

APPENDIX A: GLOSSARY OF KEY TERMS

The terminology below defines the analytical vocabulary used consistently throughout this research. These terms are used with deliberate specificity; their precise meaning supports the report's evaluative judgments and should not be substituted for general usage.

Arctic Sustainment Modes and Lifeline Constraints. Framework evaluating maritime, aviation, and ALCAN sustainment under Arctic disruption, recognizing maritime as primary, aviation as critical but limited, and overland routes as constrained redundancy.

Business Critical Infrastructure. Privately operated lifeline systems, fuel, food, transportation, communications, and medical supply, that directly support Arctic mission assurance and civilian sustainment.

Cascading Failure. A pattern in which the failure of one lifeline system propagates into other systems on which the first depended or which depended on the first. In this research, cascading failure is the primary mechanism through which the dual-theater scenario produces operational impact within the Days 0–14 window.

Cold-chain. Temperature-controlled logistics systems supporting pharmaceuticals, vaccines, and perishables whose failure under combined fuel, power, and communications disruption creates rapid sustainment risk.

Consent-dependent redundancy. A backup sustainment or transit pathway whose availability depends on approval from another nation or external authority during disruption conditions. This research distinguishes consent-dependent redundancy from constrained but U.S.- or partner-controlled redundancy on the analytical grounds that consent-dependent redundancy can be eliminated at the moment of greatest need without any change in physical conditions. The Northern Sea Route under UNCLOS Article 234 is the canonical Arctic example.

Contested logistics. The operational condition in which adversaries disrupt or degrade the supply chains and transportation systems supporting military operations and sustainment. In this research, contested logistics is treated as the operational condition under which the dual-theater scenario unfolds, distinguishing this analysis from benign-environment sustainment modeling.

Cook Inlet natural gas depletion. The projected decline of Cook Inlet gas reserves that increases long-term energy vulnerability for Anchorage, JBER, and the Railbelt power system.

Days 0–14 Decision Window. The early disruption phase when inventory depletion, cascading failure, and coordination breakdown occur before alternate sustainment pathways can stabilize operations.

Defense Critical Infrastructure (DCI). Per National Security Memorandum 22, DoD and non-DoD networked assets and facilities essential to project, support, and sustain military forces and operations worldwide. Non-DoD owned DCI consists of assets from relevant critical infrastructure sectors and subsectors, including as defined by statute.

Defense Production Act (DPA). Civilian and military infrastructure essential to sustaining defense operations, including systems not owned or controlled by the Department of Defense.

Dual-Theater Scenario. The stress-test scenario combining West Coast maritime disruption with simultaneous Arctic operational escalation to evaluate sustainment resilience.

Dual-use infrastructure. Infrastructure whose operations serve both civilian and military requirements. In Alaska, the principal example is the Port of Alaska, which simultaneously sustains Anchorage civilian demand and Joint Base Elmendorf-Richardson defense operations. Dual-use infrastructure produces operational efficiency under normal conditions and concentrated risk under disruption.

Fantasy document. A planning document whose contents describe a coordination architecture, redundancy pathway, or operational capacity that does not perform under the conditions it purports to address. In this research, the term is used as a rhetorical anchor for exposing gaps between governance frameworks and actual operational capacity, distinct from documents that describe what should be done but cannot be done within the relevant window.

Force degrader. A condition, such as workforce disruption or communications failure, that reduces operational effectiveness without direct combat engagement.

Inflection point. A specific moment within the disruption timeline at which the operational situation transitions from one phase to the next, typically because an inventory threshold is crossed, a workforce capacity limit is reached, or an institutional decision pathway is activated or fails to activate. Inflection points are identified throughout the time-phased degradation analysis in this research.

Joint Base Elmendorf-Richardson (JBER). The joint Air Force and Army installation in Anchorage, Alaska, headquarters of the Alaskan Command and 11th Air Force, and the principal defense operations node in Southcentral Alaska. In this research, JBER is treated as analytically inseparable from the surrounding civilian infrastructure, especially the Port of Alaska, the Cook Inlet natural gas system, and Anchorage water and sanitation utilities.

Jones Act. U.S. maritime law affecting domestic cargo movement and influencing surge shipping capacity and substitution options during disruption.

Just-in-time architecture. The supply chain configuration in which inventory is sized to consumption rather than to contingency, producing efficiency under normal conditions and rapid shortfall under disruption. In this research, Alaska’s commercial supply chain is characterized as a four-day Tacoma-to-shelf just-in-time architecture in which warehouse storage is minimal and stated reserve figures reflect inventory in transit and on shelves rather than in deep storage.

Master Dependency. A foundational system whose disruption simultaneously disables multiple downstream lifelines. Energy is the master dependency in the Arctic operating environment; the dependency chain Fuel → Power → Heat → Water → Communications → Coordination governs all downstream behavior.

Mission assurance. Per DoD Directive 3020.40, a process to ensure that assigned tasks or duties can be performed in accordance with the intended purpose or plan. In this research, mission assurance is treated as the operational outcome that the dependency mapping, risk assessment, and recommendations are constructed to support.

No-Fail Node. A critical infrastructure point whose failure produces major operational or statewide disruption with no viable replacement during the analytical window.

Northern Sea Route (NSR). The maritime transit corridor running along the northern coast of the Russian Federation between the Atlantic and Pacific. In benign-planning literature, the NSR is treated as a potential maritime rerouting option when Pacific gateway access is degraded. In this research, the NSR is treated as consent-dependent redundancy whose availability is determined by Russian assertion of regulatory control under UNCLOS Article 234 rather than by ice conditions or vessel-tracking capacity.

Operation Vittles (Berlin Airlift). The 1948–1949 U.S. and allied operation sustaining West Berlin by air after Soviet ground blockade. In this research, Operation Vittles serves as the historical anchor establishing the upper bound of aviation-only sustainment under conditions of constrained airfield access and weather, against which the feasibility of Arctic airlift substitution for maritime cargo is measured.

Operational Redundancy (or Real Redundancy). Backup capability that has been exercised, resourced, and demonstrated to function under realistic Arctic disruption conditions.

Paper Redundancy. Backup systems or contingency plans that exist in documentation but cannot sustain required throughput during real disruption conditions.

Pre-event planning and relationship preconditions. The standing requirement identified throughout this research, that the planning, coordination, and relationship-building necessary to manage tribal and rural community impacts during Arctic infrastructure disruption must be established before the disruption occurs.

Public-Private Partnership (P3) maturity. The level of coordination and integration between government and private-sector lifeline operators supporting resilience and sustainment planning.

Risk amplifier. A condition or system attribute that increases the severity or speed of cascading impact under disruption, distinct from the proximate cause of disruption itself. In this research, Alaska Native and tribal community vulnerability, cross-border governance gaps, and communications degradation are each identified as risk amplifiers in the dependency and risk-assessment analysis.

Seasonal Asymmetry. The condition in which the operational characteristics of Arctic infrastructure, transportation, communications, and human-systems performance differ substantially between summer and winter, with winter producing the binding constraints on capacity, throughput, and substitution. In this research, seasonal asymmetry is treated as a structural feature of the operating environment rather than as a contingent factor.

Single-Source Dependency. A condition in which one supplier, one node, or one provider is the sole pathway for a critical input. Crowley as the sole source of avgas for Alaska, Charlie's Produce as the sole produce wholesale node, and the Cook Inlet basin as the dominant Railbelt natural gas source are documented single-source dependencies.

Standalone Microgrid. A self-contained electricity generation and distribution system, typically diesel-based with limited renewable integration, that operates without interconnection to a larger transmission grid and without access to the mutual aid agreements available to interconnected utilities.

Substitution-limit modeling. The analytical approach that evaluates contingency alternatives by their operational throughput under realistic constraints rather than by their nameplate capacity. In this research, substitution-limit modeling is applied across maritime, aviation, and overland modes, and consistently establishes that planned substitutes do not perform at the volume, speed, or reliability that benign-planning models assume.

Subsistence Harvest. The traditional fish, wildlife, and wild-plant harvest that sustains rural Alaska communities outside the commercial food distribution system.

Throughput vs. Capacity. Capacity describes what a system can accommodate under optimal conditions; throughput describes what a system can actually move under the specific stress conditions of the disruption environment. The existence of capacity is not evidence of sustainment feasibility; throughput, not capacity, is the analytically operative figure throughout this research.

Time-to-failure threshold. The duration after disruption initiation at which a specific lifeline system, inventory buffer, or coordination architecture transitions from constrained to acutely degraded. Thresholds are evaluated by sector in the Risk and Vulnerability Assessment and are treated as directional rather than as decision-grade quantification.

Tribal and Alaska Native communities as risk amplifiers. The finding that infrastructure disruption disproportionately impacts remote tribal communities, accelerating humanitarian and operational pressures across the broader system.

UNCLOS Article 234. A provision of the 1982 United Nations Convention on the Law of the Sea authorizing coastal states to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction, and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone. In this research, Article 234 is treated as the legal instrument through which the Northern Sea Route is converted from a benign-planning redundancy into a consent-dependent pathway whose availability depends on conditions outside U.S. planning authority.

APPENDIX B: REFERENCE LIST

This research integrates government, academic, industry, and practitioner sources to assess community stability, workforce resilience, governance dynamics, civil–military coordination, family readiness, tribal and Alaska Native resilience, behavioral health surge capacity, and infrastructure performance affecting societal continuity and mission assurance under Arctic disruption conditions. Entries are listed alphabetically by author or organization. Italicized short-form citation tags in square brackets, used selectively in this report, key to the entries below.

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APPENDIX C: LIST OF ACRONYMS

The following acronyms appear throughout this report. Entries are grouped by category and listed alphabetically within each group.

Acronym	Full Term
AAC	Alaskan Command
AGU	American Geophysical Union
ALCAN	Alaska-Canada Highway
ANTHC	Alaska Native Tribal Health Consortium
APIP	Alaska Partnership for Infrastructure Protection
ARRC	Alaska Railroad Corporation
ASRC	Arctic Slope Regional Corporation
AUSA	Association of United States Army
AV Gas	Aviation Gasoline
BEOC	Business Emergency Operations Center
CDC	Centers for Disease Control and Prevention
CISA	Cybersecurity and Infrastructure Security Agency
CNA	CAN Corporation (formerly Center for Naval Analyses)
CONUS	Continental United States
COVID-19	Coronavirus Disease 2019
CRCI	Community Resilience Challenges Index (FEMA)
CRS	Congressional Research Service
DCI	Defense Critical Infrastructure
DCIP	Defense Critical Infrastructure Program
DHS	United States Department of Homeland Security
DHS&EM	Alaska Department of Homeland Security and Emergency Management
DOC	United States Department of Commerce

DoD	United States Department of Defense
DoDD 3020.40	DoD Directive 3020.40: Mission Assurance
DOE	United States Department of Energy
DOT	United States Department of Transportation
DOT & PF	Alaska Department of Transportation and Public Facilities
EOC	Emergency Operations Center
EOP	Emergency Operations Plan (State of Alaska)
ESA	European Space Agency
FDA	United States Food and Drug Administration
FEMA	Federal Emergency Management Agency
FEMA P3	FEMA Public-Private Partnership Program
FEMA SCAN	FEMA Supply Chain Analysis Network
GAO	U.S. Government Accountability Office
GEO	Geostationary Earth Orbit
GPS	Global Positioning System
H-2B	Temporary Non-Agricultural Worker Visa Program
HDAS	Homeland Defense Awareness Symposium
HDI	Homeland Defense Institute
HEO	Highly Elliptical Orbit
HF	High Frequency (radio)
HIMARS	High Mobility Artillery Rocket System
IHS	Indian Health Service
INDOPACOM	United States Indo-Pacific Command
JBER	Joint Base Elmendorf-Richardson
LEO	Low Earth Orbit
LNG	Liquefied Natural Gas
MARAD	United States Maritime Administration
MedEvac	Medical Evacuation

NASEM	National Academies of Sciences, Engineering, and Medicine
NDS	National Defense Strategy
NGO	Nongovernmental Organization
NORAD	North American Aerospace Defense Command
NSR	Northern Sea Route
NSM-22	National Security Memorandum 22: Critical Infrastructure Security and Resilience (2024)
OCONUS	Outside the Continental United States
ODNI	Office of the Director of National Intelligence
OPM	Office of Production Management (WWII)
OSD	Office of the Secretary of Defense
P3	Public-Private Partnership
PNW	Pacific Northwest
PPE	Personal Protective Equipment
PSEMA	Private Sector Emergency Management Association
RO/RO	Roll-On / Roll-Off
SAR	Search and Rescue
SATCOM	Satellite Communications
SCADA	Supervisory Control and Data Acquisition
SCOPE	Supply Chain Operational Engagement (CNA methodology)
SCR	Supply Chain Resilience (FEMA Framework)
SPAB	Supply Priorities and Allocations Board (WWII)
TSC	Ted Stevens Center for Arctic Security Studies
TTX	Tabletop Exercise
UNCLOS	United Nations Convention on the Law of the Sea
USARAK	United States Army Alaska
USCG	United States Coast Guard
USDA	United States Department of Agriculture

USNORTHCOM	United States Northern Command
USPS	United States Postal Service
WIB	War Industries Board (WWII)
WPB	War Production Board (WWII)

APPENDIX D: METHODOLOGY AND LIMITATIONS

This appendix documents the methodological detail underlying the analytical lines of work described in the Methodology section of the body of this report. It is organized as a technical reference for HDI, NORAD, and USNORTHCOM reviewers seeking source-level verification of the analytical record, the methodological precedents on which the engagement design rests, and the protocols governing the strategic conversations and stakeholder engagement components. The full Reference List is documented in Appendix B; this appendix references those entries by short-form citation tag rather than reproducing them.

A.1 Literature Inventory by Analytical Strand

The literature review was organized by the five analytical strands the research is structured to address: Arctic lifeline architecture and just-in-time logistics dependency; maritime gateway concentration and West Coast port disruption economics; substitution-mode feasibility (aviation, ALCAN, and Northern Sea Route) under contested conditions; communications fragility and the commercial-provider autonomy gap; and contested-logistics doctrine as it applies to Arctic homeland defense. Each strand is anchored by a small set of authoritative sources, summarized below, and supplemented by domain-specific literature documented in the Reference List.

