ADVANCED MICROREACTORS ARCTIC DEPLOYMENT WORKSHOP

SEPTEMBER 9–11, 2026 • FAIRBANKS, ALASKA

TABLETOP EXERCISE HANDBOOK

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Tabletop Exercise Handbook

Advanced Microreactor Arctic Deployment for Defense Applications Workshop

September 9-11, 2026 – Fairbanks, Alaska

Introduction

The Advanced Microreactor Arctic Deployment for Defense Applications Workshop will use a facilitated tabletop exercise (TTX) to explore the practical challenges of deploying and operating advanced microreactors in arctic environments for defense missions. This handbook provides the scenarios, assumptions, and exercise process participants will use to prepare for and participate in the TTX. Participants should keep in mind that the objective of this effort is not to develop one “correct” answer, but to identify important risks, requirements, dependencies, and future research needed to enable successful arctic microreactor deployments.

The exercise uses two complementary scenarios. Bush Camp (Scenario 1) represents a remote North Slope installation where isolation, permafrost, limited infrastructure, and challenging transportation create a representative austere deployment problem around a narrow operational requirement. Fort Brash (Scenario 2) considers a mature coastal Army installation where microreactors are specified to replace an aging coal power plant while maintaining continuity of the electricity and heat supply for the installation through the transition.

Participants will work through the full deployment lifecycle, from site selection and transportation through construction, commissioning, operations, sustainment, safety and security, and eventual decommissioning. The handbook is intended as a common starting point rather than a comprehensive technical reference. Participants should bring their own expertise while looking across disciplines for arctic-specific challenges, unresolved questions, and gaps in existing knowledge or capabilities that could inform future research, testing, and demonstration priorities.

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Tabletop Instructions:

The tabletop exercise (TTX) is a facilitated, discussion-based exercise designed to examine the practical challenges associated with deploying and operating an advanced microreactor in an Arctic environment. The exercise is not intended to produce a single "correct" solution or detailed engineering design. Rather, it provides a structured forum for participants from different technical and operational communities to work through common scenarios, identify dependencies and constraints, challenge assumptions, and identify areas where additional research, development, testing or evaluation be required.

Participants should approach the exercise from the perspective of their own expertise while considering interactions with other disciplines. The value of the TTX will come from identifying where requirements intersect, where assumptions differ, and where Arctic conditions introduce challenges that may not be adequately addressed by existing practices or technologies.

Exercise Structure

The TTX will consider two scenarios: a remote/austere deployment and an installation deployment. Both scenarios consider the full microreactor deployment lifecycle, from initial site selection through construction, commissioning, operations, sustainment, and eventual decommissioning and removal. Considerations will be made for safety, security, cybersecurity, natural hazards, and emergency response as we work through the scenarios.

The exercise is organized into four broad sessions:

1. Site Selection, Transportation, Logistics, and Civil Works
2. Construction, Commissioning, and Infrastructure Integration
3. Operations, Sustainment, and Lifecycle Support
4. Safety, Security, and Operational Resilience

Within these sessions, the exercise will progress through a series of discrete turns, each representing a phase or problem within the deployment lifecycle. Although both scenarios cover the complete lifecycle, each is intentionally structured to enable exploration of different issues in greater depth. These areas may be emphasized in each scenario through prepared questions and are intended to focus discussion rather than limit it. Participants should raise significant issues outside the facilitated focus when they affect the feasibility, risk, or success of the deployment.

How Each Turn Will Work

Each turn will follow a common facilitated sequence: *Introduction → Action → Reaction → Counteraction → Conclusion*

The facilitator will open the floor for short discussion at each step (preceded by a few minutes for discussion in small groups as time allows). Participants should record any additional thoughts in the JotForm provided for the turn.

Each turn will consider *both scenarios*; however, one scenario will be designated as the primary scenario for the turn and will be the focus for most of the facilitated discussion. Time will be allowed at the end of each turn to consider how an approach would differ for the turn's secondary scenario.

1. Introduction – Establish the problem

The facilitator will introduce the phase of the deployment lifecycle being considered and ask participants to identify important assumptions, constraints, critical events, dependencies, or decision points.

