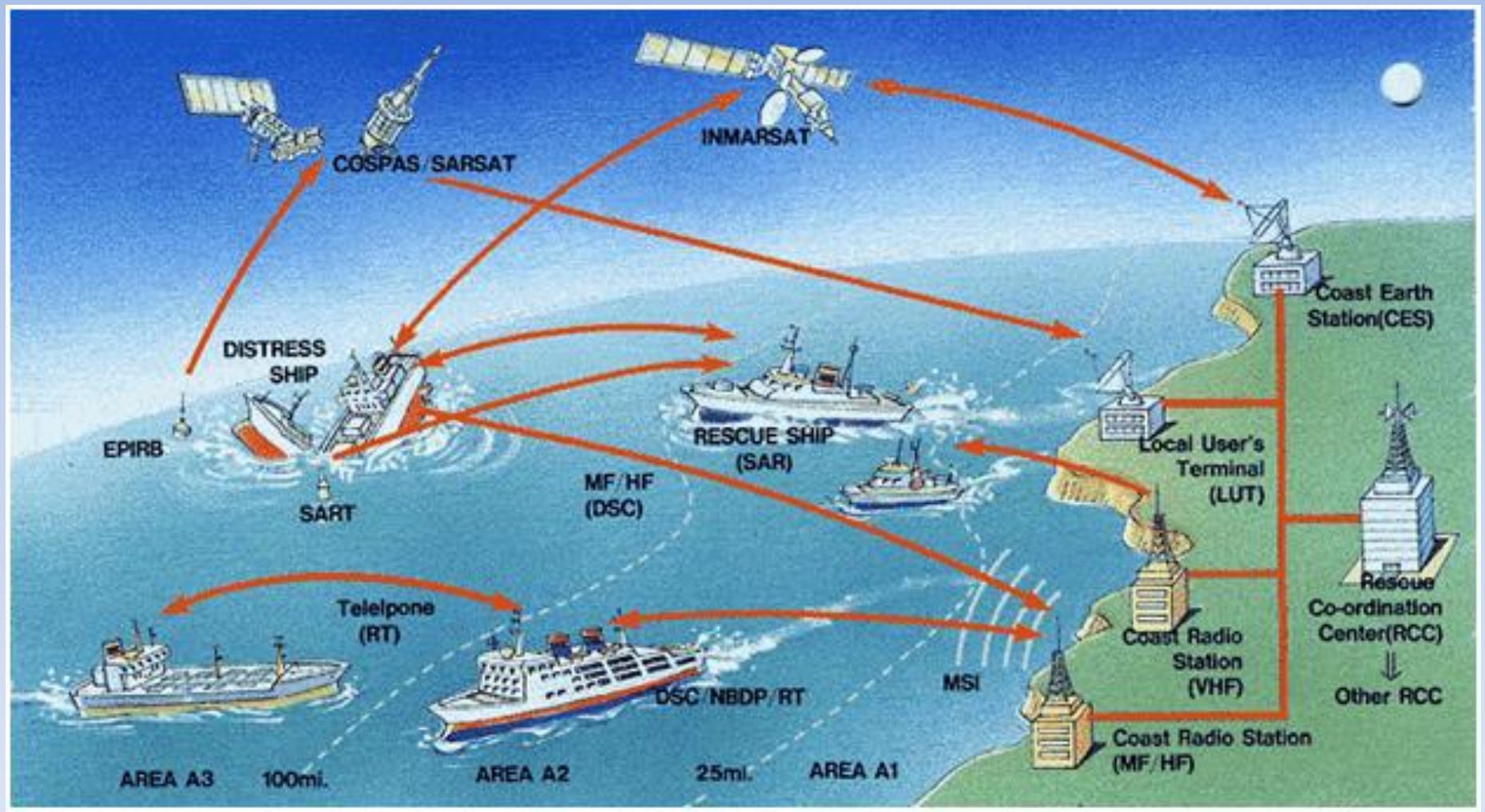
- 2008 – 2016 100% increase in Vessel Traffic
- Cruise Ships, Oil & Gas, Global Commerce, National Security
- Regional Supply & Indigenous People

NOAA's Arctic Operations

- Hydrographic Surveying
- Fisheries Assessments
- Marine Mammals
- Oceanography
- Unmanned Autonomous Systems



