Savannah River Sovereign AI Campus

Planning-Level Concept
Designed to Respect Nuclear, Tritium, and Environmental Missions and Informed by DOE's March 2025 "AI Infrastructure on DOE Lands" Request for Information [DOE RFI, Mar 2025]

Executive Summary

This document presents a planning-only concept for a Savannah River Sovereign AI Campus: a small, tightly governed AI enclave nested within the much larger Savannah River Site, which the RFI describes as an approximately 310-square-mile DOE/NNSA complex supporting tritium production, nuclear material management, and environmental cleanup and stewardship [DOE RFI, Mar 2025]. The AI campus is conceived as a phased, long-horizon presence that coexists with, but does not interface with, SRS's nuclear and national security missions.

The proposal defines architecture templates, proxy modeling constructs, governance assumptions, and readiness criteria that DOE can use to consider whether SRS could host a limited, sovereign AI campus in support of long-term national objectives. All content is confined to conceptual planning and proxy simulation: no operational control, grid actuation, facility interfacing, deployment decision, or vendor selection is proposed or implied.

Problem Statement and Opportunity

The Savannah River Site is a very large, mission-critical DOE/NNSA complex with tritium, nuclear materials, and environmental missions, and it is explicitly cited in the RFI as one of 16 candidate locations for potential AI infrastructure [DOE RFI, Mar 2025]. The RFI notes that SRS includes extensive DOE-managed land and that any new land use is controlled through a Site Use Permit process that applies to all activities on any tract of land [DOE RFI, Mar 2025].

The planning problem is that there is currently no SRS-specific concept that demonstrates:

- How a small, sovereign AI enclave could be sited and phased at SRS while maintaining clear isolation from tritium, nuclear, and other mission facilities.
- How such an enclave could evolve over long time horizons under the Site Use Permit framework and environmental hard constraints.
- How SRS's scale and mission profile can be translated into a conservative, reversible AI campus concept using only planning constructs and information explicitly available in the RFI.

The opportunity is to develop a Savannah River-specific sovereign AI campus framework that:

- Treats AI infrastructure as a small, gated enclave within an approximately 310-square-mile reservation, as described in the RFI [DOE RFI, Mar 2025].
- Uses the Site Use Permit process as the primary gating and oversight mechanism for any conceptual land use.
- Provides DOE with a long-horizon, reversible planning construct that can be adapted, slowed, or redirected as missions, policy, and environmental conditions evolve.

Scope and Non-Scope

Scope

- Define a conceptual Savannah River Sovereign AI Campus with a small relative footprint and phased growth, explicitly subject to the SRS Site Use Permit framework [DOE RFI, Mar 2025].
- Develop architecture templates that describe different modes of AI presence (initial node, distributed nodes, long-horizon campus) in ways that are compatible, in concept, with SRS missions.
- Create a tool-agnostic proxy modeling plan focused on AI workloads, conceptual energy supply abstractions, and environmental constraints, using only qualitative or range-based metrics.
- Outline planning-level governance, security zoning, environmental, and community considerations informed by the RFI's description of SRS and DOE-wide requirements [DOE RFI, Mar 2025].
- Identify information gaps and decision gates that must be addressed before any consideration of a solicitation or design effort.

Non-Scope (Explicit)

- No operational control of tritium facilities, nuclear reactors, or any SRS mission asset.
- No grid control, dispatch, or actuation of any off-site or on-site energy infrastructure.
- No commitment to construct, deploy, solicit, or procure AI infrastructure.
- No vendor, product, or specific technology selection; all references remain generic planning constructs.

- No new numerical values for power, capacities, water volumes, line ratings, acreage (beyond the ~310-square-mile site description), or budgets beyond what is explicitly stated in the RFI; where details are unknown, the document states "Not specified in the RFI" [DOE RFI, Mar 2025].

- No assumptions about classified networks or special access programs; the planning is entirely unclassified.