Participants should consider: *What must be known, decided, or accomplished before this phase can proceed?*

2. Action – Describe what you would do

Participants will discuss the actions that their organization, discipline, or technical function would take during this phase. The discussion should identify major tasks, sequencing, information requirements, dependencies, and interfaces with other participants.

The objective is not to develop detailed procedures, but to establish a credible sequence of actions and identify the requirements necessary to execute them.

3. Reaction – Respond to changing conditions

The facilitator *may* introduce one or more scenario injects during the turn representing changing or unexpected conditions. For example, severe weather, transportation delays, equipment failures, infrastructure problems, safety concerns, or other complications. Treat injects as new information within the scenario rather than as questions with predetermined answers.

Not all turns will have an inject. Participants should consider throughout how changing and unexpected conditions could impact the success of the mission and should raise areas where likely or significant risks could emerge. (i.e. don't wait for an inject when you perceive a significant risk!).

4. Counteraction – Adapt the plan

Participants will identify how they would respond. Consider whether the new condition changes:

- Planned actions or sequencing
- Resource or personnel requirements
- Safety or operational risk
- Assumptions made earlier in the exercise
- Coordination with another organization or discipline
- A previous or upcoming decision
- The overall viability of the approach

Participants are encouraged to identify uncertainty. "We would need additional information, testing, analysis, or authority before making that decision" is a useful TTX finding when accompanied by an explanation of what is needed and why.

5. Conclusion – Capture what matters

At the end of each turn, the facilitator will summarize the discussion and revisit assumptions, critical events, and decision points. Participants will help identify the principal tasks and their purpose, significant hazards and potential mitigations, and decisions or information requirements that should be carried forward.

The group will also consider whether the proposed approach remains:

- Feasible – achievable within available time, space, resources, and technical constraints;
- Suitable – consistent with the intended mission and planning objectives;
- Acceptable – provides an appropriate balance of cost, risk, and benefit; and
- Complete – addresses the major foreseeable tasks and conditions necessary for successful execution.

How to Participate

Participants are not expected to be experts in every aspect of microreactor arctic deployment. Contribute primarily from your area of expertise, while actively identifying connections to other disciplines.

During the discussion:

Think across the lifecycle: An action taken during site selection or construction may create requirements at a later point during operations, maintenance, emergency response, or decommissioning.

State assumptions explicitly: If your recommendation depends on an assumption about plant design, environmental conditions, available infrastructure, workforce, transportation, regulatory requirements, or another factor, identify it.

Identify dependencies: Highlight where your actions require another organization, technical discipline, piece of infrastructure, decision, or prerequisite activity.

Distinguish requirements from preferences: Where possible, identify what must be achieved rather than assuming a particular technical solution you like.

Challenge assumptions constructively: Understanding how different disciplines would approach a similar problem is a useful exercise outcome and should be surfaced rather than "solved".

Consider what challenges are Arctic specific throughout: Ask whether cold, permafrost, snow and ice, limited transportation access, seasonal constraints, workforce limitations, or long logistics chains drive the challenge or change otherwise standard approaches.

Identify gaps: Pay particular attention to areas where existing data, standards, models, materials, procedures, test capabilities, or operational experience may be insufficient for an Arctic deployment.

Stay at the appropriate level of detail: The objective is to identify consequential requirements, risks, dependencies, and research needs not to solve all details of an engineering challenge. It's OK to step into a rabbit hole or two – but don't get stuck there!

Preparing for the Exercise

Before the workshop, participants should review the scenario materials provided in this handbook and become familiar with the representative reactor systems, site conditions, existing infrastructure, transportation constraints, and scenario objectives and assumptions.

As you review the material, consider three questions from the perspective of your area of expertise:

1. **What would have to happen?** (major activities, analyses, approvals, capabilities, and resources required in each phase)

2. **What could prevent it from working?** (environmental, technical, logistical, organizational, safety, regulatory, or operational conditions)
3. **What do we not know well enough today?** (where is additional research, testing, demonstration, data, standards, or operational experience needed)

Participants do not need to arrive with formal presentations or fully developed solutions. Familiarity with the scenarios and a willingness to contribute technical judgment, identify assumptions, and engage across disciplines will be more valuable.