Arctic lifeline architecture and just-in-time logistics strand. The Dewberry Alaska Supply Chain Analysis Baseline Report, prepared under the FEMA Supply Chain Analysis Network Pacific Partnership Project, provides the most operationally specific characterization of Alaska's just-in-time logistics architecture available in the unclassified literature. [26] It is the primary source for inventory buffer figures, the four-day Tacoma-to-shelf cycle, the absence of meaningful in-state warehousing capacity, single-source wholesale concentration at the Anchorage tier, and the 150 standalone microgrids comprising the rural energy architecture. The Alaska Food Security and Independence Task Force report supplements Dewberry with food-system specificity, particularly the 95-percent import figure and the modal split across maritime, ALCAN, and air-cargo pathways. [4] The State of Alaska Mass Care Group Feeding Support Operations Guide documents the named commercial partners on which state feeding operations depend, establishing the paper-redundancy condition at the operational layer. [55]

Maritime gateway concentration and West Coast port disruption strand. The Port of Alaska Fact Sheet provides the foundational throughput figures: 1.66 million tons inbound, 1.47 million tons of refined petroleum products, 3.1 million barrels of liquid fuel storage capacity, and the dependency picture in which a single intermodal hub serves approximately 90 percent of the state's population. [44] The Rose et al. analysis of economic impacts of complex disasters affecting seaports updates the West Coast disruption economics with current modeling. [49] The Denali Commission dual-use infrastructure assessment provides the cross-state characterization of Alaska as a distributed, fragile supply chain system with few redundancies. [25] The National Academies post-hurricane supply chain resilience study contributes the analytical

framework for cascading port-disruption effects developed across the 2017 hurricane season. [41] The CNA Corporation supply chain analysis capabilities documentation provides the methodological precedent for cross-sector supply chain characterization. [16]

Substitution-mode feasibility strand. The RAND Plan Blue 21 wargame is the primary doctrinal anchor for the substitution-mode analysis, establishing that Arctic operations are logistics-dominated, that sustainment is the pacing function rather than maneuver, and that aviation cannot substitute for maritime cargo volumes at scale. [45] The Operation Vittles operational record from the Berlin Airlift provides the empirical upper bound on aviation-only sustainment under conditions favorable to airlift feasibility, the benchmark against which the seven-hundred-wide-body-sortie figure for replacing one week of Port of Alaska throughput is calibrated. [66] The Government of Yukon Alaska Highway traffic statistics and the Transport Canada Northern Transportation Infrastructure assessment together establish the ALCAN operating throughput (approximately 350 vehicles per day) and the theoretical capacity gap (12,000 to 15,000 vehicles per day) that define the corridor's paper-redundancy condition. [36; 62] The RAND Exploring Gaps in Arctic Governance analysis identifies the cross-border coordination architecture gaps that constrain ALCAN surge under disruption, including Canadian sovereignty, weight-restriction waivers, hours-of-service waivers, and provincial permitting decision points. [46] The U.S. Coast Guard Polar Icebreaker Fleet Mix Analysis and the CRS Polar Security Cutter Program report together document the icebreaker fleet gap that constrains the Northern Sea Route option. [68; 21]

Communications fragility and commercial-provider autonomy strand. The European Space Agency KA-SAT network cyberattack overview documents the 2022 Viasat incident as the canonical cascade pathway in which a cyber vector compounds adversarial-jamming and commercial-autonomy vectors to produce simultaneous defense and civilian impacts. [28] The ESA Arctic communications assessment establishes the high-latitude coverage constraints that make Arctic communications structurally fragile before any disruption begins. [27] The Breaking Defense analysis of the Arctic high-north communications gap and the American Geophysical Union polar air traffic study together document the geostationary coverage limit above approximately seventy degrees north and the space-weather constraints that further degrade polar operations. [6; 11] The CNA supply chain analysis and the CSIS commercialization and dual-use space capabilities assessment document the commercial-provider autonomy vector – the gap in which over half of U.S. satellites are commercially owned and Arctic operations depend on providers whose service availability during conflict is discretionary commercial decision rather than contractual guarantee. [15; 16] The Caton master's thesis at Naval Postgraduate School identifies the federal structural gap that the United States has not formally designated space as a critical infrastructure sector. [12] The Ted Stevens Center ICE-PPR Communications Workshop report and the CSIS analysis of the 2026 National Defense Strategy document the active adversarial degradation vectors: Russian GPS jamming and submarine telecommunications cable interference as ongoing tactics rather than hypothetical risks. [14; 58]

Contested-logistics doctrine strand. The contested-logistics literature developed since 2022 establishes the doctrinal frame within which Arctic mission assurance must now be analyzed. The Shaffer and Miles characterization of logistics in contested environments provides the foundational treatment of fuel as the non-substitutable foundation and the ultimate last-mile challenge in contested theaters. [51] The Fox primer on contested logistics anchors the analytical vocabulary (tight coupling, loose coupling, exterior-lines vulnerability, sustainment as pacing function) used throughout the report. [34] The Scott-Skillern and Singer treatment of Army logistics in the Pacific establishes the exterior-lines vulnerability pattern in which the same maritime gateway nodes sustain both Pacific operations and northern resupply. [50] The Unified Pacific Wargame Series 2022 unclassified overview, the Gully, Roque, Taylor-Catterson, and Wormuth contributions to the Army contested-logistics modernization literature, and the Williams master's thesis on FEMA contested logistics together establish that sustainment is the pacing function in modern conflict and that the homeland is now understood as a strategic support area rather than a sanctuary. [37; 48; 57; 64; 78; 79]

Strategic context anchors. The 2025 National Defense Strategy and the supporting CSIS analysis establish the strategic context in which Arctic mission assurance now operates, including the simultaneity problem the strategy identifies as a primary planning challenge across the Arctic and Western Hemisphere. [14; 70] DoD Directive 3020.40 (Mission Assurance) and National Security Memorandum 22 establish the institutional grounding for treating non-DoD-owned commercial Arctic systems as Defense Critical Infrastructure within mission-assurance scope. [69; 80]

Domain-specific sources supporting fuel and energy systems, food systems, medical and pharmaceutical supply chains, workforce dynamics, and the mitigation and prioritization analysis are documented in the Reference List and are not repeated here.

A.2 Analytical Commitments Embedded in the Methodology

Three analytical commitments are embedded throughout the research and warrant explicit identification.

Throughput, not capacity. The research uses operationally achievable throughput figures rather than theoretical maximum capacity figures whenever the distinction matters. Aviation surge calculations, ALCAN traffic estimates, and port substitution projections are framed against what actually moves under stress conditions, not against nameplate capacity. The capacity-versus-throughput distinction is the single most operationally significant analytical commitment in the research. The seven-hundred-wide-body-sortie aviation substitution figure, the 350-vehicles-per-day ALCAN operating throughput, and the no-viable-alternative finding for the six identified Port of Alaska contingency candidates are each calibrated to throughput rather than capacity. The commitment is methodologically grounded in the contested-logistics literature, which establishes that nameplate capacity figures consistently overstate operational reality under stress. [34; 51]

Operational redundancy, not paper redundancy. The research distinguishes systematically between redundancies documented in plans, contracts, or contingency frameworks and redundancies that perform at the volume, speed, and reliability required under disruption. Mitigation prioritization is shaped by which investments close the gap between the two and which simply formalize a redundancy that does not function. The paper-versus-operational distinction extends to the governance layer: coordination frameworks that exist on paper but have not been exercised, formalized through charter, or integrated into lifeline operator business processes do not meaningfully reduce risk during Days 0–14. The FEMA Public-Private Partnership maturity framework is the source for the Basic / Intermediate / Advanced characterization of coordination capacity that anchors the governance-layer application of the principle. [30]

Arguments lead; research corroborates. The presentation of findings prioritizes the analytical claim and uses the literature to corroborate rather than to construct the argument. Source attribution is precise where it matters operationally, particularly for figures, thresholds, and policy citations, but the report does not foreground source names as a substitute for analytical reasoning. This commitment shapes the citation convention used throughout the body: inline citations are reserved for direct quotes, specific statistics, and named legal or policy authorities, while cross-source synthesis and analytical findings are stated as findings rather than as source-attributed claims. The Reference List in Appendix B is the comprehensive sourcing record; the body of the report is the analytical argument the sources corroborate.

A.3 Cross-Source Validation Patterns

Where individual findings rest on multiple independent sources, the convergence is noted in the body of the report. Particularly consequential examples are documented here as the cross-source validation record for the most analytically significant conclusions.

Maritime gateway concentration risk is cross-validated across the Dewberry Alaska Supply Chain Baseline Assessment, the Denali Commission dual-use infrastructure assessment, the National Academies post-hurricane supply chain resilience study and the Rose et al. economic impacts analysis. The convergent finding across these sources is that a full West Coast port shutdown produces \$1.9 to \$2.5 billion per day in national economic losses with no rerouting alternative available at sufficient scale within the early-phase window, and that Alaska’s downstream concentration at the Port of Alaska means that disruption arrives statewide, immediately, at a single point with no equivalent substitute. [25; 26; 41; 49]

Seasonal asymmetry in fuel delivery is cross-validated across the Dewberry Alaska Supply Chain Baseline Assessment and the Alaska Food Security and Independence Task Force report, both of which document that the October-to-April winter window eliminates barge resupply and concentrates dependence on bush plane aviation. [4; 26] The seasonal asymmetry finding is structurally consistent with the AGU polar air traffic analysis of space-weather and weather-driven aviation constraints. [6]

The paper-redundancy pattern at the maritime, aviation, and overland substitution layers is cross-validated across the contested-logistics literature, the Alaska Supply Chain Baseline Assessment, the Yukon and Transport Canada infrastructure assessments, and the RAND Plan Blue 21 wargame outputs. The convergent finding is that the redundancies invoked in planning documents (alternate ports, aviation surge, ALCAN throughput, Northern Sea Route rerouting) consistently fail to perform at the volume, speed, and reliability the dual-theater scenario requires. [26; 34; 36; 45; 51; 62]

The FEMA Public-Private Partnership maturity model is validated against the operational records of the Nebraska Preparedness Partnership twelve-hour logistics coordination during 2019 flooding and the Houston Supply Chain Group COVID-19 response pivot, both documented in the Building Private-Public Partnerships guidance. [30] These cases establish that where the P3 architecture has been built and exercised, coordination moves at the pace disruption requires; where it has not, coordination must be improvised under time pressure with predictably degraded results.

The commercial-provider autonomy gap in Arctic communications is cross-validated across the CNA supply chain analysis, the CSIS commercialization and dual-use space assessment, the Ted Stevens Center ICE-PPR Communications Workshop report, and the Caton thesis on federal coordination architecture. The convergent finding is that no single satellite architecture provides full Arctic coverage, that commercial provider service availability during conflict is discretionary commercial decision rather than contractual guarantee, and that the absence of a critical-infrastructure-sector designation for space concentrates risk in a coordination architecture that does not currently exist. [12; 15; 16; 58]

A.4 Strategic Conversations Protocol

Strategic conversations with current and former NORAD and USNORTHCOM leadership were conducted on a non-attributed basis. The conversations were not structured interviews and did not follow a fixed question set; they were oriented toward validating the operational relevance of the dual-theater scenario, confirming command-level recognition of the lifeline and infrastructure gaps under examination, and identifying the research areas most consequential for mission-assurance planning within the three-month performance window.

The conversations are not treated in this report as primary data; they are treated as analytical-scope validation. Findings, recommendations, and analytical claims throughout the report rest on the literature record and the structured stakeholder engagement, not on conversation content. This separation is deliberate and protects both the candor of the conversations and the analytical integrity of the report.

A.5 Stakeholder Engagement Instrument and Distribution

Stakeholder engagement was distributed through PSEMA's network and through targeted outreach to the sectors identified in the engagement plan, including infrastructure and access systems; energy, utilities, and fuel; supply chain, logistics, and distribution; communications and technology; community organizations and nonprofit operators; state, local, and territorial agencies; government agencies. The question architecture was calibrated to the dual-theater disruption scenario and oriented toward four analytical objectives: surfacing dependencies and chokepoints across the five-layer Arctic dependency framework; identifying substitution limits and failure thresholds at the operator level; mapping civil–military coordination gaps in the Days 0–14 window; and identifying the early-phase decision points at which lifeline systems are most likely to strain.

Engagement participation was self-selected, and the resulting respondent set is systematically more disposed toward cross-sector coordination than the sector population as a whole. The non-attributed aggregation approach was a precondition for candid engagement and is preserved throughout the analysis. Where stakeholder input refines or extends literature-derived findings, the integration is documented at the section level rather than presented as a separate evidence stream. Where stakeholder input diverges from literature-derived findings, the divergence is treated as an operationally consequential finding to be carried forward rather than as practitioner error to be reconciled. This is the methodological precedent adopted from the mental-models tradition in risk research, which holds that decision-relevant risk information is what practitioners and decision-makers actually use to make choices under uncertainty, not what analysts would prefer that they used.

A.6 Tribal Engagement Protocol

Tribal and Alaska Native communities occupy a distinct position in the Arctic vulnerability picture that this research treats analytically as a risk-amplifier dimension. The risk-amplifier framing identifies the structural conditions under which disruption impacts will be most severe and where pre-incident coordination investment yields the highest resilience return; it does not assign causation to tribal communities, and it does not substitute for the sovereignty, consent, and reciprocity framing under which substantive tribal engagement properly occurs.

Within the engagement window for this research, tribal institutional engagement did not occur at a level sufficient to constitute primary data, and the report does not claim tribal participation it did not have. The risk-amplifier findings rest on the documentary record: the CRS Arctic report on infrastructure damage to Alaska Native communities from erosion, flooding, and permafrost degradation; the GAO Alaska Native Issues report on federal programmatic access barriers; the Behe and related Indigenous voices climate-adaptation literature; and the Alaska Federation of Natives community resilience documentation. [2; 9; 19] Functional coordination capacity between non-tribal institutions and tribal governments is treated throughout the report as dependent on pre-existing relationships that cannot be improvised under disruption conditions, with

statutory consultation mechanisms identified as not substituting for substantive operational engagement built over time.

Substantive tribal engagement on terms tribal governments determine, with sufficient time for the institutional relationships and consent architecture that meaningful participation requires, is identified across the report as a priority for follow-on research and as a precondition for any mitigation pathway involving tribal infrastructure, workforce, or governance contributions. The framing that tribal engagement operates outside the default aggregation framework is itself documented as a methodological commitment of this research, not as a limitation of it. The companion study, *Continuity of Society in the North: Multi-Modal Resiliency in Arctic Defense*, addresses tribal and Alaska Native communities under the sovereignty, consent, and reciprocity framing appropriate to its continuity-of-society scope; this research preserves analytical distinctness by holding tribal content within the risk-amplifier frame.

A.7 Bounded Scope and Acknowledged Limits

Methodology limits are documented at section level in the Methodology section of the body and are summarized here for the technical reference record. The directional findings established in this research, that inventory buffers are measured in days rather than weeks, that cascading failure initiates within the first seventy-two hours, that governance friction compounds degradation during Days 0–14, and that paper redundancy at the maritime, aviation, overland, and governance layers consistently fails to perform under Arctic disruption conditions, establish the shape of the problem. They do not yet establish the precise, decision-grade parameters that investment, pre-positioning, and coordination decisions ultimately require. Time-to-failure thresholds expressed in hours and days, by commodity, location, and disruption condition, cannot be derived from published sources alone; they require sustained engagement with operators who have experienced Arctic system performance under real conditions. Producing them is the organizing purpose of the follow-on research and the exercise-based validation identified in the Recommendations section of the Final Report and in Appendix H.

The engagement-window-bounded scope of this research, the unclassified and non-attributed bounds on the data accessible under the engagement, and the absence of decision-grade quantification at precision below the directional findings are documented in the Methodology section. The recommendations section identifies follow-on engagement, exercise-based validation, and the integrated Arctic logistics testbed concept as near-term priorities that address what the current methodology cannot deliver.