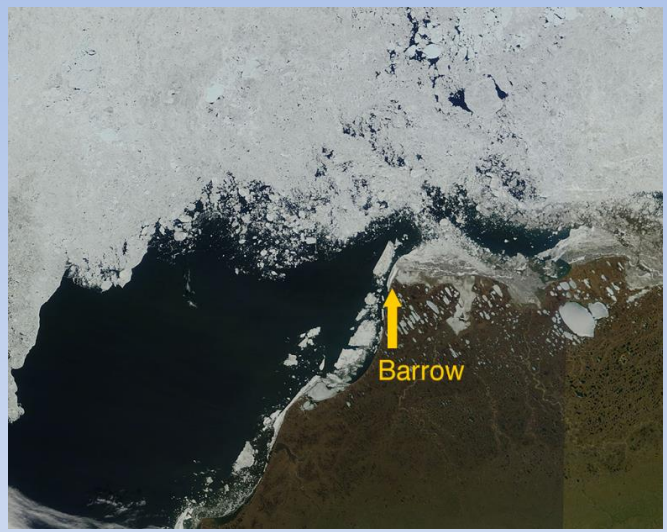
Global Marine Distress & Safety System

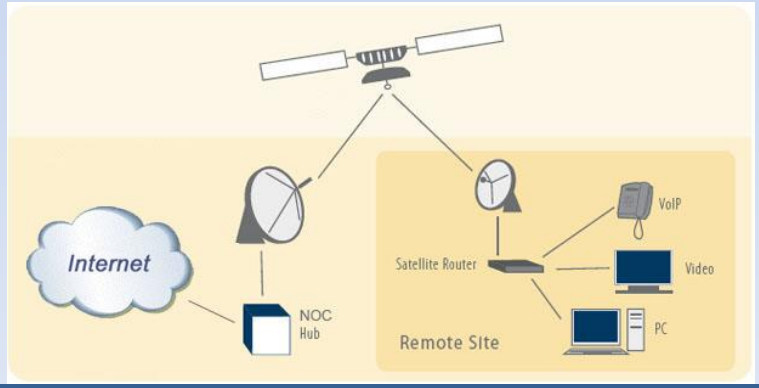


Internet as a Critical System

Modern Operations Require Enterprise Level Web Services

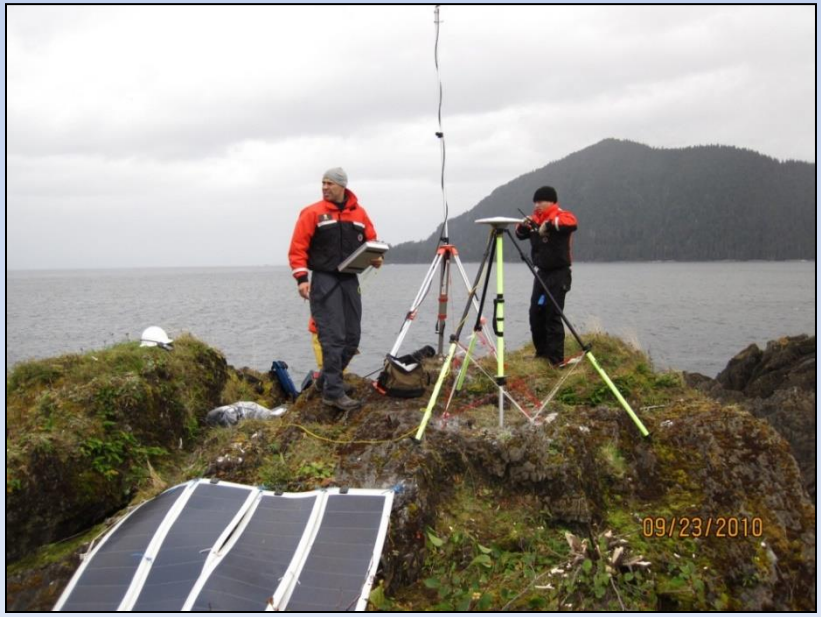
- Detailed/Specialized Support & Forecasts
- Survey Support – Tides & Positioning
- Personnel/HR - Payroll, Personnel Files, Travel
- VOIP Phones
- Corporate Admin/Policy
  - Safety Management System
  - Reporting – incidents, safety, repairs, etc
  - Email – Planning, daily business, etc





Space Weather Concerns

- Satellite Communications Reliability
  - GMDSS – Operational Safety
  - Survey Work – Access to Tides, Positioning Data
  - Repairs & Daily Business (Internet Access)
- Stability of GPS Positioning
- HF/MF Communications



Major Space Weather Impact – Polar Region

Solar Radiation Storms

S 5	Biological: unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and		

Geomagnetic Storms

G 5	Extreme	Power systems: widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. Spacecraft operations: may experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. Other systems: pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).**
G 4	Severe	Power systems: possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. Spacecraft operations: may experience surface charging and tracking problems, corrections may be needed for orientation problems. Other systems: induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).**
G 3	Strong	Power systems: voltage corrections may be required, false alarms triggered on some protection devices. Spacecraft operations: surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. Other systems: intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).**

S 4	
S 3	

Space Weather Needs for the Arctic

To Better Understanding Polar Region Impact & Prediction:

- What is the impact of a 4-5 level event on Safety Systems
- What are the limitations on satellite communications, GPS.
- Impacts on the National Spatial Ref System (CORS Network).
- What are the limitations on HF/MF systems.

Moving forward

1.4 Identify and assess the effects of frequent and extreme space weather events on operations and missions. To better quantify and manage the risk space weather poses to critical assets and national security missions, there is a need to identify and assess the consequences of both direct and indirect effects of space weather.

NOAA Marine Operations

Thank you!
Questions?

Agenda

- Arctic Marine Use, NOAAs Arctic Operations
- Systems Vulnerable to Space Weather
  - GMDSS System
  - Internet as a Critical System
- Space Weather Concerns for the Mariner
- Space Weather Needs for the Arctic