Exercise Outputs

Facilitators and scribes will capture the discussion throughout the TTX. JotForm links will be provided for participants to capture additional ideas or details beyond the time or scope limits of the discussion, but participants will not be expected to produce extensive or formal written products during the exercise. The TTX framework provides for outputs such as a Synchronization Matrix, connecting participants and actions across time; a Decision Support Matrix, connecting assumptions and changing conditions to decisions; and an Execution Checklist, capturing identified tasks, responsible proponents, and timing.

For this workshop, these records will also support identification of cross-cutting deployment challenges, key dependencies and decision points, and priority research or technology gaps associated with Arctic microreactor deployment.

The objective is not to "win" the scenario. A successful TTX is one that makes important assumptions visible, exposes difficult interfaces and unresolved questions, and identifies where additional work can most effectively reduce the technical and operational risk of future Arctic deployments.

Attribution

No attribution will be made to individual participants of specific topics, ideas, or perspectives shared in the workshop in any published or distributed exercise output unless specifically requested or agreed in writing by the participant.

Scenario 1: Bush Camp (Remote)

Background

It is April 2032. Over the past eighteen months, the strategic environment in the U.S. Arctic has changed significantly. U.S. intelligence has observed a sustained increase in Chinese and Russian military activity across the Arctic, including long-range aviation, unmanned aircraft, and maritime operations in and around the Beaufort Sea. Chinese government and commercial vessels are also operating throughout the region and routinely approaching the U.S. Arctic coastline including research vessels, icebreakers, unmanned surface systems, and ships assessed to possess intelligence collection capabilities.

This increased activity coincides with the growing strategic importance of the U.S. Arctic and heightened concern over potential air and missile threats approaching North America through the northern approaches. U.S. Northern Command has identified persistent detection and tracking of aircraft, cruise missiles, and unmanned aircraft operating in the region as an increasingly important requirement for continental defense.

Recent incidents have heightened these concerns. Three months ago, U.S. sensors detected an unidentified unmanned aircraft operating over the Beaufort Sea near a foreign research vessel. The aircraft was not reliably tracked until it approached the U.S. coastline, highlighting gaps in persistent low-altitude surveillance of Alaska's northern approaches. Similar incidents involving unidentified aircraft and unmanned systems have increased concern over the ability of existing sensors to provide timely warning of potential threats approaching through the Arctic.

To strengthen surveillance of the northern approaches, the Department of War (DoW) has directed expansion of Bush Camp, an existing Army installation on Alaska's North Slope, into a permanent year-round operating location supporting a new long-range Arctic Active Electronically Scanned Array (AESA) air-surveillance radar. The radar will provide persistent detection, classification, and tracking of aircraft, cruise missiles, and unmanned aircraft approaching through the Arctic and provide track data to the broader North American air-defense network. Bush Camp's elevated location near the northern foothills of the Brooks Range provides an unobstructed field of view across the North Slope and Beaufort Sea. DoW has directed Army to have the new capability fully operational by October 2033, before winter 2033/34.

Mission

The U.S. Army has been tasked to expand and sustain Bush Camp as a year-round forward operating installation capable of supporting continuous operation of the new Arctic AESA air-surveillance radar system.

The installation will include:

- Long-range AESA air-surveillance radar and associated cooling and control systems
- Company-sized garrison (~150 personnel)
- Maintenance and logistics facilities

- Command, communications, data processing, and support infrastructure
- Airfield support facilities
- Independent power generation

Given the site's extreme remoteness and the recent availability of rapidly deployable modular microreactors, Army leadership has directed that the installation's primary power source be a nuclear microreactor.

Power System

The selected power system consists of:

- 900 kWe advanced microreactor
- Combined Heat and Power (CHP) system providing primary heating for all occupied facilities (occupied facilities are also equipped with backup electric heating)
- 5 MWh long duration energy storage system capable of supporting load following and maintaining essential operations during reactor outages

The microreactor will provide the installation's primary electrical and thermal energy. Diesel generators will be installed and available for emergency backup and contingency operations.