A.8 Companion-Study Coordination and Analytical Distinctness

This research is conducted under a shared scenario framework with the companion study, *Continuity of Society in the North: Multi-Modal Resiliency in Arctic Defense*, which addresses human-systems dimensions of the same disruption environment. The two studies are analytically distinct in scope and terminology but mutually reinforcing in conclusion. The shared scenario framework ensures findings are analytically comparable;

the analytical distinctness ensures that each study delivers an integrated picture within its own scope without duplicating the other.

Terminology distinctness is maintained as a standing editorial guardrail. This research uses Arctic Sustainment Modes and Lifeline Constraints as the primary terminology for the four-mode sustainment architecture and the five-layer Arctic dependency framework; the companion study uses Multi-Modal Resiliency as its primary frame. This research uses the paper-redundancy and operational-redundancy distinction as the organizing analytical commitment for substitution-mode feasibility and coordination-architecture maturity; the companion study addresses parallel coordination findings under the continuity-of-society frame. Tribal and Alaska Native engagement in this research is held within the risk-amplifier framing documented in A.6; the companion study addresses tribal and Alaska Native communities under sovereignty, consent, and reciprocity framing. Communications degradation is identified as a force degrader (never as a force multiplier) in both studies, with this research developing the four-vector degradation surface (weather and environmental, adversarial jamming and physical interference, cyber, and commercial provider autonomy) within the lifeline-architecture frame.

Citation conventions are aligned across the two studies. Inline citations are reserved for direct quotes, specific statistics, and named legal or policy authorities. Cross-source synthesis is stated as analytical finding rather than as source-attributed claim. The Reference List in Appendix B is the comprehensive sourcing record for this research; the companion study maintains a separate Reference List under its own analytical scope. Where the two reference lists overlap, the overlap is intentional and reflects the shared scenario framework, not a duplication of analytical scope.

APPENDIX E: STAKEHOLDER ENGAGEMENT DETAIL

This appendix summarizes the stakeholder engagement conducted in support of this research. All individual organizations and individuals are de-identified consistent with the non-attribution principle established in the engagement methodology.

Engagement Principles

Engagement was governed by three principles: (1) system-of-systems by design, with question architecture surfacing cross-sector interdependencies; (2) structured rather than open-ended, with a standardized question framework asked across all participants; and (3) aggregated and non-attributed by default, with no proprietary or sensitive data required and qualitative thresholds and operational insights treated as sufficient. Participation does not imply endorsement of findings.

Sectors Engaged

Engagement was distributed across the lifeline sectors examined in this research:

Energy and Fuel. Power generation; bulk fuel; aviation fuel; heating fuel; the single-source aviation gasoline dependency at the Port of Alaska; in-state refinery operators; the primary Railbelt utility; Western Alaska diesel distribution.

Transportation and Logistics. Ports including the Port of Alaska and the Tacoma-to-Alaska maritime corridor; maritime carriers; trucking; aviation cargo; the six identified contingency alternatives to the Port of Alaska; Alaska Railroad emergency freight activation; ALCAN Highway pre-scripted waiver pathways.

Food and Retail Distribution. Wholesale distribution; grocery; cold chain; warehouse operations; the four-day Tacoma-to-shelf transit cycle; primary food service distributors; the sole produce distributor; the dominant retail tier; state feeding operations.

Communications and Data Systems. Satellite operators; fiber networks; commercial carriers; Arctic ground station operators; contractual resilience commitments; network segmentation practices; cyber incident response capacity.

Medical Supply, Cold Chain, and Medical Evacuation. Pharmaceutical distributors; cold-chain logistics; hospital systems; medevac operators; Indian Health Service facilities; Alaska Native tribal health organizations.

Warehousing and Distribution Nodes. Regional hubs; intermodal staging; pre-positioning operations.

Workforce and Maintenance Operators. Transient, seasonal, and locally rooted labor pools on which critical systems depend.

Emergency Management and Coordination Entities. State, federal, and interagency coordination architectures including the Alaska Mass Care Group and Feeding Task Force, the Alaska Food Value Chain Coordination Council, and the Alaska Partnership for Infrastructure Protection.

Engagement Modalities

Three complementary inputs were used: a structured survey instrument distributed across sector contacts; informal conversations with operators and subject-matter experts; and a literature review of authoritative public sources, sector reporting, federal and state planning documents, and prior PSEMA engagement records. Findings reflect the convergence of these inputs rather than a structured interview program.

Engagement Intensity by Sector

Substantial engagement: Maritime and port operators; logistics and 3PL providers; energy and fuel distributors; food retail and wholesale; emergency management and coordination entities.

Moderate engagement: Communications and data systems; medical supply and medevac; warehousing and distribution; workforce and maintenance.

Engagement gaps: Direct fuel and energy operator participation, direct maritime and port operator participation, and direct communications and telecommunications provider participation were below the levels that sector-specific quantitative claims would require. Tribal and Alaska Native organizational engagement did not occur within the engagement window and is identified as a priority for future research under sovereignty, consent, and reciprocity framing.

Interpretation Considerations

Survey participation was self-selected; respondents who chose to engage are systematically more disposed toward cross-sector coordination than the sector population as a whole, which is a relevant consideration when interpreting the strength of the joint government–industry coordination consensus. The non-attributed aggregation approach protects respondent confidentiality and was a precondition for candid engagement but limits the specificity with which individual findings can be sourced. Engagement findings are treated as directional validation of the analytical record and as identification of practitioner-versus-analytical divergences worth carrying forward, not as the basis for sector-specific quantitative claims in under-represented categories.

Question Architecture

The structured question framework was organized around six analytical emphasis areas derived directly from the dependency, risk, and substitution analyses. Each area was probed through standardized questions designed to surface failure thresholds that operators may not have consciously articulated because the conditions that would trigger them have not yet been experienced.

Failure Pathways

What fails first under disruption conditions; how impacts propagate across interdependent lifeline systems; where cascading effects accelerate from sequential to convergent failure. The canonical home for the cascade analysis is the Cascading Impact Narratives section, with the underlying mechanism developed in the Cascading Failure Analysis: From Trigger to Convergence subsection of the Focused Risk and Vulnerability Assessment.

Throughput and Capacity Constraints

Maximum operational throughput under degraded conditions; volume limitations across maritime, aviation, and overland transportation; the gap between theoretical capacity and operationally achievable throughput under the stress conditions specific to the dual-theater scenario.

Resource Competition and Prioritization

Allocation decisions under constrained supply; interactions between civilian, defense, and tribal demand for fuel, airlift, medical evacuation, and communications capacity; internal prioritization criteria that operators apply when external prioritization frameworks have not been pre-defined. The canonical home is the Civilian–Military Convergence subsection of the Focused Risk and Vulnerability Assessment, with the institutional-architecture dimension developed in the Institutional Coordination as a Risk Amplifier section.

Time Sensitivity

Decision timelines under disruption; points at which delayed action becomes operationally limiting; the Days 0–14 analytical window as practitioners experience it from inside their own operations. Particular attention to the inflection points within the window at which sustainment assumptions fail and the self-reinforcing character of the cascade takes over, and to the tempo mismatch between commercial supply chains operating on hours timelines and government activation operating on days’ timelines.

Substitution and Operational Reality

Feasible alternatives versus theoretical options; constraints driven by weather, workforce, infrastructure, and scale; the specific conditions under which a documented redundancy ceases to perform the function planning frameworks assume it performs. This emphasis area operationalizes the paper-versus-operational-redundancy analytical commitment that organizes the substitution analysis throughout the report. The canonical home is the Substitution and Redundancy Reality Check, where the pattern is shown to be systemic rather than incidental across the maritime, aviation, overland, fuel, communications, pharmaceutical, feeding, and governance layers simultaneously.

Governance and Authority Gaps

Decisions on how scarce resources are allocated in practice, and where that authority diverges from what formal coordination frameworks specify; where civilian, military, tribal, and commercial authority structures intersect or operate in parallel without coordination, particularly for fuel, airlift, medical evacuation, and communications prioritization; what pre-established coordination frameworks exist versus where

improvised coordination is the expected mode, and what happens when improvised coordination under time pressure fails. The canonical home is the Institutional Coordination as a Risk Amplifier section, where coordination architecture is treated as itself a primary cascade trigger rather than as a passive backdrop to lifeline failure.

Engagement Conduct

Engagement was conducted under non-attribution and aggregation rules, with no proprietary or sensitive data required and qualitative thresholds and operational insights treated as sufficient. A SurveyMonkey-distributed Stakeholder Input Survey of fifteen items operated in parallel using the same six-area question architecture documented above. Distribution channels included PSEMA member channels, the broader PSEMA distribution list, and direct outreach to non-PSEMA strategic respondents. The engagement window closed April 30, 2026, following an extension to ensure adequate sectoral representation across infrastructure and access systems; energy, utilities, and fuel; supply chain, logistics, and distribution; communications and technology; community organizations and nonprofit operators; state, local, and territorial agencies; and retired military.

Tribal and Alaska Native engagement is governed by sovereignty, consent, and reciprocity protocols rather than by the default aggregation framework applied to other stakeholder input. Within the engagement window for this research, tribal institutional engagement did not occur at a level sufficient to constitute primary data, and the report does not claim tribal participation it did not have. Risk-amplifier findings concerning tribal and Alaska Native communities rest on the documentary record rather than on stakeholder input, and substantive tribal engagement on terms tribal governments determine is identified as a priority for follow-on research. The full tribal engagement protocol is documented in Appendix D, Section D.6.

Integration of Engagement Input into the Analytical Record

Where stakeholder input refines or extends literature-derived findings, the integration is documented at the section level rather than presented as a separate evidence stream. Where stakeholder input diverges from literature-derived findings, the divergence is treated as an operationally consequential finding to be carried forward rather than as practitioner error to be reconciled. This is the methodological precedent adopted from the mental-models tradition in risk research and is documented in Appendix D, Section D.2. Two operationally distinctive findings surfaced through engagement warrant explicit identification here. First, the seasonal lock-in dimension surfaces from defense logistics framing as a binding constraint that the Days 0–14 frame may understate: when fall barge season closes before disruption arrives, the only operational alternative in some communities is to wait for spring breakup, extending the no-substitution window from days into months. This dimension is consistent with the seasonal asymmetry analysis developed in the Scenario Development section and reinforces it from the practitioner side. Second, the hub-and-spoke last-mile community delivery pattern surfaces from the humanitarian response sector as a substitution pathway distinct from commercial logistics: where central hubs can receive bulk goods, locally-retrieved last-mile delivery using traditional transport provides a delivery mechanism that does not depend on commercial logistics or aviation substitution. This is operationally significant as a

community-resilience dimension that the analytical record had not previously developed and that is integrated into the cross-modal logistics redundancy mitigation pathway.

The thematic pattern across open-ended cascade descriptions reinforces the analytical finding that failure is convergent rather than sequential. Practitioners describe fuel, power, and communications as failing together because they share underlying infrastructure, not as a clean sequence in which one system fails before the next. The systematic identification of paper-redundancy conditions across sectors converges with the substitution catalog developed in the Substitution and Redundancy Reality Check, and no respondent described a paper redundancy that the analytical record had not also identified, the cross-sector convergence is in identifying the same paper-redundancy conditions from independent operational vantage points. Practitioner input on Days 0–14 inventory thresholds, fuel allocation decision criteria, communications resilience under commercial provider autonomy, and the operational adequacy of existing coordination architecture refines the findings developed in the Targeted Dependency Mapping, Focused Risk and Vulnerability Assessment, Substitution and Redundancy Reality Check, and Institutional Coordination as a Risk Amplifier sections respectively.

The SurveyMonkey questions and responses are located at the end of the Appendices.

APPENDIX F: HISTORICAL PRECEDENTS REFERENCE

This appendix consolidates the historical precedents referenced or implied in the body of the report. Each precedent is summarized with sufficient detail for follow-on researchers to verify the parallel without re-deriving it.

Operation Vittles (Berlin Airlift), 1948–1949

U.S. and allied operation sustaining the western sectors of Berlin by air after Soviet ground blockade of road and rail access. Operation duration June 1948 through September 1949. Sustainment volume reached approximately 8,000 tons per day at peak operations into Tempelhof, Tegel, and Gatow airfields. Aircraft cycles approached the operational limit of the airfield infrastructure available. Operation analytically significant for Arctic mission assurance because it establishes the upper bound of aviation-only sustainment under conditions of constrained airfield access, weather limitations, and geopolitical pressure. Cited in this report as the analog for evaluating the feasibility of Arctic airlift substitution for maritime cargo.

Galena Flood, May 2013

Yukon River ice-jam flooding of the village of Galena, Alaska. Event significant for Principal Investigator's direct operational experience supporting the State of Alaska response and for the operational lessons drawn about transportation, supply chain continuity, and feeding operations in remote Arctic regions. Cited in the Continuation Statement and as part of the research foundation establishing the operational experience of PSEMA leadership.

Typhoon Mawar, Guam, May 2023

Category 4 typhoon causing extensive infrastructure damage to Guam and Andersen Air Force Base. Cited in the HDI Holistic Defense Awareness research focus area as an example of disasters and adversary actions detrimentally impacting military installations. Relevant to this research as an analog for installation-community interdependency under infrastructure disruption.

War Industries Board (WIB), 1917–1918 (WWI)

Established by Executive Order in July 1917 under the Council of National Defense to coordinate U.S. industrial mobilization for World War I. Operated for approximately sixteen months before achieving substantive operational effectiveness under Bernard Baruch's chairmanship in March 1918. Demonstrates both the value of centralized priorities adjudication and the cost of constructing it after conflict has begun. The foundational U.S. case for the proposition that resource-adjudication architecture should be pre-established rather than constructed under stress.

Office of Production Management (OPM), Supply Priorities and Allocations Board (SPAB), and War Production Board (WPB), 1941–1945 (WWII)

Successive WWII U.S. industrial mobilization agencies. The OPM was established in January 1941. The SPAB was established in August 1941. The WPB was established in January 1942 under Executive Order 9024 with priorities and rationing authority over the U.S. industrial base. Allocated steel, aluminum, rubber, fuel, and consumer goods across military and civilian demand throughout the war. The WPB’s effectiveness rested on the pre-1941 foundation laid by the OPM and SPAB. Demonstrates that adjudication architecture builds on prior architecture rather than emerging from improvisation, and that institutional learning required is not compressible to crisis timelines.

COVID-19 Allocation Framework, 2020–2022

Federal framework for allocating ventilators, personal protective equipment, vaccines, and pharmaceuticals across states during the COVID-19 pandemic. The framework operated through multiple integrated components: Defense Production Act authorities; the FEMA temporary final rule on prioritization and allocation of scarce health and medical resources (April 2020); CDC Advisory Committee on Immunization Practices (ACIP) guidance on vaccine prioritization; and the National Academies of Sciences, Engineering, and Medicine’s Framework for Equitable Allocation of COVID-19 Vaccine (2020). Demonstrates that pre-existing planning infrastructure (the 2009 H1N1 response architecture, university medical ethics allocation models) produced faster and more institutionally defensible decisions than architecture constructed during the crisis. The closest contemporary analog to the civil–military adjudication architecture this research recommends.