RFI Alignment Narrative (Categories 1–10)

This concept is explicitly aligned with the March 2025 RFI and its Savannah River appendix [DOE RFI, Mar 2025].

- **Category 1 – Interest in Solicitation**:
  The document presents a measured interest in SRS as a candidate site for a small, sovereign AI enclave, noting that SRS's large land area and mission-critical status make it important to explore AI siting only within a highly constrained, permit-gated framework. It does not assume any future solicitation or selection outcome [DOE RFI, Mar 2025].

- **Category 2 – Site Information and Data Center Design**:
  The concept uses the RFI's observation that any data center at SRS would occupy a small footprint compared with the overall site scale and frames the campus as modest and enclave-like [DOE RFI, Mar 2025]. Data center design is discussed only at a qualitative level, emphasizing phased growth, environmental compatibility, and clear separation from mission facilities.

- **Category 3 – On-Site Energy Development**:
  The proposal allows only conceptual references to on-site energy options as planning abstractions, recognizing that any actual co-located energy projects at SRS would require separate, detailed evaluation and authorization. No specific on-site energy technologies, sizes, or development plans are assumed [DOE RFI, Mar 2025].

- **Category 4 – Off-Site Energy and Transmission Capacity**:
  SRS is acknowledged as having access to regional energy and transmission infrastructure as described generally in the RFI [DOE RFI, Mar 2025]. However, no line ratings, substation characteristics, or power capacities are given in the RFI, so they remain "Not specified in the RFI." Any AI campus energy analysis would require additional, non-RFI planning data.

- **Category 5 – Financial and Contractual Considerations**:
  The concept notes that, consistent with the RFI, any AI land use at SRS would rely on DOE realty mechanisms such as ground leases or easements and that developers would be responsible for costs and liabilities related to data center construction and necessary

infrastructure upgrades, in principle [DOE RFI, Mar 2025]. No specific business terms or tariffs are proposed.

- **Category 6 – Benefits and Collaboration Opportunities**:
  The proposal suggests that a sovereign AI enclave at SRS could support unclassified, long-horizon analytics for environmental modeling, stewardship, and mission-related research, and could offer collaboration potential with universities and industry. These are presented as conceptual opportunities, consistent with the RFI's focus on collaboration and technology testbeds [DOE RFI, Mar 2025].

- **Category 7 – Economic Opportunities and Considerations**:
  It qualitatively notes that SRS is important to the regional economy and that AI infrastructure could, in concept, contribute to workforce development and local business ecosystems. Detailed economic projections, tax structures, and incentives are "Not specified in the RFI" and therefore not included [DOE RFI, Mar 2025].

- **Category 8 – Environmental Documentation**:
  The RFI states that environmental baseline data and land use constraints must inform site selection and that additional engineering and feasibility studies will be needed to support regulatory approvals [DOE RFI, Mar 2025]. This concept integrates those requirements by making environmental and Site Use Permit constraints primary design drivers.

- **Category 9 – Challenges and Additional Information**:
  The concept acknowledges SRS-specific challenges including mission coexistence, security, legacy contamination, complex land-use patterns, and potential supply chain limitations. It explicitly notes that future, site-specific environmental, geotechnical, and infrastructure information would be required for any detailed AI campus assessment [DOE RFI, Mar 2025].

- **Category 10 – Engagement Strategy with Communities and Tribes**:
  The proposal recognizes the RFI's emphasis on relationships with local authorities, surrounding communities, and Tribal governments and frames such engagement as a prerequisite for any move beyond planning [DOE RFI, Mar 2025]. No particular engagement actions are assumed to have occurred.

Site Context

According to the RFI:

- SRS is an approximately 310-square-mile reservation managed by DOE/NNSA, supporting missions that include tritium production, nuclear materials management, and environmental cleanup and stewardship [DOE RFI, Mar 2025].