Operational Environment

Location

Bush Camp is located on Alaska's North Slope approximately:

- 30 miles south of the Beaufort Sea coast
- Approximately 100 miles from the Dalton Highway
- Near the transition between the Arctic Coastal Plain and northern Brooks Range foothills sitting on continuous permafrost
- In a remote location, not near to any existing settlement

The site is located on an elevated area near the northern foothills of the Brooks Range and was selected in part for its unobstructed field of view across the North Slope and Beaufort Sea, providing coverage of Alaska's northern air approaches.

A broad gravel beach approximately 30 miles north of the installation has been identified as suitable for seasonal sealift operations using barges and lighterage equipment.

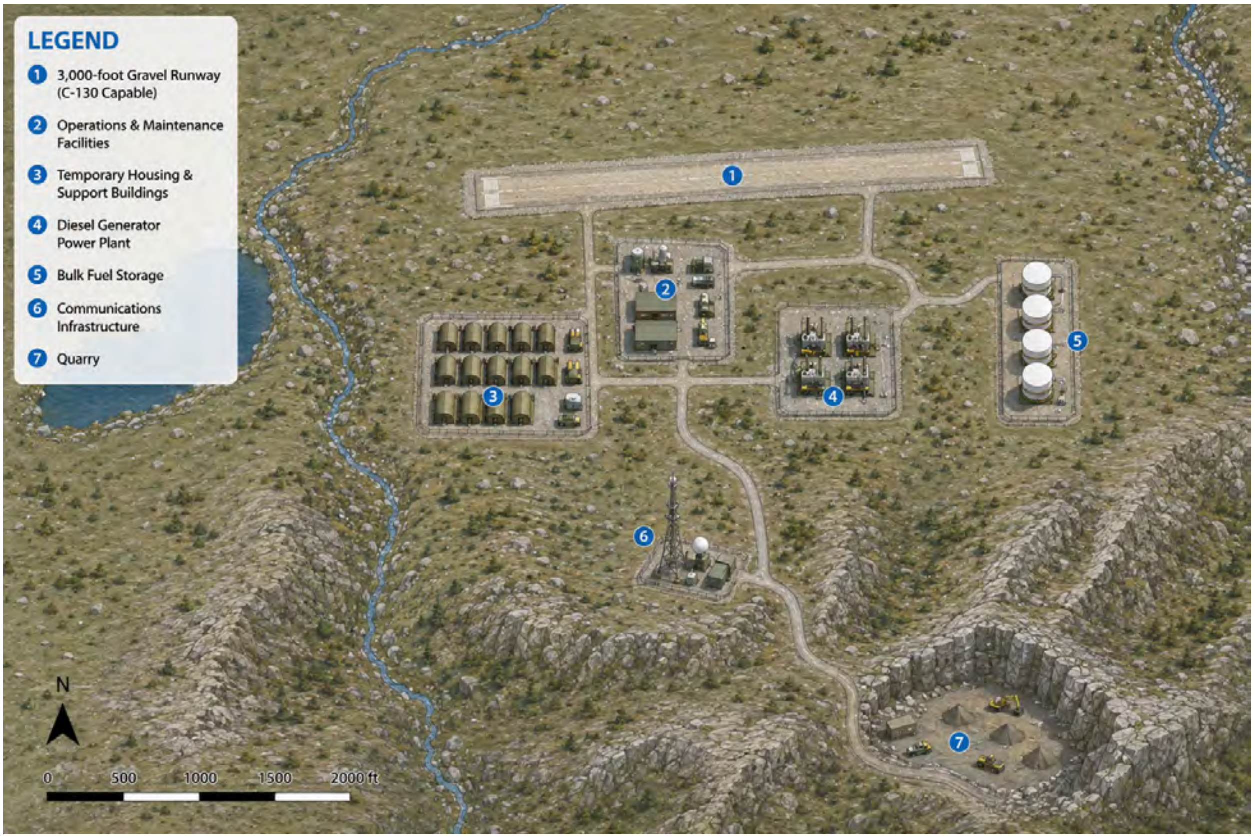
Existing Infrastructure

Bush Camp currently serves as a small Army operating location supporting approximately ten personnel.