APPENDIX G: LEGAL AND POLICY AUTHORITY INDEX

This appendix indexes the legal and policy authorities referenced in the body of the report, with one-paragraph entries summarizing the relevance of each authority to Arctic mission assurance. Full citations appear in Appendix B (Reference List).

Defense Production Act (DPA)

Statutory authority enabling federal allocation and prioritization of scarce industrial output, raw materials, and other resources under national defense necessity. Identified in this research as the regulatory mechanism through which adjudicated allocations can be implemented during the Days 0–14 window if pre-staged civil–military adjudication protocols exist.

DoD Directive 3020.40, Mission Assurance

Establishes DoD policy framework for mission assurance as the integrating concept for the defense of critical capabilities, assets, infrastructure, and information. Identifies non-DoD-owned infrastructure as a defense dependency. Cited throughout this research as the doctrinal foundation for the proposition that mission assurance depends on civilian critical infrastructure, much of it privately operated.

DoD Instruction 3020.45, Defense Critical Infrastructure Program Management

Implementing instruction for DoDD 3020.40, defining roles and responsibilities for DoD’s critical assets and infrastructures. Establishes the Defense Critical Infrastructure Program (DCIP) management framework. Relevant to this research as the framework under which non-DoD-owned Defense Critical Infrastructure (DCI) is identified and protected.

Jones Act (Merchant Marine Act of 1920)

Requires that cargo moved between U.S. ports be carried on vessels built in the United States, owned by U.S. citizens, and crewed by U.S. mariners. Identified in this research as a structural constraint on maritime substitution capacity during disruption. The waiver framework, administered by the Department of Homeland Security with Department of Defense, MARAD, and DOT coordination, is identified as the determining variable in whether maritime surge can be activated within the Days 0–14 window.

National Defense Strategy (NDS-2025)

U.S. national defense policy framework establishing strategic priorities. Cited in this research for its Arctic operations and homeland defense doctrine and as the strategic-level authority connecting Arctic mission assurance to broader national defense objectives.

National Security Memorandum 22, Critical Infrastructure Security and Resilience (30 April 2024)

White House policy framework defining Defense Critical Infrastructure and establishing federal coordination authorities for critical infrastructure resilience. Defines DCI as DoD and non-DoD networked assets and facilities essential to project, support, and sustain military forces and operations worldwide. Cited throughout this research as the strategic-level policy authority for the cross-sector coordination architecture the recommendations call for.

Stafford Act

(Robert T. Stafford Disaster Relief and Emergency Assistance Act)

Federal statutory authority for FEMA-coordinated disaster response, including the Presidential disaster declaration framework, mass care operations, and federal-state cost-share for disaster relief. Relevant to this research as the authority structure under which FEMA Region X would coordinate Arctic disaster response and as one of the legal frameworks across which civil–military adjudication must operate.

Title 10 vs. Title 32 Authority

Title 10 authority governs federal active-duty military forces under the Secretary of Defense; Title 32 authority governs National Guard forces operating under state authority while federally funded. The distinction is operationally consequential in disaster response because Title 32 forces can support law enforcement and civilian authorities in ways Title 10 forces typically cannot. Civil–military adjudication protocols must address allocation decisions across Title 10, Title 32, Stafford Act, DPA, and tribal sovereign authorities.

Tribal Sovereign Authority Frameworks

Alaska Native and tribal governments hold sovereign authority over tribal lands, communities, and citizens. Sovereign authority is exercised under federal trust responsibility, the Alaska Native Claims Settlement Act (1971), tribal consultation policies, and government-to-government coordination protocols. Engagement is governed by sovereignty, consent, and reciprocity principles. Civil–military adjudication protocols must address tribal sovereign authority alongside Title 10, Title 32, Stafford Act, and DPA authorities.

UNCLOS Article 234

(United Nations Convention on the Law of the Sea, 1982)

Authorizes coastal states to adopt and enforce non-discriminatory laws and regulations for the prevention, reduction, and control of marine pollution from vessels in ice-covered areas within the limits of the exclusive economic zone. The legal instrument through which the Northern Sea Route is converted from a benign-planning maritime redundancy into a consent-dependent pathway whose availability depends on Russian regulatory consent. Treated in this research as the canonical case of consent-dependent redundancy.

APPENDIX H: RECOMMENDATIONS BY INVESTMENT HORIZON

The recommendations below consolidate the analytical findings of this report into a single, decision-grade reference, organized into three implementation horizons. Near-Term (0–12 months) covers policy clarifications, planning integration, pre-staged authorities, exercise activity, and low-cost mitigations executable within the current planning cycle. Mid-Term (12-36 Months) covers programmatic build-out, infrastructure hardening at existing nodes, contracting actions, and institutional architecture requiring sustained investment beyond a single budget cycle. Long-Term (36 Months or More) covers new infrastructure construction, doctrinal codification, multi-year research, and capital-intensive resilience investments.

Each recommendation is tagged against the Five Criteria Framework introduced in the Mitigation and Cost–Benefit Prioritization section, Mission Impact, Cascade Risk, Time Sensitivity, Feasibility, and Dual-Use Value, with the level assigned to each criterion shown. Tiering reflects implementation horizon rather than priority; near-term, mid-term, and long-term lines of effort run concurrently, not sequentially. Lead and Supporting Partner attributions reflect the operational accountability and enabling-role architecture identified across the dependency mapping, risk and vulnerability assessment, institutional coordination review, and recommendations findings of this report.

Near Term Recommendations (0–12 Months)

Pre-Position Strategic Stockpiles for the Days 0–14 Window

Description: Establish pre-positioned reserves of fuel, food, pharmaceuticals, cold-chain capacity, and critical materiel at Anchorage, Fairbanks, the JBER area, and rural community hubs sized for both routine and disruption-period demand, the only mechanism that closes the inventory-buffer gap within the dual-theater scenario window.

Five Criteria Framework Tags:

- Mission Impact:* High
- Cascade Risk:* High
- Time Sensitivity:* High (Days 0–14)
- Feasibility:* Moderate
- Dual-Use Value:* High

Lead Partner(s): USNORTHCOM; Alaska Department of Homeland Security and Emergency Management (Alaska DHS&EM)

Supporting Partner(s): Defense Logistics Agency; FEMA Region X; commercial fuel and pharmaceutical distributors operating in Alaska; rural community hub operators (barge-season-dependent communities); PSEMA

Pre-Stage Jones Act Waiver and Regulatory Authority Documentation

Description: Develop and maintain pre-staged documentation packages supporting Jones Act, weight-limit, hours-of-service, CDL endorsement, and Canadian provincial waivers, converting the waiver process from a capability that may exceed the operational window into a regulatory mechanism activatable within hours.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: Moderate

Time Sensitivity: High

Feasibility: High

Dual-Use Value: High

Lead Partner(s): Department of Homeland Security (DHS); Department of Defense (DoD) Maritime Administration (MARAD); Department of Transportation (DOT)

Supporting Partner(s): USNORTHCOM; FEMA Region X; Alaska DHS&EM; commercial vessel operators serving Alaska (A.P. Moller–Maersk, Crowley Maritime, Lynden Incorporated); Canadian provincial transportation authorities; PSEMA

Initiate Pre-Defined Civil–Military Adjudication Protocols

Description: Develop pre-defined protocols for adjudicating civilian and military claims on scarce fuel, food, transportation, and medical capacity, addressing allocation across Title 10 authority, state emergency management authority, tribal sovereignty, and commercial cargo prioritization with clearly identified decision authorities and pre-established communication pathways.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: High

Time Sensitivity: High (Days 0–14)

Feasibility: Moderate (political complexity)

Dual-Use Value: High

Lead Partner(s): USNORTHCOM; Alaska DHS&EM; tribal governments and Alaska Native organizations (operating under sovereignty, consent, and reciprocity protocols)

Supporting Partner(s): FEMA Region X; CISA; Alaska Federation of Natives; commercial cargo prioritization authorities; PSEMA

Conduct Tabletop Exercise—Based Validation of Existing Coordination Architectures

Description: Convene structured tabletop exercises that test Alaska’s Partnership for Infrastructure Protection, Mass Care Group and Feeding Task Force, Alaska Food Value Chain Coordination Council, and federal-state-tribal-military coordination against the dual-theater scenario, converting paper-redundancy coordination into operationally validated capacity.

Five Criteria Framework Tags:

Mission Impact: Moderate–High

Cascade Risk: Moderate

Time Sensitivity: Moderate

Feasibility: High

Dual-Use Value: High

Lead Partner(s): Alaska DHS&EM (Partnership for Infrastructure Protection convener); USNORTHCOM

Supporting Partner(s): FEMA Region X; Alaska Food Value Chain Coordination Council; Alaska Mass Care Group and Feeding Task Force; Canadian Joint Operations Command counterparts; tribal governments and Alaska Native organizations; PSEMA

Establish Communications Hardening Priorities for Multi-Layer Architecture

Description: Identify the specific communications hardening investments, anti-jam capability for primary nodes, redundant LEO/GEO satellite pathways, HF radio backup, and subsea cable protection, that within twelve months produce material reduction in the communications cascade pathway documented in this research.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: Very High (communications = coordination spine)

Time Sensitivity: High

Feasibility: Moderate (some capital required)

Dual-Use Value: High

Lead Partner(s): USNORTHCOM
Cybersecurity and Infrastructure Security Agency (CISA)

Supporting Partner(s): Alaska DHS&EM; AT&T FirstNet; commercial LEO and GEO satellite providers (Iridium Communications, Starlink, Inmarsat); Alaska Public Safety Communications Services; subsea cable operators; PSEMA

Establish Pharmaceutical Cold-Chain Pre-Positioning at Key Nodes

Description: Pre-position insulin, antibiotics, oxygen, dialysis supplies, and other categories where inventory depletion produces life-threatening outcomes within days at regional hospital, IHS, and ANTHC nodes whose service populations cannot be reached by external resupply within the Days 0–14 window, the only mechanism that closes the medical pathway gap.

Five Criteria Framework Tags:

Mission Impact: High (life safety)

Cascade Risk: Moderate

Time Sensitivity: Very High (non-recoverable cold-chain failure)

Feasibility: High

Dual-Use Value: Very High

Lead Partner(s): Indian Health Service (Alaska Area); Alaska Native Tribal Health Consortium (ANTHC); Alaska Native Medical Center

Supporting Partner(s): Commercial pharmaceutical distributors operating in Alaska (McKesson); regional hospitals; CVS Health; Global Medical Response; Guardian Flight Alaska; FEMA Region X; PSEMA

Initiate Sustained Stakeholder Engagement Architecture

Description: Convert the engagement architecture established for this research into a sustained, recurring mechanism connecting DoD mission assurance planners, NORAD/USNORTHCOM J-staff equivalents, Alaska DHS&EM, FEMA, CISA, tribal governments, and private-sector lifeline operators across the seven sectors examined, converting episodic input into continuous data architecture.

Five Criteria Framework Tags:

Mission Impact: Moderate–High

Cascade Risk: High (coordination architecture)

Time Sensitivity: Moderate

Feasibility: High

Dual-Use Value: High

Lead Partner(s): Homeland Defense Institute (HDI); PSEMA (connective infrastructure)

Supporting Partner(s): NORAD and USNORTHCOM J-staff equivalents; Alaska DHS&EM; FEMA Region X; CISA; tribal governments and Alaska Native organizations; private-sector lifeline operators across the seven sectors examined

Mid Term Recommendations (12–36 Months)

Distribute Microgrid Capacity to Reduce Single-Point Energy Dependency

Description: Expand distributed microgrid capacity at rural Alaska communities, regional installations, and dual-use civilian-military sites where energy concentration risk is highest, with diesel-plus-renewable-plus-storage configurations and the workforce capacity and spare-parts logistics required to sustain operations under Arctic conditions.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: Very High (energy = master dependency)

Time Sensitivity: Moderate

Feasibility: Moderate (Arctic workforce/logistics)

Dual-Use Value: Very High

Lead Partner(s): Alaska Village Electric Cooperative; Chugach Electric Association; USNORTHCOM (installation-side coordination)

Supporting Partner(s): Denali Commission; Department of Energy; National Rural Electric Cooperative Association (NRECA); Cold Regions Research and Engineering Laboratory (CRREL); Alaska Energy Authority; PSEMA

Advance Alternate Port Readiness Investments

Description: Initiate capital investment programs to convert Seward, Valdez, Kodiak, Homer, Whittier, and MacKenzie into functional substitutes for containerized cargo handling, including reefer plug-in installation, RO/RO ramps, weight-restriction infrastructure, deep-draft construction, and the rail and road improvements required to connect alternate ports to downstream distribution.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: Very High (port concentration)

Time Sensitivity: Long (strategic, not Days 0–14)

Feasibility: Moderate (capital intensive)

Dual-Use Value: High

Lead Partner(s): Maritime Administration (MARAD); Alaska Department of Transportation and Public Facilities (DOT&PF)

Supporting Partner(s): Ports of Seward, Valdez, Homer, Kodiak, and Whittier; commercial vessel operators (A.P. Moller–Maersk, Crowley Maritime); USNORTHCOM; FEMA Region X; PSEMA

Build Medical Evacuation Surge Capacity

Description: Expand medical evacuation surge capacity through pre-positioned aviation fuel reserves at key medevac airfields, redundant flight-following and medical consultation communications, pre-defined receiving-facility coordination at Anchorage and Seattle tertiary centers, and crew availability programs that build depth in the thin specialty workforce medevac depends on.

Five Criteria Framework Tags:

Mission Impact: High (life safety)

Cascade Risk: High (medevac competition with cargo airlift)

Time Sensitivity: High

Feasibility: Moderate

Dual-Use Value: Very High

Lead Partner(s): Guardian Flight Alaska; Global Medical Response; Alaska Native Medical Center

Supporting Partner(s): Anchorage tertiary care receiving facilities; Seattle tertiary care receiving facilities; Indian Health Service (Alaska Area); USNORTHCOM (aviation deconfliction); commercial aviation fuel suppliers at medevac airfields; PSEMA

Establish Tribal Partner Protocols for Sustained Engagement

Description: Build a standing protocol for tribal and Alaska Native organization participation in Arctic mission assurance research, planning, and operational coordination, addressing the absence of pre-existing relationships that the Risk and Vulnerability Assessment establishes as a primary risk-amplifier condition.

