The Rights and Obligations of Coastal States to Provide and Maintain Navigational Aids in the Arctic Ocean

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Why important to investigate?

Incident: M/V Hanseatic grounded due to a buoy that drifted off its charted position.

Context: Canadian Coast Guard strike prevented seasonal removal of summer buoys.

Consequence: Safety and Environmental Damage

Lesson: Arctic AtoN systems must be robust, seasonal, and continuously maintained.

Why AtoN in Arctic Is Not Just a Technical Issue It's a Legal Obligation

- *CSL Group v. Canada* (1992): Failure to adapt AtoN to winter ice led to commercial losses and legal action.
- Exposed systemic gaps and confirmed state liability for inadequate AtoN.
- A landmark case showing that poor AtoN management brings legal, environmental, and operational risks.







Transformation in the Arctic Ocean

- Climate change \rightarrow Retreating sea ice
- New shipping lanes: Northwest Passage and Northern Sea route
- More shipping = more risk
- AtoN needed for safety and marine protection
- Coastal state duties under UNCLOS, SOLAS, and Polar Code



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Navigational Challenges in the Arctic Ocean

Unpredictable and mobile sea ice

Fog, snow, and reduced visibility

Poor hydrographic coverage and outdated charts

Narrow passages and choke points

Limited salvage and SAR infrastructure

Types of Navigational Aids in Arctic

- Floating Aids (e.g., buoys)
- Terrestrial Aids (e.g., RACONs, ranges)
- Fixed Aids (e.g., lighthouses, markers)
- Space-based Aids (e.g., GNSS, DGPS)
- E-navigation and digital overlays



Buoys in Ice-Covered Waters

- Essential but vulnerable in icy conditions
- Ice movement displaces or destroys buoys
- Sacrificial and biodegradable designs common
- Seasonal deployment/removal
- High maintenance and operational costs





Fixed Aids: Immovable but Indispensable

- Include lighthouses, day beacons, and markers
- Permanent structures withstand Arctic weather
- Require ice-resistant design and regular upkeep
- Provide stable references near coasts and ports



Land-Based Navigation: RACONs and Ranges

- **RACONs**: Radar-triggered beacons
- Appear clearly on radar even in icy/foggy conditions
- **Ranges**: Visual aids for channel alignment
- Operable in low-visibility, snow-prone Arctic areas





Canada's Aids to Navigation in the Arctic

- Managed by Canadian Coast Guard (CCG)
- Seasonal deployment of sacrificial buoys
- Focus on Low Impact Corridors
- NORDREG for mandatory ship reporting
- Aids retrieved before ice returns

The U.S. Arctic (Strategy: Electronic Navigation)

- Sparse physical AtoN in northern Alaska
- Transition to e-AtoN systems (AIS, DGPS)
- Marine Exchange of Alaska (MXAK) operates 140+ receiver sites
- Polar Scout satellites support EPIRB signals
- Icebreaking upgrades: Polar Security Cutters



Greenland

(Coastal Markers & Local Knowledge)

- No buoys land-based markers dominate
- 63 lighthouses maintained by Danish Maritime Authority
- Extensive RACON use
- Heavy dependence on local pilot knowledge
- Flexibility through 'kjentmann' system



Landbaserte basestasjoner

FURC

SWEDEN

NORWAY

Norway (Comprehensive Arctic Navigation System)

BARENTS

Svalbard

GREENLAND SEA

GREENLAND

- Led by Norwegian Coastal Administration
- Extensive AtoN coverage in Svalbard and fjords
- Over 90 AIS stations including remote Arctic
- Integrated VTS and weather systems

RUSSIA

ASIA

Local coordination with Svalbard authorities

BEAUFORT



Russia (AtoN Infrastructure Along the NSR)

- AtoN includes fixed and floating aids
- NSRA provides daily ice and hydrographic updates
- Rosatom coordinates AtoN and icebreaker support
- Strong state-led approach with modernized port access
- Extensive coastline coverage for Arctic trade routes



Coastal States' Role in AtoN Management in Arctic Waters

- Legal authority from UNCLOS, SOLAS, and Polar Code
- Obligation to ensure safe navigation and marine protection
- AtoN systems must suit extreme Arctic conditions
- Requires state investment and international collaboration
- Localized adaptation of global standards

UNCLOS on AtoN Rights and Duties

INCLOS

- Article 21: Coastal states may regulate safety, traffic, and AtoN in territorial seas
- Article 16: Obligates publication of sea lanes and traffic schemes
- Article 43: Calls for cooperation in international straits



United Nations Convention on the Law of the Sea



AtoN Responsibilities in Territorial Waters

Full regulatory authority within 12 nautical miles (Article 16)

- Responsibility to provide AtoN in EEZs for safetyObligations increase with growing Arctic traffic
- Climate variability requires adaptable systems

Traffic Separation Schemes and Sea Lanes in the Arctic

- Article 16 allows designation of sea lanes
- Essential in congested, ice-prone corridors
- Aims to reduce collision and grounding risks
- Must be communicated via IMO and global charts



AtoN Responsibilities in Arctic Straits

- Article 43: Coastal and user states should jointly establish AtoN and safety measures
- . Shared funding and technical cooperation may be required
- . Infrastructure remains sparse in remote Arctic straits





SOLAS Chapter V Operational Standards for AtoN

- Reg. 12 & 13 govern AtoN establishment and maintenance
- Reg.19 Mandatory Electronic Chart Display wi paper backup for voyage planning
- AtoN must meet IMO/IALA recommendations
- Periodic maintenance, inspection, and reporti

The Polar Code: Safety and Environmental Compliance

- Adopted by IMO in 2014, effective from 2017
- Integrates SOLAS, MARPOL, and STCW
- Regulates design, equipment, operations, training
- Applicable in Arctic waters north of 60° latitude

POLAR Code

INTERNATIONAL CODE FOR SHIPS OPERATING IN POLAR WATERS







Ice Navigators, Pilots, and Training Requirements

- Polar Code mandates certified crew for polar navigation (e.g., Ice Navigators)
- Ice Pilots offer local expertise in highrisk or coastal Arctic zones
- AtoN systems complement trained crew by supporting decision-making
- Coastal States must ensure AtoN services align with operational needs

Conclusion: Strengthening Arctic AtoN Systems Arctic AtoN must
be resilient,
seasonally adaptiveStates should
integrate virtual
and space-based
aidsMaintenance and
ice-specific design
are criticalInternational
collaboration
through IALA/IMO

Legal frameworks must remain enforceable and flexible

is vital