Existing infrastructure includes:

- 3,000-foot gravel runway capable of limited C-130 operations
- Small operations and maintenance facilities
- Temporary housing and support buildings
- Diesel generator power plant
- Bulk fuel storage
- Communications infrastructure

Figure 1: Existing Bush Camp site.



The installation is currently powered entirely by diesel generators. Fuel is delivered throughout the year by C-130 aircraft, resulting in high operating costs and significant logistical burden.

Because of the site's continuous permafrost, infrastructure has been designed using established Arctic engineering practices.

The existing runway was constructed using an insulated gravel pad to preserve underlying permafrost and minimize thaw settlement. Permanent buildings are elevated on piles and supported by passive thermosyphons to maintain frozen foundation conditions.

Expansion of the installation will require substantial new civil works while maintaining long-term permafrost stability.

Regional Transportation

Bush Camp currently has no permanent road connection to Alaska's highway system.

A recent engineering survey evaluated construction of a seasonal snow road connecting the Dalton Highway to Bush Camp and identified a feasible route approximately 100 miles in length. While no construction has yet occurred, the route is considered technically achievable using established Arctic snow-road construction practices.

A second engineering assessment determined that either a seasonal snow road or a gravel road (using arctic / permafrost construction methods) could also be constructed between Bush Camp and the Beaufort Sea coast, approximately 30 miles to the north. This route would provide access between a temporary sealift landing area and the installation, either seasonal for the snow road or year-round for the gravel road, enabling delivery of oversized equipment not suitable for air transport.

Participants should assume both snow-road routes are technically feasible but would require annual construction and maintenance. The gravel road to the seacoast is also technically feasible using standard construction methods for continuous permafrost. Limestone and dolomite can be quarried from the foothills immediately south of Bush Camp, with glacial outwash gravel and sand also readily available nearby. All other construction materials must be transported to the site from outside sources.

Climate

Participants should assume typical Arctic North Slope conditions, including:

- Winter temperatures below -40°C
- Strong year-round prevailing winds from the east and northeast (polar easterlies) with occasional west and northwest winds (typically during specific storm events)
- Frequent blowing snow and reduced visibility
- Extended periods of winter darkness
- Continuous daylight during summer
- Continuous permafrost

- Poor natural drainage
- Active-layer thaw during summer
- Short construction season

Construction activities remain constrained by a brief summer season (July-September) and by engineering requirements necessary to preserve permafrost beneath roads, foundations, and utilities.

Strategic Considerations

The installation is intended to provide:

- Persistent surveillance of Alaska's northern approaches
- Detection and tracking of aircraft, cruise missiles, and unmanned aircraft operating in or approaching U.S. airspace
- Enhanced early warning of potential air and missile threats approaching through the Arctic
- Integration with the broader North American air-defense network
- A sustained U.S. military presence on Alaska's North Slope

The installation is expected to remain operational for a minimum of ten years.

Planning Assumptions

For the purposes of this tabletop exercise, participants should assume:

- Congressional authorization and funding have been approved.
- All required environmental approvals have been obtained.
- The microreactor will be deployed under Army regulatory authority.
- The selected reactor design has completed all required licensing, testing, and safety certification.
- Commercial supply chains remain available.
- The regional security environment remains below the threshold of armed conflict; however, sabotage and gray-zone activities continue to increase.
- Intelligence assessments indicate that, in the event of a broader conflict, Bush Camp and its associated AESA radar would likely become an early target because of the installation's role in detecting and tracking potential air and missile threats approaching North America through the Arctic.
- Initial Operational Capability (IOC) is required within 18 months of project authorization.

Scenario 2: Fort Brash (Installation)

Background

It is November 2021. Fort Brash is a long-established U.S. Army installation on coast of Alaska. Approximately 4,000 active-duty military personnel, Army civilian employees, and family dependents live or work on the installation. A small civilian community occupies the same coastal valley and is connected to Fort Brash by the local road network. There is no road connection over the surrounding mountains to Alaska's broader road system.