Five Criteria Framework Tags:

Mission Impact: Moderate–High

Cascade Risk: High (risk amplifier when absent)

Time Sensitivity: Moderate

Feasibility: Moderate (requires sovereign consent and reciprocity)

Dual-Use Value: High

Lead Partner(s): Tribal governments and Alaska Native organizations (operating under sovereignty, consent, and reciprocity protocols); Alaska Federation of Natives

Supporting Partner(s): Native regional corporations (Arctic Slope Regional Corporation, NANA Regional Corporation, Doyon Limited, Cook Inlet Region Inc.); First Alaskans Institute; HDI; USNORTHCOM; Alaska DHS&EM; PSEMA

Advance FEMA P3 Maturity Beyond Basic and Low-Intermediate Tier

Description: Build the institutional architecture that progresses Alaska’s Partnership for Infrastructure Protection and the federal-state-tribal-military coordination mechanisms from current Basic and low-Intermediate maturity toward Advanced tier, through formalized charters, sustained pre-incident engagement, regular exercise activity, and integration into commercial lifeline operator business processes.

Five Criteria Framework Tags:

Mission Impact: High (institutional architecture)
Cascade Risk: High
Time Sensitivity: Moderate
Feasibility: High
Dual-Use Value: Very High

Lead Partner(s): FEMA (Region X and Office of Business, Industry, and Infrastructure Integration); Alaska DHS&EM (Partnership for Infrastructure Protection)

Supporting Partner(s): CISA; USNORTHCOM; tribal governments and Alaska Native organizations; private-sector lifeline operators across the seven sectors examined; PSEMA

Establish a Permanent Cross-Sector Supply Chain Intelligence Function

Description: Build a permanent coordinating capability for anticipating and responding to cross-sector supply chain disruption, leveraging FEMA’s DPA authorities, CISA’s Critical Infrastructure Partnership frameworks, and peer-level coordination with DOT, Commerce, and the ODNI, applying CNA’s Supply Chain Operational Engagement methodology to Arctic-specific conditions.

Five Criteria Framework Tags:

Mission Impact: High
Cascade Risk: Very High
Time Sensitivity: Moderate
Feasibility: Moderate
Dual-Use Value: Very High

Lead Partner(s): FEMA (Supply Chain Resilience Office); CISA

Supporting Partner(s): Department of Transportation; Department of Commerce; Office of the Director of National Intelligence; CNA; USNORTHCOM; private-sector lifeline operators across the seven sectors examined; PSEMA

Build Cold-Chain and Pre-Positioning Infrastructure at Tribal and Community Health Nodes

Description: Expand cold-chain capacity, backup power, and pre-positioned medical supply at IHS facilities, ANTHC nodes, regional tribal health organizations, and Community Health Aide Program village sites that constitute the only line of healthcare access for many Alaska Native communities, addressing the parallel cold-chain failure pathway documented in the Risk and Vulnerability Assessment.

Five Criteria Framework Tags:

Mission Impact: High (life safety in isolated communities)

Cascade Risk: High (parallel cold-chain failure pathway)

Time Sensitivity: High

Feasibility: Moderate

Dual-Use Value: Very High

Lead Partner(s): Indian Health Service (Alaska Area); Alaska Native Tribal Health Consortium (ANTHC); regional tribal health organizations; Community Health Aide Program (CHAP)

Supporting Partner(s): Tribal governments and Alaska Native organizations; Alaska Federation of Natives; commercial pharmaceutical distributors operating in Alaska; FEMA Region X; PSEMA

Long Term (36 Months or More)

Extended Sustainment Modeling Beyond the Days 0–14 Window

Description: Conduct extended sustainment modeling for the recovery dynamics, structural reconstitution, and multi-month sustainment trajectories that lie beyond the analytical window of this research, providing the time-to-failure parameter precision that command-level decisions ultimately require.

Five Criteria Framework Tags:

Mission Impact: High (informs all longer-horizon decisions)

Cascade Risk: High

Time Sensitivity: Long

Feasibility: High

Dual-Use Value: High

Lead Partner(s): Homeland Defense Institute (HDI); RAND Corporation

Supporting Partner(s): Ted Stevens Center for Arctic Security Studies; Naval Postgraduate School; CNA; university research centers with Arctic specialization; USNORTHCOM; PSEMA

Multi-Year Resilience Studies Across Lifeline Sectors

Description: Conduct multi-year resilience studies that build on the dependency mapping and risk assessment foundation of this research, extending the analytical scope to Cook Inlet natural gas depletion, polar icebreaker fleet recapitalization, Arctic ground station resilience, and undersea cable protection over a five-year horizon.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: High

Time Sensitivity: Long

Feasibility: High

Dual-Use Value: High

Lead Partner(s): Homeland Defense Institute (HDI); Ted Stevens Center for Arctic Security Studies

Supporting Partner(s): RAND Corporation; Naval Postgraduate School; CRREL; Dewberry; Tetra Tech; AECOM; USNORTHCOM; FEMA Region X; PSEMA

Operational Piloting of Recommended Coordination Architectures

Description: Pilot the coordination architectures identified in the near-term and mid-term recommendations under live operational conditions, federally declared emergencies, large-scale exercises, and Arctic-specific TTX programs, converting coordination from validated-on-paper to validated-in-operations.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: High (addresses paper-redundancy condition)

Time Sensitivity: Moderate

Feasibility: Moderate (requires sustained commitment)

Dual-Use Value: High

Lead Partner(s): USNORTHCOM; FEMA Region X; Alaska DHS&EM

Supporting Partner(s): HDI; tribal governments and Alaska Native organizations; Canadian Joint Operations Command counterparts; private-sector lifeline operators across the seven sectors examined; PSEMA

Establish Integrated Arctic Logistics Testbed

Description: Establish an integrated Arctic logistics testbed supporting operational evaluation of mitigation investments, coordination architectures, and emerging logistics technologies under realistic Arctic conditions, the institutional vehicle through which research, operational capability, and private-sector partnership converge.

Five Criteria Framework Tags:

Mission Impact: High

Cascade Risk: High

Time Sensitivity: Long

Feasibility: Moderate (multi-agency)

Dual-Use Value: Very High

Lead Partner(s): Department of Defense (Office of the Secretary of Defense); Maritime Administration (MARAD); FEMA

Supporting Partner(s): Department of Transportation; State of Alaska; tribal governments and Alaska Native organizations; private-sector lifeline operators across the seven sectors examined; HDI; CRREL; PSEMA

Codify DoD–Private Sector–Nongovernmental Coordination Doctrine

Description: Develop codified doctrine for DoD–private sector–nongovernmental coordination under contested-logistics conditions, building on NSM-22’s defense critical infrastructure framework, the FEMA P3 maturity model, the Jones Act waiver framework, and the contested-logistics literature.

Five Criteria Framework Tags:

Mission Impact: Very High (doctrinal foundation)

Cascade Risk: High

Time Sensitivity: Long

Feasibility: Moderate (institutional process)

Dual-Use Value: Very High

Lead Partner(s): NORAD and USNORTHCOM; Office of the Secretary of Defense; FEMA

Supporting Partner(s): CISA; HDI; Joint Chiefs of Staff; emergency management and private-sector partnership community; PSEMA

Sustain Long-Horizon Infrastructure Investments: Polar Icebreakers, Processing Capacity, Refining

Description: Sustain the long-horizon infrastructure investments necessary for structural Arctic resilience: polar icebreaker fleet recapitalization through the Polar Security Cutter program and Arctic Security Cutter RFI, in-state food processing capacity expansion, and in-state refining capacity assessment.

Five Criteria Framework Tags:

- Mission Impact:* Very High (structural baseline)
- Cascade Risk:* Very High
- Time Sensitivity:* Long (multi-year construction)
- Feasibility:* Low–Moderate (capital and timeline intensive)
- Dual-Use Value:* Very High

Lead Partner(s): U.S. Coast Guard (Polar Security Cutter and Arctic Security Cutter programs); Department of Defense; State of Alaska

Supporting Partner(s): Maritime Administration (MARAD); Alaska Federation of Natives (subsistence and in-state food-processing context); in-state refining capacity stakeholders; Department of Energy; Department of Agriculture; PSEMA

Recommendations by Investment Priority Tier

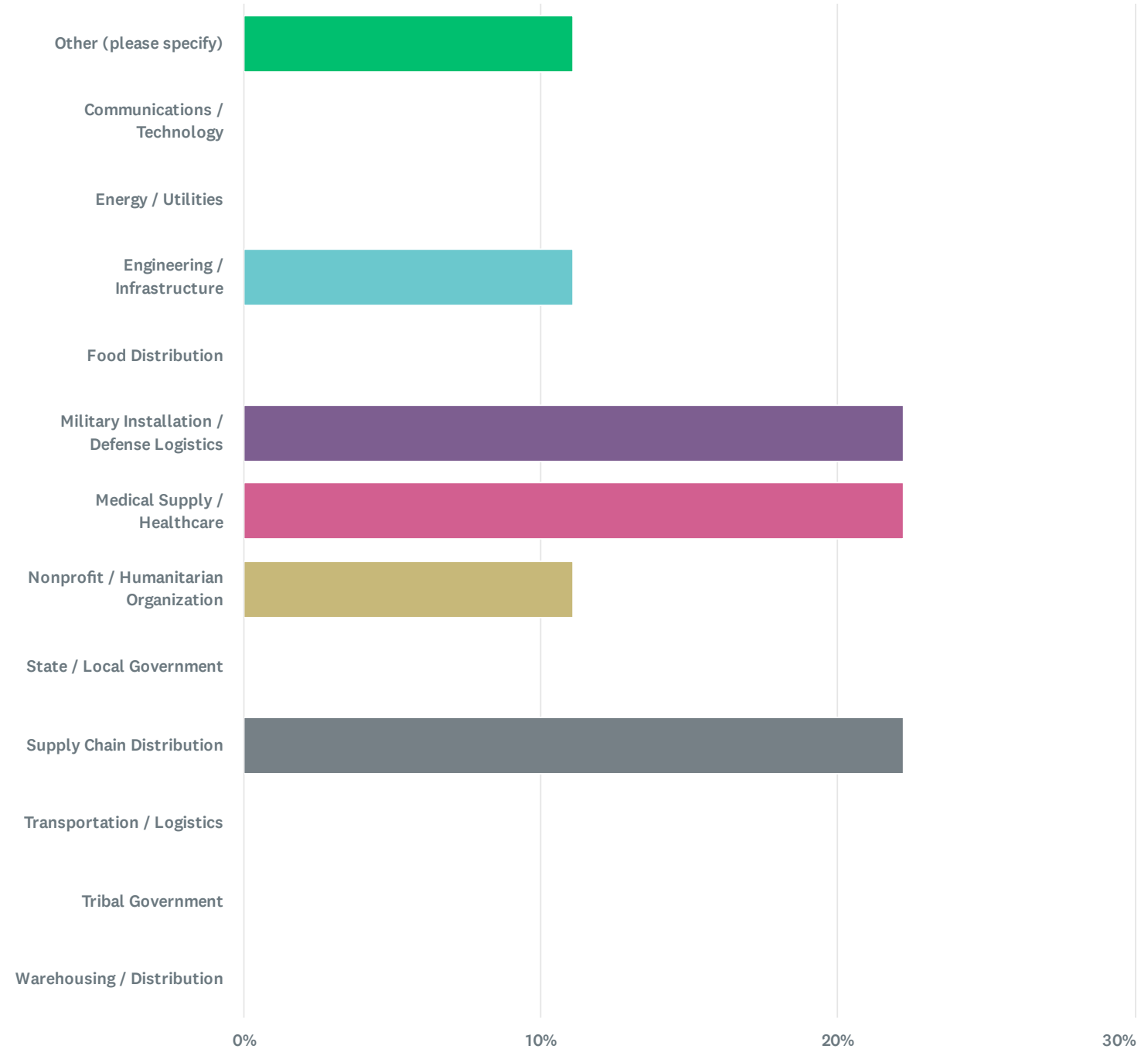
Tiered framework organizing Arctic resilience recommendations by urgency and investment level

TIER 1 PRIORITY	Foundational / Near-Term (0-18 months) Highest mission impact, fastest deployment, lowest barriers - Establish redundant satellite communications for Arctic installations and mutual-aid partners - Pre-position critical fuel and pharmaceutical buffers at JBER, Fairbanks, and Anchorage hubs - Stand up cross-sector coordination architecture (DoD-FEMA-CISA-State-Tribal-Industry)
TIER 2 PRIORITY	Capability Building (18-36 months) Hardening, redundancy, and dual-use infrastructure investments - Microgrid deployment at priority installations and cooperative-served rural hubs - Multi-modal logistics redundancy: ALCAN, rail, alternate-port and barge capacity - Workforce sustainment: Arctic-specific maintenance, contracting, and certification pipelines
TIER 3 PRIORITY	Strategic / Long-Term (36+ months) Structural changes that reshape Arctic mission assurance over the long horizon - Whole-of-nation Arctic resilience framework with sustained P3 investment vehicles - Hardened port and runway capacity expansion with cold-region engineering standards - Integrated tribal sovereignty, consent, and reciprocity protocols across federal Arctic plans

Tier ordering reflects mission impact × deployment feasibility, not exclusivity — work across tiers in parallel as resources allow.

Tier assignment reflects composite score and timing; tiers are not strict, and recommendations may move between tiers as conditions change.