- Any new land use at SRS must be approved through a Site Use Permit, required for all activities on any tract of land. This process evaluates mission conflicts, the presence of endangered or threatened species, wetlands and ecological values, and the need for access to environmental monitoring locations, among other factors [DOE RFI, Mar 2025].
- SRS is one of the candidate sites for AI infrastructure, and the RFI explicitly notes that any data center would occupy a relatively small footprint compared to the total site area [DOE RFI, Mar 2025].

The RFI does not specify:

- Exact parcels or zones that would be suitable for an AI enclave.
- Detailed power capacities, transmission line ratings, or specific interconnection points.
- Water resource volumes or cooling constraints specific to SRS AI infrastructure.
- Local tax structures, incentives, or workforce availability.

Where such details are not provided, they are treated as "Not specified in the RFI" [DOE RFI, Mar 2025].

Concept of Operations (CONOPS)

In planning constructs, the Savannah River Sovereign AI Campus is a small enclave that operates conceptually and analytically within SRS while remaining fully isolated from operational mission facilities.

Key Elements

- **Enclave Footprint**:
  The campus is modeled as one or more modest AI data center modules in areas that would, subject to the Site Use Permit process, be considered potentially compatible with long-term research and analytics activities. Specific locations are not defined in the RFI.
- **Operational Separation**:
  All AI enclave activities are conceptually separated from tritium, nuclear, and other mission operations. No operational signals, control paths, or direct data feeds are assumed.
- **Workload Focus**:
  Modeled AI workloads are long-horizon, unclassified analytics and simulations that support DOE priorities such as environmental modeling, stewardship planning, and generic systems analysis.

- **Power and Cooling**:
  Power to the enclave is represented as abstract grid-supplied and, optionally, generic on-site resources in models, without tying to specific plants or capacities.
  Cooling is represented by technology classes under qualitative environmental and water constraints; specific volumes and systems are "Not specified in the RFI."

- **Phased Operation**:
  Enclave growth is modeled in phases, with each phase subject to conceptual checks against environmental, Site Use Permit, and mission coexistence constraints.

At all times, this CONOPS remains a planning construct and does not imply integration with, or control over, any operational systems at SRS.

Architecture Templates (S1 / S2 / S3)

Three templates describe different planning-level configurations for the sovereign AI enclave.

S1 – Initial Sovereign AI Node

- **Purpose**: Represent a minimal, pilot-scale AI enclave that tests governance, environmental compatibility, and mission separation at SRS.

- **Planning Characteristics**:

  - A single small AI node located in a conceptually suitable area, with all siting and activities gated by a Site Use Permit and associated conditions [DOE RFI, Mar 2025].

  - Workloads focused on low-risk, unclassified analytics and modeling that align with DOE missions in a general way.

- **Constraints**:

  - Strict adherence to Site Use Permit outcomes, including avoidance of sensitive ecological areas and maintaining access to monitoring infrastructure.

  - High reversibility, allowing the enclave to be scaled back or removed in planning constructs if needed.

S2 – Distributed Sovereign AI Campus

- **Purpose**: Explore a configuration with multiple small AI nodes distributed across different conceptual locations to disperse environmental and infrastructure impacts.

- **Planning Characteristics**:
    - Several modest AI modules, each envisioned as being separately reviewed through the Site Use Permit process and operating under distinct environmental and mission constraints.
    - Workloads possibly differentiated by mission themes (e.g., environmental analytics, generic systems research) in planning space.
- **Constraints**:
    - Cumulative effects on environmental and mission constraints must be considered across nodes.
    - Coordination among conceptual nodes to avoid overlapping impacts or conflicts.

S3 – Long-Horizon Sovereign Campus

- **Purpose**: Provide a long-term planning construct that extends S1 or S2 into a multi-phase, still small-footprint AI campus over many years.
- **Planning Characteristics**:
    - Sequential addition of AI modules as mission-aligned analytics needs and technology evolve, always contingent on Site Use Permit approval and environmental review.
    - Diverse unclassified workloads, including advanced modeling for stewardship and long-term planning, represented only as proxy tasks.
- **Constraints**:
    - Each phase is individually evaluated for mission coexistence, environmental compatibility, and community and Tribal considerations.
    - Clear conceptual checkpoints where growth can be paused, modified, or reversed.