The installation and neighboring community are closely linked. Many community residents work on post, local businesses depend heavily on installation activity, and the community relies on Fort Brash as the region's principal transportation and economic hub. The installation also hosts an Alaska Army National Guard aviation element with a significant regional search-and-rescue mission, conducted primarily with CH-47 Chinook helicopters.

Fort Brash currently receives essentially all bulk energy supplies by sea. An aging coal-fired combined heat and power (CHP) plant supplies installation electricity and central steam heat. The plant has recently experienced a string of mechanical failures and unplanned outages. Limited diesel generation can support selected critical electrical loads, but there is no other major source of heat capable of replacing the central steam system.

Following the most recent failures, Army Headquarters determined that continued reliance on the existing coal plant presents an unacceptable risk to mission continuity and directed construction of a replacement power plant as soon as practicable. Army leadership also concluded that replacing the plant with another fossil-fueled system would perpetuate dependence on costly fuel barges and a logistics chain that could be disrupted or targeted during a crisis. The Army has therefore decided to deploy a modular high-temperature gas reactor (HTGR) microreactor power plant at Fort Brash.

Mission

The U.S. Army has been tasked to replace Fort Brash's aging coal CHP plant with a modular microreactor-based power system while maintaining continuous electrical service, district steam heat, aviation operations, and installation support functions.

The project must:

- Provide reliable electrical power for an installation with approximately 8 MWe average demand and 15 MWe peak demand
- Provide steam or equivalent thermal energy to the existing installation district-heating system

- Maintain continuity of critical missions during construction, commissioning, and transition from the coal plant
- Achieve operation of the first 9 MWe reactor/steam loop within two years of project authorization
- Achieve operation of the second 9 MWe reactor/steam loop within three years
- Enable decommissioning of the existing coal CHP plant after the replacement system is fully operational
- Reduce dependence on recurring coal and diesel deliveries by sea

Power System

The selected power system has a maximum electrical generating capacity of 18 MWe and consists of:

- Six transportable 3 MWe HTGR microreactor modules
- Two independent groups of three reactor modules
- A separate secondary steam loop for each three-reactor group
- One Rankine-cycle steam turbine-generator connected to each steam loop
- Steam extraction and heat-transfer equipment capable of supplying the installation's central heating system
- Electrical interconnection to the existing Fort Brash distribution system (a self-contained grid not connected to the local community diesel power generation)

Each three-reactor group can provide up to approximately 9 MWe through its associated steam turbine. Each turbine can operate effectively with either two or three reactors online. This configuration allows one reactor on each loop to be shut down for maintenance or otherwise be unavailable without shutting down that steam loop.

The configuration also provides plant-level maintenance flexibility. One complete 9 MWe steam loop can be taken offline while the other operates with all three reactors and carries most of the installation's electrical load. Limited diesel generation and other load-management measures would be required to support critical loads and manage demand during periods when only one steam loop is available.

The existing coal plant must remain available during construction and phased commissioning because it provides both electricity and central steam heat. Transition planning must account for tie-ins to the electrical distribution and district-steam systems, testing of the first reactor group, and eventual transfer of the full installation load before coal-plant decommissioning.

Operational Environment

Location

Fort Brash is in a coastal valley ~450 miles south of the arctic circle. Mountainous terrain surrounds the valley on the landward side, while a protected coastal inlet provides marine access. The installation and adjacent community share a local road network, but no road crosses the mountain pass to connect the valley with Alaska's broader highway system.

For purposes of the exercise, participants should assume that all oversized construction equipment, reactor modules, major turbomachinery, bulk fuels, and most heavy materials must arrive by sealift or airlift. Local road transport is available between the port, airfield, installation, and community.