Q1
9 responses
Your Perspective1. Which sector best represents your perspective?(Select one)



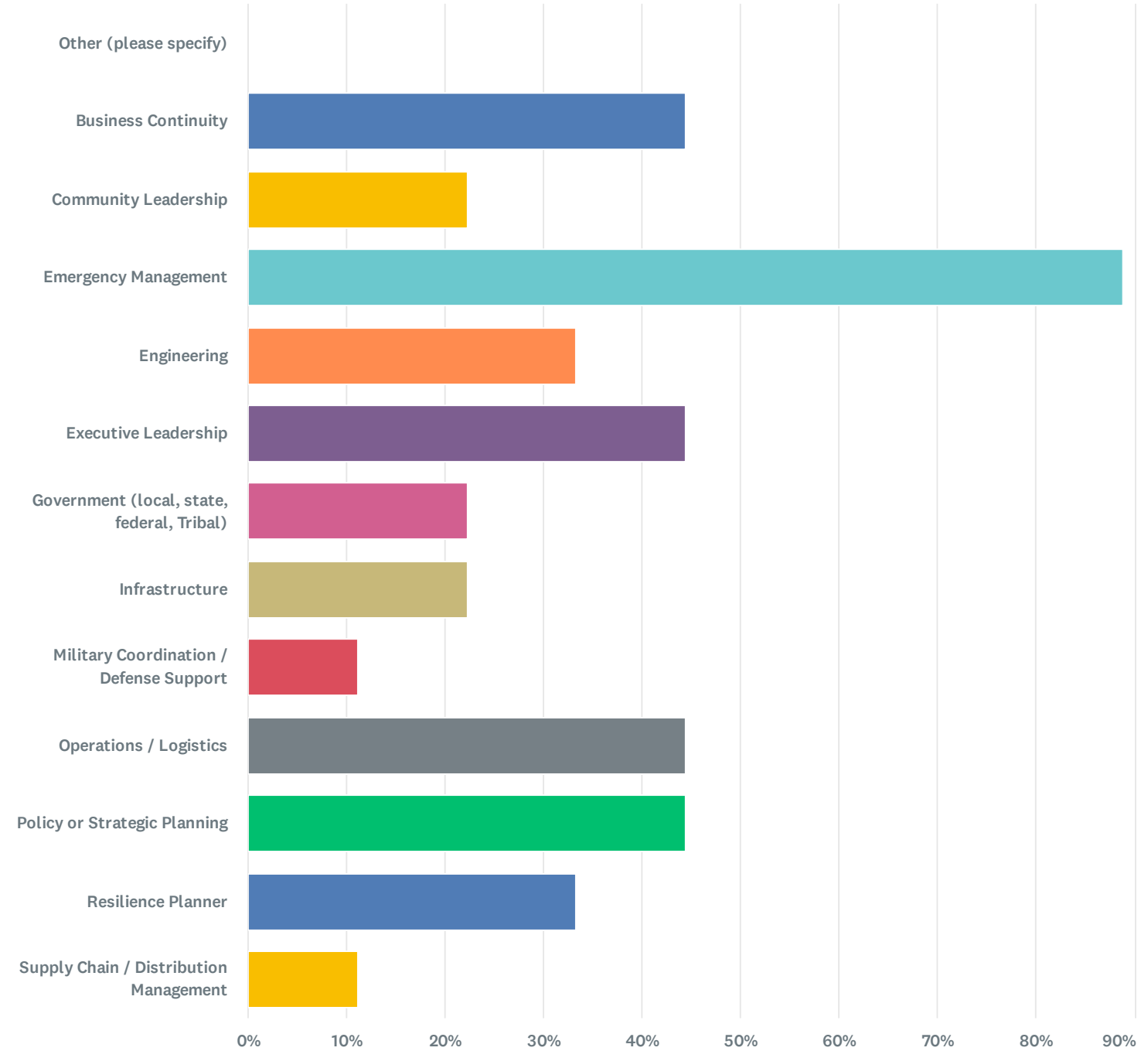
RESPONSES (0) WORD CLOUD TAGS (0)

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☐ No responses yet

Q2
9 responses

2. What role best describes your perspective in your organization or professional experience?(Select all that apply)



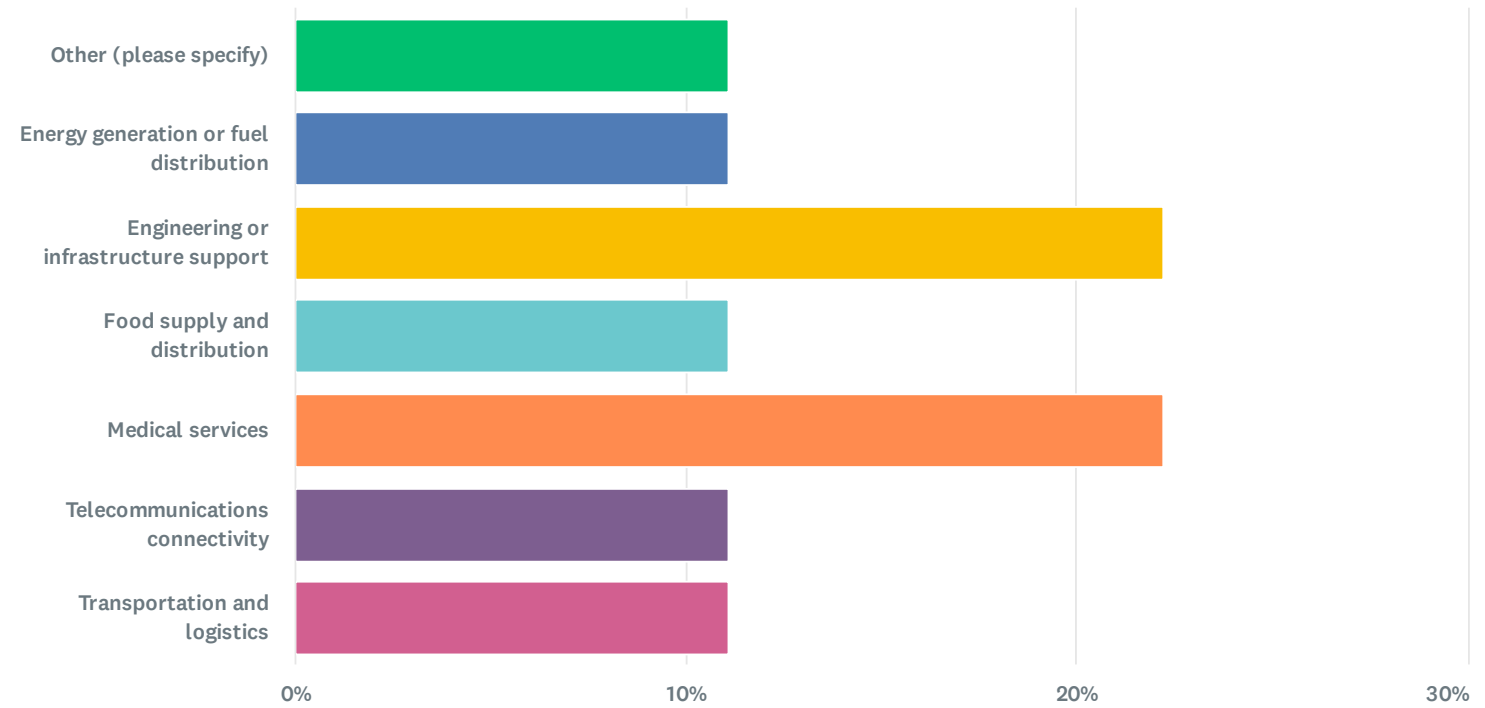
RESPONSES (0) WORD CLOUD TAGS (0)

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☐ No responses yet

Q3
9 responses

Essential ServicesFor this survey, an Arctic disruption refers to a prolonged event that limits transportation, energy supply, communications, or resupply to Arctic communities and installations.3. Which core service or operational capability provided by your organization would be most essential during a major Arctic disruption?(Select one)



RESPONSES (0)

WORD CLOUD

TAGS (0)

Q Search Responses

?

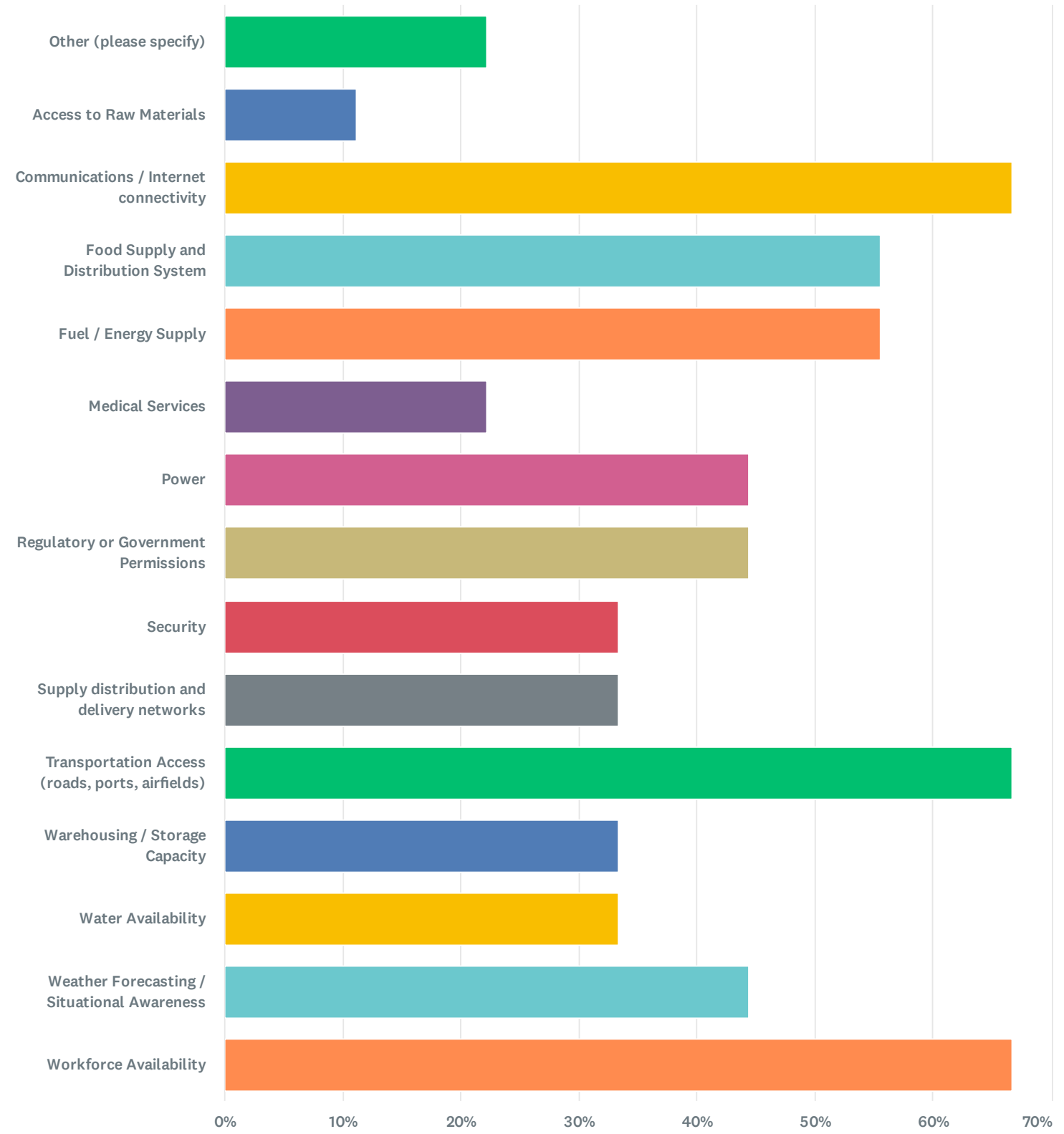
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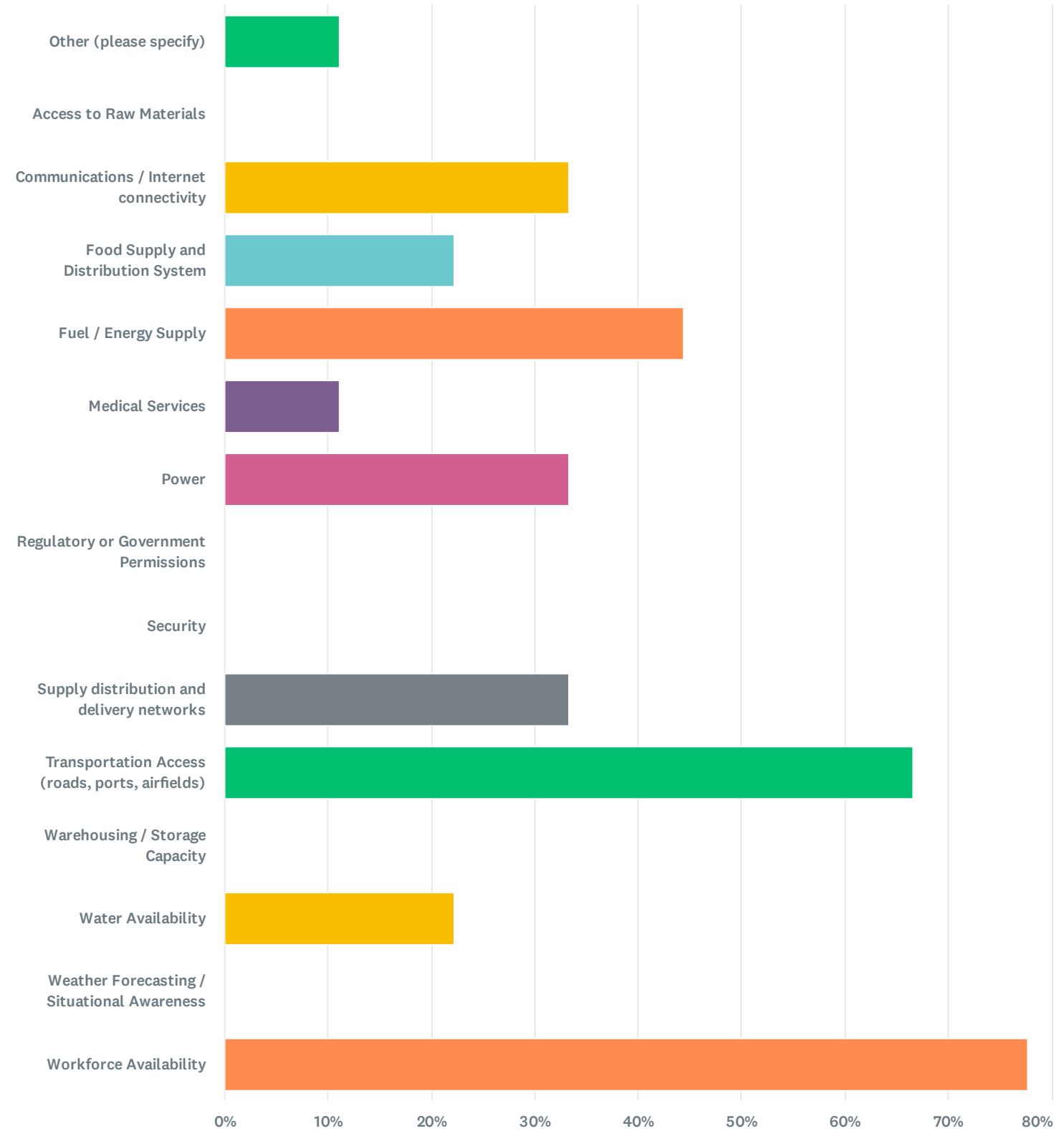
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No responses yet

Q5
9 responses

Infrastructure Dependencies5. What inputs are essential for your organization to continue operating?(Select all that apply)