SRS Enclave Design Principles

The sovereign AI enclave at SRS follows a set of planning-level design principles:

- **Mission Isolation**: All AI infrastructure is conceived as physically and logically separated from tritium, nuclear, and other mission operations, with no operational integration.

- **Site Use Permit Gating**: Every enclave node or phase is conditioned on passing the SRS Site Use Permit process, including mission conflict screening and environmental review [DOE RFI, Mar 2025].
- **Environmental Hard Constraints**: Sensitive ecological areas, wetlands, and monitoring sites are treated as hard no-go zones in planning constructs, in line with Site Use Permit considerations.
- **Security Zoning**: The enclave is modeled as a distinct zone with appropriate security posture, ensuring that mission facilities remain shielded from AI campus activities.
- **Reversibility Checkpoints**: Each template incorporates conceptual checkpoints at which growth can be halted or scaled back based on new information or policy, without assuming any prior commitment.
- **Non-Operational Stance**: All AI use cases, energy representations, and interactions remain in proxy modeling space; no real-time control or interfacing with mission systems is contemplated.
- **Long-Horizon Stewardship**: Enclave design is guided by long-term stewardship, emphasizing small, adaptable footprints over large, fixed installations.

Unclassified Proxy Use-Case Menu

All use-cases are planning constructs using surrogate, public, or proxy data and have no connection to operational tritium, nuclear, or mission systems:

- **Environmental Trajectory Modeling**: Use proxy and publicly available environmental and climate data to simulate long-term ecosystem and watershed scenarios, without accessing SRS operational environmental monitoring systems.
- **Stewardship Analytics**: Apply surrogate datasets to test AI methods for generic, long-horizon stewardship planning problems that resemble but do not use operational SRS data.
- **Generic Infrastructure Stress Testing**: Use synthetic infrastructure and logistics datasets to explore how AI could help plan maintenance and inspection schedules, with no access to real SRS facility systems.
- **Policy and Scenario Analysis**: Employ public or synthetic policy and socioeconomic datasets to evaluate hypothetical policy pathways, without interfacing with any live SRS decision systems.

- **Method Development Testbeds**: Use publicly available benchmark datasets to develop and compare AI methods relevant to complex mission domains, without applying them to actual SRS operations.
- **Data Stewardship Prototypes**: Explore data governance and metadata handling practices using only surrogate or public datasets, strictly separated from SRS operational data.

Proxy Modeling Plan (Tool-Agnostic)

The proxy modeling plan is structured to remain conservative, unclassified, and consistent with the limited information in the RFI [DOE RFI, Mar 2025].

Core Components

- **Representations**:
  - AI nodes in S1–S3 are represented as time-varying load points with conceptual workload profiles appropriate to long-term analytics and modeling.
  - Power is represented as generic grid-supplied and, optionally, generic on-site resources; no specific energy sources, capacities, or technologies are assumed.
- **Scenario Families**:
  - **Baseline Scenarios**: Focus on S1 with stable, moderate AI workloads and nominal environmental constraints.
  - **Distributed Scenarios**: Examine S2 with multiple nodes to evaluate planning-level cumulative effects on environmental and infrastructure assumptions.
  - **Long-Horizon Scenarios**: Explore S3 with phased addition of nodes over extended planning horizons, testing when additional environmental or mission analyses would be indicated.
- **Metrics (Qualitative)**:
  - Qualitative load levels (e.g., low/moderate/high within assumed planning constraints).
  - Qualitative environmental stress bands (e.g., within assumed limits, approaching assumed limits).

    - Qualitative mission coexistence risk descriptors (e.g., very low risk in S1 configurations under baseline assumptions).

Stability Proxy Lens

- The modeling introduces a generic “stability proxy” objective, where different S1–S3 scenarios are compared based on their ability, in planning constructs, to smooth conceptual demand over time and reduce volatility in AI load patterns.
- This stability proxy is used only as a relative comparison metric between templates and does not rely on, or make claims about, actual SRS power system characteristics, which are “Not specified in the RFI.”