Existing Infrastructure

Fort Brash is a mature installation. Existing infrastructure includes:

- C-17-rated airfield supporting military and strategic airlift operations
- Low-draft port facility that regularly receives sealift barges
- Aging coal-fired combined heat and power plant
- Central steam distribution system serving major installation facilities
- Limited diesel backup generation for critical electrical loads
- Bulk coal and diesel storage and handling facilities
- Army aviation facilities supporting CH-47 Chinook operations
- Housing, administrative, maintenance, logistics, medical, and community-support facilities
- Local road network connecting the installation, port, airfield, and neighboring community

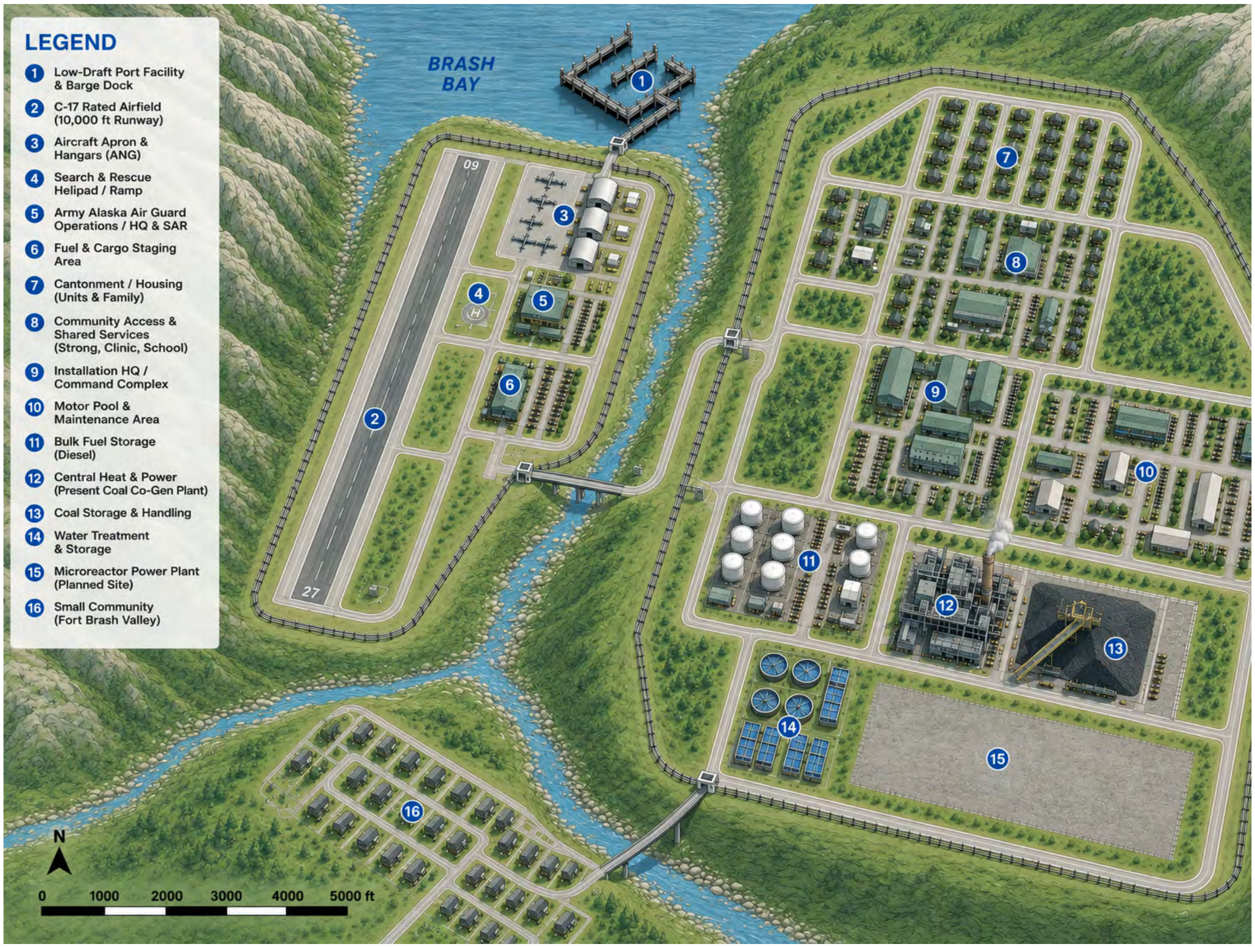
The existing coal plant supplies most installation electricity and is the primary source of central heat. Average electrical demand is approximately 8 MWe, with peak demand of about 15 MWe. The condition of the coal plant has become a major installation resilience concern because recent mechanical issues have increased the likelihood of an extended outage.