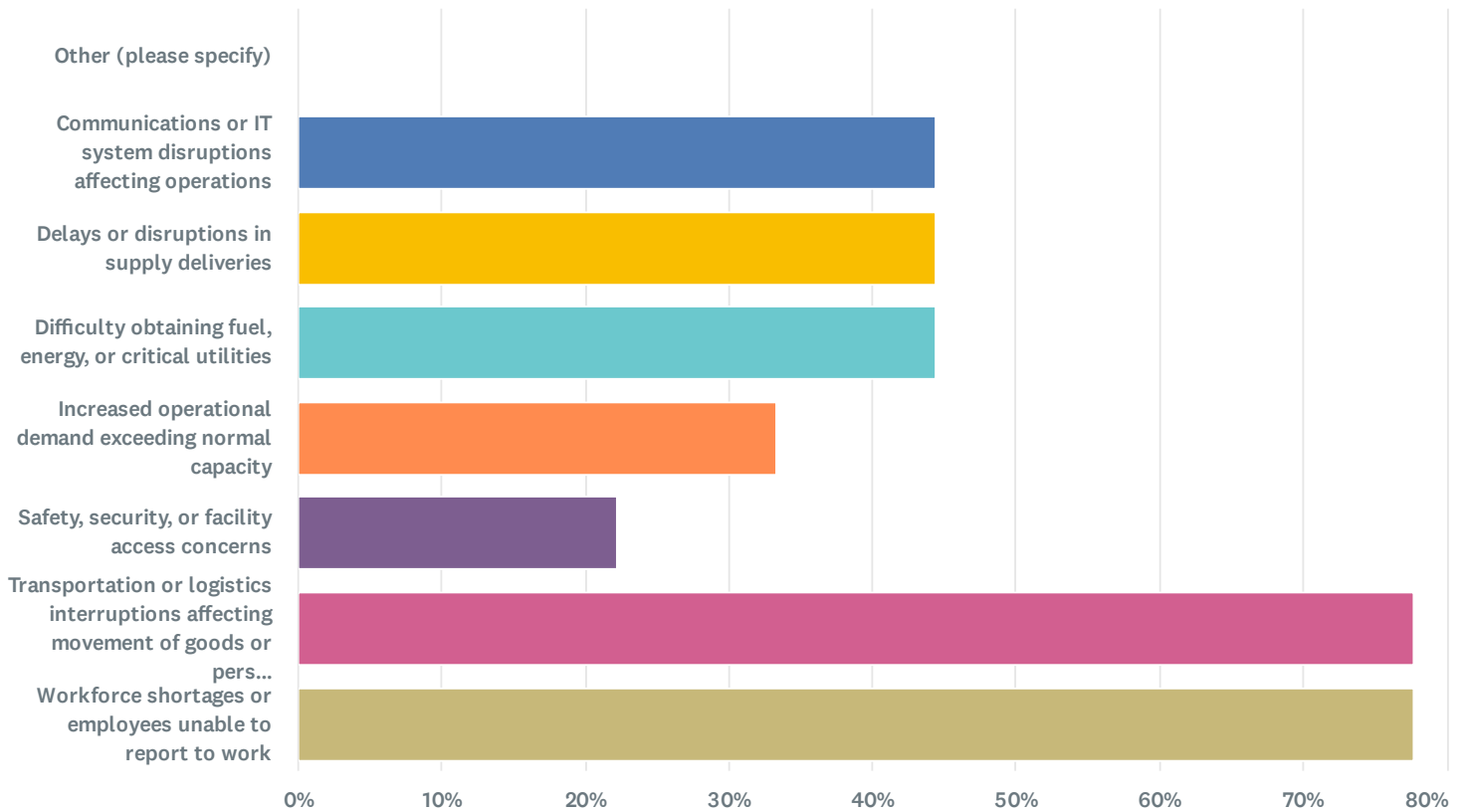
RESPONSES (0) WORD CLOUD TAGS (0)

Filter: by tag ▼ by sentiment ▼

Q7

9 responses

Early Stress IndicatorsEarly stress indicators are often the first signs that infrastructure systems supporting operations are beginning to degrade during a disruption. 7. During the first days of an Arctic disruption, which warning signs would indicate that the systems your organization depends on are beginning to degrade or fail?(Select all that apply)



RESPONSES (0)

WORD CLOUD

TAGS (0)



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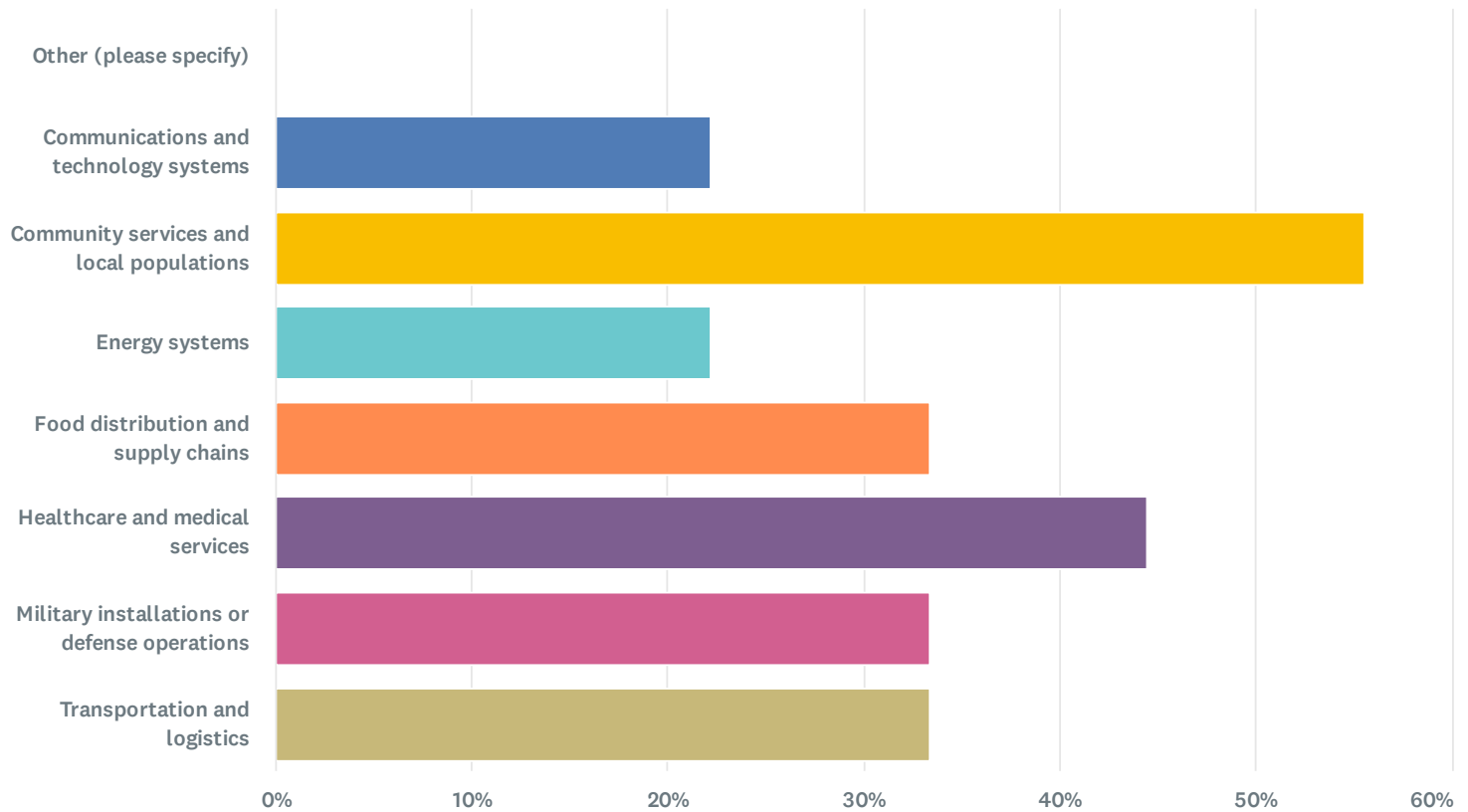


No responses yet

Q9

9 responses

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)



RESPONSES (0)

WORD CLOUD

TAGS (0)



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by sentiment ▼

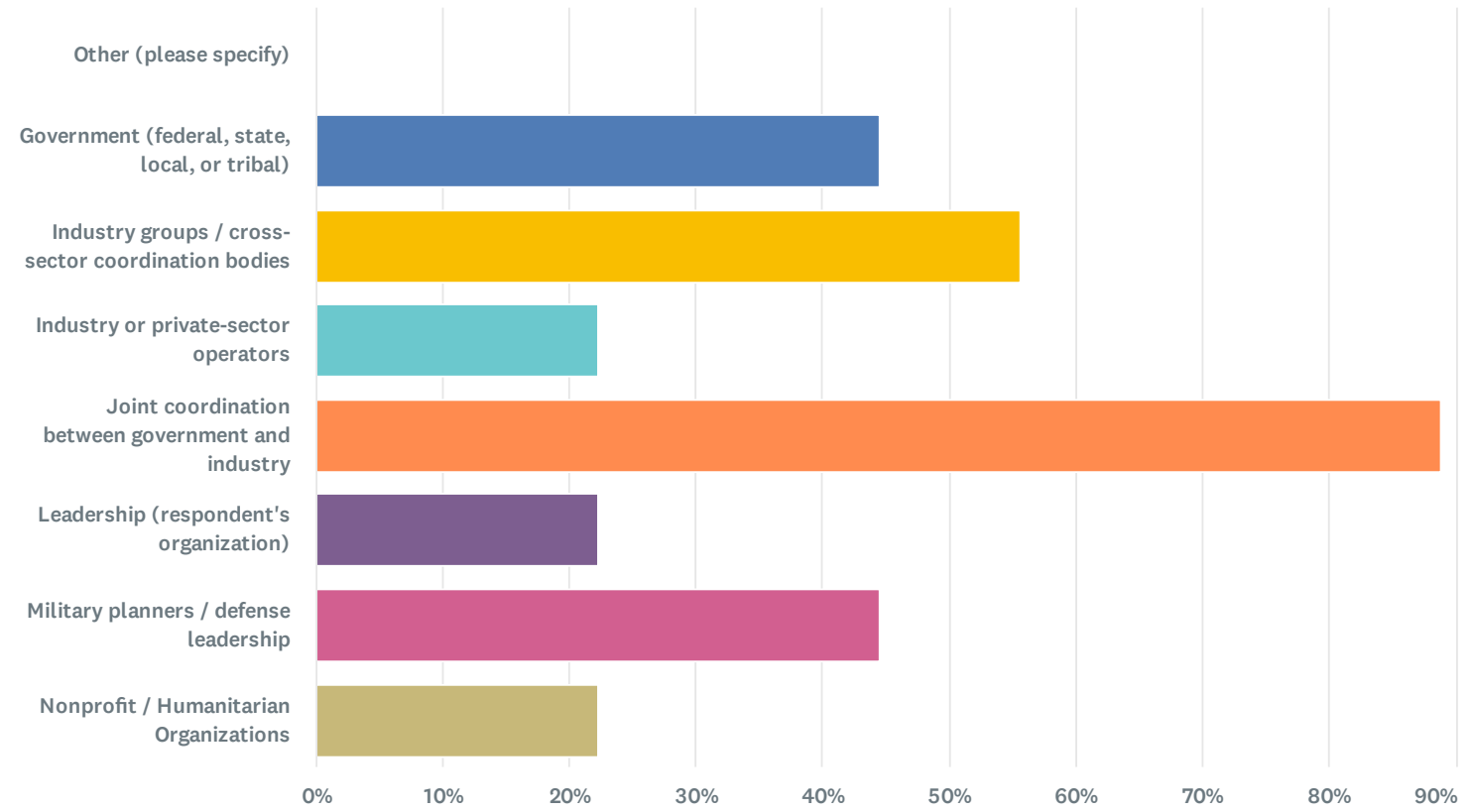


No responses yet

Q14

9 responses

Strategic Insight14. What one investment, policy change, or coordination improvement would most strengthen resilience in your sector? Who would need to take action?Examples may include infrastructure investment, regulatory change, improved coordination mechanisms, or new communication protocols.(Select all that apply)



RESPONSES (0) WORD CLOUD TAGS (0)

? Filter: by tag ▼ by sentiment ▼

☐ No responses yet

#1

COMPLETE

Collector: Project 1 (Web Link)
Started: Tuesday, March 17, 2026 6:12:54 PM
Last Modified: Tuesday, March 17, 2026 6:24:14 PM
Time Spent: 00:11:20

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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Medical services

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Internet connectivity
Workforce availability
Supply chain collapse

Q9

Communications and technology systems

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Q10

10. If helpful, briefly describe the dependency relationship.

Inability to provide situation awareness to vulnerable populations

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

Not enough experience to determine

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

Starlink, alternative platforms

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Basic services for food, water, power, shelter and workforce

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

The narrow margins of the civilian communities to sustain themselves around installations.

#2**COMPLETE**

Collector:	Project 1 (Web Link)
Started:	Wednesday, March 18, 2026 12:23:26 PM
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Time Spent:	00:40:32

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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

If disruption required services to be prioritized, the function that must be preserved first is the continued operation of pharmaceutical distribution and inventory management, including distribution center operations, cold-chain handling, and domestic transportation. Preserving these capabilities ensures that available medications can be allocated, redistributed, and delivered to healthcare providers and patients, sustaining continuity of care even when upstream manufacturing or transportation constraints exist. Maintaining core distribution operations minimizes immediate patient impact, supports critical healthcare infrastructure, and allows the organization to absorb and manage longer-term supply disruptions that originate outside of its direct operational control.

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.
8. Under Arctic disruption conditions, what circumstances would force your organization to:
Curtail service (reduce capacity) Ration service (prioritize limited availability) Stop operations

Under Arctic disruption conditions, service impacts would be driven primarily by the severity and duration of degradation to the domestic transportation network, rather than a lack of internal operational capacity. The organization maintains a robust distribution capability with significant built in redundancy; however, curtailment of service would occur if extreme cold, ice, or snow reduced road accessibility, limited trucking capacity, or constrained air cargo operations, resulting in slower delivery cycles and reduced throughput. Rationing of service would be required if prolonged transportation disruptions materially constrained inbound or outbound movement, necessitating prioritization of critical healthcare deliveries and allocation of limited transportation resources. A full disruption of operations would be unlikely and would only occur under extreme conditions where widespread, sustained failure of both road and air transportation networks prevented safe movement of goods altogether, despite facilities remaining operational and inventory being available. In this context, Arctic conditions represent a transportation driven risk rather than a loss of core distribution capability, with impacts escalating as domestic mobility degrades rather than from internal capacity shortfalls.

Q9**Healthcare and medical services**

Cascading Impacts9. If your system were disrupted, which sectors would be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Q10

10. If helpful, briefly describe the dependency relationship.

We are heavily reliant on the domestic transportation network to deliver products to essential service providers. We are also dependent on product deliveries from the EU, China, and India, which rely on maritime shipping and international air cargo. A disruption to either transportation system can result in product shortages if the disruption is prolonged.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

When Arctic lifeline systems fail, the most common cascading effects stem from the loss of transportation, power, and logistics connectivity, which rapidly constrains the movement of critical goods and services. Severe cold and infrastructure failures can disrupt road and air transportation, delay or halt deliveries, and limit workforce mobility, leading to reduced distribution capacity and supply imbalances. As these disruptions persist, inventory replenishment becomes increasingly constrained, and patients may not receive the critical medications required for life saving or life sustaining care. While federal initiatives, including efforts led by HHS, are underway to strengthen and expand domestic pharmaceutical production, the vast majority of medications and active pharmaceutical ingredients are still produced outside of the United States, leaving healthcare supply chains vulnerable to prolonged Arctic events that affect both domestic lifelines and global transportation systems.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

If a primary system, route, or supplier failed, several practical alternatives exist, including rerouting through alternate domestic transportation corridors, leveraging multiple distribution locations, engaging secondary or tertiary suppliers, and reallocating available inventory to support critical needs. The organization maintains multiple layers of redundancy across suppliers, transportation modes, and distribution capabilities to absorb localized or short term disruptions. However, if an event were widespread and prolonged, affecting large portions of the transportation network or multiple upstream suppliers simultaneously, these alternatives would become increasingly constrained and would disrupt normal operations, requiring prioritization of services and extended recovery timelines.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

In Arctic conditions, several backup solutions that are often assumed in planning prove unrealistic due to the scale and severity of impacts. These include the expectation that alternate road routes or nearby airports will remain accessible, when extreme cold, ice, and snow frequently affect wide geographic areas simultaneously. Similarly, leveraging multiple distribution points may be assumed to provide continuity; however, Arctic events can disrupt transportation corridors, utilities, and workforce availability across multiple locations at once, limiting the ability to reposition inventory or shift volume. Assumptions that air transportation can rapidly offset ground disruptions or that suppliers can quickly increase output are also often unrealistic under prolonged Arctic conditions, as aircraft availability, crew safety, and upstream supply constraints are commonly affected in parallel.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

Decision makers often underestimate how quickly Arctic infrastructure disruptions translate into operational and human impact, particularly in commercial healthcare supply chains that operate on tight margins, compressed timelines, and high velocity. There is a common assumption that private sector operations can absorb delays or “slow down” in the same way government systems often do; however, the speed of business is critical, and even short disruptions to transportation, power, or logistics can rapidly cascade into reduced service levels and patient impact. Arctic events tend to affect large geographic areas simultaneously, limiting practical workarounds and compressing decision timelines to hours—not days or weeks. This research should capture that commercial supply chains are designed for efficiency and continuity of care, not prolonged pauses, and that misalignment between the pace of government response and the tempo required to sustain critical services can exacerbate downstream consequences during Arctic infrastructure failures.