Regional Transportation

Fort Brash's port is fully open and ice-free from May through September and regularly handles shallow-draft barges. During the remainder of the year, the port is typically accessible to ice-strengthened barges without icebreaker escort. Periodically, however, local ice conditions close the harbor for approximately one to two weeks at a time.

The harbor is too shallow for regional icebreakers to enter and clear an access channel. When the harbor freezes in, arriving cargo generally must wait offshore or at another location until wind, waves, and weather reopen the approach. Participants should therefore account for seasonal uncertainty and short-duration winter interruptions when sequencing heavy deliveries.

Figure 2: Fort Brash installation map.



The C-17-rated airfield provides an important alternative for personnel, high-priority cargo, and equipment suitable for airlift. The absence of an external road connection means that sealift and airlift are the only practical routes for bringing major equipment and material into the valley.

Climate

Participants should assume typical Alaskan maritime conditions, including:

- Long, cold, wet, and windy winters with frequent storms
- Heavy snowfall and icing conditions

- Rapidly changing coastal weather and periods of poor visibility
- Seasonal sea ice capable of temporarily restricting harbor access
- Salt-laden marine air and significant corrosion exposure
- Freeze-thaw cycles affecting roads, foundations, and utilities
- Shorter and more weather-constrained construction seasons than temperate installations
- Seismic hazards

Construction and reactor operations must account for coastal weather, corrosion, seismic design requirements, snow and ice loading, and the possibility that marine access will be temporarily interrupted during winter.

Community and Mission Considerations

The neighboring civilian community is economically and operationally intertwined with Fort Brash. Many residents work on the installation, while installation personnel depend on community businesses and services. Major construction activity, changes in utility operations, port congestion, workforce influx, or extended power disruptions would therefore affect both the military installation and the surrounding community.

The Alaska Army National Guard aviation mission also places a premium on reliable power, heat, communications, airfield support, and maintenance facilities. Search-and-rescue missions may be launched throughout the year and can become particularly important during severe regional weather, when commercial transportation and marine access are most constrained.

Strategic Considerations

The microreactor project is intended to:

- Replace an increasingly unreliable coal CHP plant before a major failure jeopardizes operations
- Provide resilient electricity and central heat for Fort Brash
- Reduce dependence on recurring coal and diesel sealift
- Reduce exposure of predictable fuel-barge movements to disruption or adversary action
- Support continuity of Army and Alaska Army National Guard missions
- Demonstrate a modular, maintainable nuclear power architecture suitable for a large, isolated defense installation

Planning Assumptions

For the purposes of this tabletop exercise, participants should assume:

- Congressional authorization and project funding have been approved.
- Required environmental reviews and site approvals can be completed within the project schedule.
- The microreactors will be deployed under applicable Army regulatory authority.
- The selected reactor design has completed required licensing, testing, and safety certification before shipment to Fort Brash.
- Commercial and government supply chains remain available, but sealift schedules and winter harbor closures remain operational constraints.
- The existing coal plant can continue operating during the transition period but remains at elevated risk of additional mechanical failures.
- Limited diesel generation is available for critical electrical loads but cannot replace the installation's full electrical demand or central heating requirement.
- The regional security environment remains below the threshold of armed conflict; however, Army planners consider recurring fuel-barge dependence a significant vulnerability in the event of a crisis or conflict.
- Initial Operational Capability for the first three-reactor, 9 MWe steam loop is required within 24 months of project authorization.
- The second three-reactor, 9 MWe steam loop is required to be operational within 36 months.
- The coal CHP plant will be decommissioned after both reactor/steam loops are operational and the replacement plant has demonstrated reliable electrical and thermal service.

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