#3

COMPLETE

Collector: Project 1 (Web Link)
Started: Friday, March 20, 2026 8:32:24 PM
Last Modified: Friday, March 20, 2026 8:58:50 PM
Time Spent: 00:26:26

Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Supply Chain

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Workforce availability

Product availability

Utilities

Q9

Cascading Impacts9. If your system were disrupted, which sectors would be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Community services and local populations,

Food distribution and supply chains,

Healthcare and medical services

Q10

10. If helpful, briefly describe the dependency relationship.

Many northern communities rely on diesel-based generation and imported fuels, often with no interconnected grid; failures can persist and compound with transport disruption.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

A resilient population, lack of transportation, workforce & utility would lead to bigger impacts

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

We have a limited footprint in Alaska and Northern Canada. If distribution routes were impacted, alternative routes would be shipping and air. If workforce is not available, there is no alternative option.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Short term disruptions would be cleared within days. In this case, that can't be assumed.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture? Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

- “Workforce is a secondary concern” — workforce stability is mission assurance
- “Infrastructure failure is binary” — it isn’t
- “Logistics problems are short-term” — Arctic recovery is slow by default
- That DoD assets (airlift, generators, satellite comms, fuel) can readily replace civilian lifelines during disruption. The private sector (food, fuel, retail, logistics) is not “adjacent support”—it is foundational infrastructure for Arctic operations.

#4**COMPLETE**

Collector: Project 1 (Web Link)
Started: Monday, April 06, 2026 2:54:59 PM
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Time Spent: 00:23:37

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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Energy/fuel for initial people/life support

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

1. Curtail - supply chain disruptions
2. Ration - Fuel and workforce limitations
3. Stop - extreme weather and lack of transit capability (roads, airfields, etc).

Q9

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Community services and local populations,
Energy systems,
Food distribution and supply chains,
Healthcare and medical services,
Military installations or defense operations,
Transportation and logistics

Q10

Respondent skipped this question

10. If helpful, briefly describe the dependency relationship.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

People/community/medical support becomes a priority vs. supporting security infrastructure or non-life sustaining systems. This can cause significant infrastructure degradation due to severe weather impacts.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

The plan would need to build in the primary, alternate and contingency alternatives up front. A singular system or route is not sufficient. But if industry does not have contingencies, then support would have to come from US or State government agencies (FEMA, National Guard, Army, etc).

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

It's unrealistic to rely on one supply method or route. Routes and logistics will be impacted seasonally, so planning for marine supply routes would work in summer months but must transition to an alternative (e.g. ground transportation) during winter months. This will reduce goods flow and resupply times.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

Decision makers often misunderstand the weather and size/scale of the Arctic, along with the time it will take to build life support and operational infrastructure. Ice engineering is difficult at best, and the population level is mostly confined to cities and larger towns. You also don't have readily available materials to build with (lumber, concrete, etc..) and obtaining the goods and civilian support for arctic response will be difficult and time consuming due to distances from the L48.

#5**COMPLETE**

Collector: Project 1 (Web Link)
Started: Monday, April 06, 2026 4:35:47 PM
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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

During a major Arctic disruption, the limiting factor is rarely what aid exists—it's whether it can reach isolated communities safely and fast. Team Rubicon's strongest and most consistently deployed capability is operational logistics in austere, disrupted environments, including:

Route clearance and access restoration

Ground and air movement coordination in damaged or weather-constrained areas

Last-mile delivery of critical supplies (fuel, food, medical materials)

Incident management, staging, and integration with government and military partners

Operating when normal transportation networks are degraded or unavailable

In Arctic conditions—where terrain, weather, ice, limited infrastructure, and long distances dominate—logistics is the enabling function that makes every other core service possible.

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Extreme weather has historically affected our ability to provide services. The life safety risk are too high for the roles we typically provide that are not directly life safety task.

Q9

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Community services and local populations,

Food distribution and supply chains,

Transportation and logistics

Q10

Respondent skipped this question

10. If helpful, briefly describe the dependency relationship.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

Food chain and essential services are critical. The Arctic region historically does a good job of food reserves for the winter months but an early or late season arrival disrupts that timing. Access for transportation would make meaningful delivery of last mile logistics difficult. Resource allocation of life sustaining goods in an equitable way becomes very difficult.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

Based on limited population centers in the Arctic the delivery to central hubs and routes is important. A hub and spoke delivery model where locals can use their resources to retrieve goods through traditional transport means they use is the most realistic. From sled teams to airdrops.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Air assets are depended on. Stockpiles of supplies that can be housed securely is a key factor.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

The complexity of delivering services and supplies in the Arctic is dependent on transportation heavily. The military is the best equipped to solve this issue. The coordination across the public/private/non-profit sector with the Military is critical. People to execute the mission is not the blocker, the ability to get the people to the mission will be.

#6**COMPLETE**

Collector:	Project 1 Email Follow-Up (Email)
Started:	Friday, April 10, 2026 8:52:43 AM
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Time Spent:	00:10:37
First Name:	136.226.2.85
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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Supply Chain - drug delivery to markets

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Inability to access fuel that power N+1 generators, ingress and egress of couriers to DCs and out to markets due to road conditions or airport access and/or availability of staff.

Q9

Healthcare and medical services

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Q10

10. If helpful, briefly describe the dependency relationship.

McKesson delivers 40% of all market sure drugs in North America. If those drugs to not make it to hospitals, clinics and pharmacies, it can cost lives.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

Lack of fuel for redundant power, reduced capacity of food supplies, power down for extended periods as Alaska likely does not have DOT resources to respond at scale, communications challenges, airport restrictions.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

Transfer order lines to lower 48, work on solution to get supplies to market via air, hot shot drivers, other means. Put employees up in local hotels (essential employees) so they they can man the DCs, engage with EOC on time to clear roads.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Fuel availability, food supplies, communication and the overall preparedness of the government to respond timely.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

That it takes both private sector and the government to coordinate successfully and the government does not typically put effort into preparedness coordination in many states with only 28 states having an EOC at all.

#7**COMPLETE**

Collector: Project 1 Email Follow-Up (Email)
Started: Wednesday, April 22, 2026 9:14:06 AM
Last Modified: Wednesday, April 22, 2026 10:42:40 AM
Time Spent: 01:28:33
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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

In my opinion, organizational operations and structure must be preserved first. Organizations can provide no external assistance or participate in any kind of response without first stabilizing their internal structures.

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Our industry is all about the ability to communicate and arrive on client site. If we would need to curtail services if communications are disrupted, we are unable to access clients, or if our workforce is unable to participate.

Q9

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Communications and technology systems,
Community services and local populations,
Military installations or defense operations

Q10

Respondent skipped this question

10. If helpful, briefly describe the dependency relationship.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

The first thing to go in a disruption event are strong communications and shared operating picture. These initial disruptions cascade down into every sector and industry and force organizations to make choices with bad information.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

None

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

The idea that outside or external partners (like government) will show up with manpower and resources ready to be utilized.

Q15

Respondent skipped this question

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture? Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

#8**COMPLETE**

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Time Spent:	00:26:08

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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Power, communications, workforce, and physical restoration.

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Given the remote nature of a 501(3)(c) non-profit, the National Hazard Mitigation Association would be severely impacted by long-term power outages, hampering all communications and potentially dismantling the organization's capacity to re-emerge.

Q9**Community services and local populations**

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Q10

10. If helpful, briefly describe the dependency relationship.

NHMA's main pillar is training and education of local communities, organizations, and students in emergency management, with specific aim on hazard mitigation and resilience.

Q11

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

A blackout would entail a complete lack of situational awareness. This would leave people blind to hazard risk during or after a catastrophic event. Without communication, most interagency and organizational initiatives would fail to reduce that harm. Post-event restoration may be prolonged, causing people to migrate to non-affected areas, with a majority of the population not returning in the long run.

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

For power, electric generators and a few carbon-free options exist. However, these options only serve for limited time frames and are unable to replace the grid system.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Large generators with thousands of fuel gallons are needed, but in artic conditions, this may not exist. However, artic populations might not be as high as compact urban areas. Therefore, planned assessments often show that it is possible to have sufficient backup for artic communities, but if hazard intensity keeps growing, well begin to see these unrealistic assessments made during planning stages.

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

If would say, "The time required to restore critical services", as this may be highly volatile to extreme weather conditions, further aggravated by below-zero temperatures.

#9**COMPLETE**

Collector: Project 1 Email Follow-Up (Email)
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First Name:
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Q4

4. If disruption forced you to prioritize services, which function must be preserved first?(Please answer based on the services or capabilities your organization provides.)

Restoration of the transportation system

Q8

Operational ThresholdsOperational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations.8. Under Arctic disruption conditions, what circumstances would force your organization to:Curtail service (reduce capacity)Ration service (prioritize limited availability)Stop operations

Inability to maintain supply lines

Q9

Cascading Impacts9. If your system were disrupted, which sectors would be be most immediately affected? Consider organizations, sectors, or communities that depend on your service to continue operating.(Select all that apply)

Energy systems,
Military installations or defense operations,
Transportation and logistics

Q10

Respondent skipped this question

10. If helpful, briefly describe the dependency relationship.

Q11

Respondent skipped this question

11. In your experience, what cascading effects are most likely when Arctic lifeline systems fail?

Q12

Backup and Resilience12. If your primary system, route, or supplier failed, what practical alternatives exist?

Other commercial suppliers

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Availability of military airlft

Q15

15. What do decision-makers (military / government leadership) most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

Lack of interconnected road system for many communities throughout the state.

#1

COMPLETE

Collector: project 1 military (Web Link)
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Q1

Military Operations or Command Leadership

Your Perspective1. Which sector best represents your perspective?(Select one)

Q2

Command or Senior Leadership

2. What role best reflects your experience?(Select all that apply)

Q3

Energy generation or fuel distribution

Essential ServicesFor this survey, an Arctic disruption refers to a prolonged event that limits transportation, energy supply, communications, or resupply to Arctic communities and installations.3. Based on your operational experience, which service or operational capability is most essential to sustaining Arctic operations during a major disruption?(Select one)

Q4

4. If disruption forced operational prioritization, which function would need to be preserved first?Please answer based on the services or capabilities most critical to sustaining operations or supporting installations.

First, energy and fuel distribution closely followed by transportation and logistics.

Q5

Infrastructure Dependencies5. Based on your experience, what resources or systems are essential for Arctic operations to continue functioning?(Select all that apply)

Access to Raw Materials,
Supply distribution and delivery networks,
Transportation Access (roads, ports, airfields),
Warehousing / Storage Capacity,
Fuel / Energy Supply,
Regulatory or Government Permissions,
Communications / Internet connectivity,
Power,
Security,
Water Availability,
Weather Forecasting / Situational Awareness,
Food Supply and Distribution System,
Medical Services,
Workforce Availability

Q6

6. Which of these dependencies would be most difficult to replace or substitute during Arctic conditions?Arctic conditions refer to environments where extreme weather, long distances, and limited infrastructure reduce redundancy and make transportation, communications, energy supply, and logistics difficult to replace if disrupted. (Select all that apply)

Supply distribution and delivery networks,
Transportation Access (roads, ports, airfields),
Fuel / Energy Supply,
Communications / Internet connectivity,
Security,
Food Supply and Distribution System,
Medical Services,
Workforce Availability

Q7

Early Stress Indicators Early stress indicators are often the first signs that infrastructure systems supporting operations are beginning to degrade during a disruption. 7. During the first days of an Arctic disruption, which warning signs would indicate that the systems supporting Arctic operations are beginning to degrade or fail?(Select all that apply)

Communications or IT system disruptions affecting operations

,

Delays or disruptions in supply deliveries,

Difficulty obtaining fuel, energy, or critical utilities,

Increased operational demand exceeding normal capacity

,

Safety, security, or facility access concerns,

Transportation or logistics interruptions affecting movement of goods or personnel

,

Workforce shortages or employees unable to report to work

Q8

Operational Thresholds Operational thresholds are conditions where infrastructure systems can no longer operate normally due to Arctic constraints such as extreme weather, transportation disruption, fuel shortages, or workforce limitations. 8. Based on your experience, what conditions would force infrastructure systems supporting Arctic operations to: Curtail service (reduce capacity) Ration service (prioritize limited availability) Stop operations

Fuel shortages, logistics supply support, workforce limitations.

Q9

Cascading Impacts 9. If a critical infrastructure system supporting Arctic operations were disrupted, which sectors would be most immediately affected?(Select all that apply)

Community services and local populations,

Energy systems,

Food distribution and supply chains,

Transportation and logistics

Q10

10. If helpful, briefly describe the dependency relationship.

Respondent skipped this question

Q11

11. Based on your experience, what cascading effects are most likely when Arctic lifeline systems fail?

Basic public services. Support to security and military operations.

Q12

Backup and Resilience 12. If your primary system, route, or supplier failed, what practical alternatives exist?

Not currently applicable but I've seen the only alternative be to wait for spring weather.

Q13

13. What backup solutions are often assumed in planning but are unrealistic in Arctic conditions?

Resupply using commercial air or maritime means.

Q14

Strategic Insight14. What investment, policy change, or coordination improvement would most strengthen resilience in Arctic infrastructure systems? Who would need to take action?Examples may include infrastructure investment, regulatory change, improved coordination mechanisms, or new communication protocols.(Select all that apply)

Government (federal, state, local, or tribal),

Industry or private-sector operators,

Joint coordination between government and industry

Q15

15. What do decision-makers most often misunderstand about Arctic infrastructure disruption that this research should capture?Examples may include misunderstandings about transportation availability, supply chain timelines, workforce capacity, communications reliability, or the time required to restore critical services.

That most locations have a dual support requirement where both the local population and the government or industry rely on the same means for energy, transportation, medical, and sustenance.