Validation / Sensitivity / Robustness / Reversibility

Validation

- **Internal Consistency**: Confirm that assumptions about workloads, land use, environmental constraints, and Site Use Permit gating match the qualitative SRS descriptions in the RFI [DOE RFI, Mar 2025].
- **Reasonableness Checks**: Compare modeled enclave behavior to generic small data center and research workload patterns, without inferring site-specific numbers.

Sensitivity

- **Vary Within Conservative Ranges**:
    - Growth rate and sequencing of S1–S3 phases.
    - Allocation of workloads across nodes.
    - Tightness of environmental and Site Use Permit constraints in planning.
- **Observe Impacts On**:
    - Environmental stress bands.
    - Mission coexistence risk descriptors.
    - Stability proxy performance (e.g., how evenly conceptual loads are distributed over time).

Robustness

- Assess how each template performs across scenario variations:
    - S1 is expected, in planning constructs, to be robust because of its minimal footprint and simplified governance requirements.
    - S2 may remain robust under moderate growth if distributed siting aligns with Site Use Permit outcomes; it is more sensitive to cumulative environmental and governance complexity.
    - S3's robustness is highly dependent on long-term environmental, mission, and policy trajectories, and it is evaluated as a long-horizon planning construct rather than a commitment.

Reversibility

- **S1**: Provides straightforward conceptual reversibility; the pilot node can be scaled back or not progressed beyond planning.
- **S2**: Allows pausing or removal of individual nodes in planning scenarios if environmental or mission constraints tighten.
- **S3**: Explicitly structured with phase checkpoints where additional nodes are added only if updated analyses indicate continued compatibility with constraints.

All reversibility is conceptual; actual changes would require separate, formal decision processes and analyses.

Governance, Security Zoning, and Data Handling

Governance

- DOE and NNSA retain full authority over land use, mission priorities, and risk tolerances at SRS.
- Any AI enclave concept must operate under existing governance structures and SRS procedures, including the Site Use Permit process [DOE RFI, Mar 2025].

Security Zoning

- The enclave is conceived as a separate zone from tritium, nuclear, and other mission facilities, with physical and organizational separation.
- Security zoning is treated as a planning constraint to prevent AI activities from creating new pathways into mission environments.

Data Handling

- All planning-level workloads and datasets are unclassified and use surrogate, public, or proxy data.
- If, in the future, any sensitive workloads were considered, detailed data governance and security frameworks would need to be developed separately; they are not defined here.

Collaboration Model

The collaboration model reflects the multi-stakeholder context described in the RFI [DOE RFI, Mar 2025].

- **DOE and NNSA**: Define mission boundaries, acceptable risk levels, and strategic value for considering an AI enclave at SRS.
- **SRS Site Management**: Operates the Site Use Permit process and coordinates environmental, mission, and safety reviews for any conceptual enclave footprint.
- **Research Organizations**: Could contribute expertise in environmental modeling, long-term stewardship analytics, and other unclassified AI research areas.
- **Utilities and Transmission Entities**: Would provide planning-grade, non-proprietary information about power and interconnection options as needed for further studies.
- **Communities and Tribal Governments**: Are recognized as critical stakeholders for any future change in land use, environmental footprint, or employment patterns.

No specific partner names or vendor relationships are assumed.

Deliverables Package

If DOE elects to advance this concept into a more detailed planning exercise, the following deliverables would be produced:

- **Architecture Templates Dossier**: Comprehensive planning-level descriptions of S1, S2, and S3, including assumptions, constraints, and conceptual use-cases.
- **Proxy Modeling and Scenarios Report**: Documentation of modeling constructs, scenario definitions, stability proxy comparisons, and qualitative findings across S1–S3.

- **Governance and Site Use Alignment Note**: Planning-level explanation of how the enclave concept interacts with SRS governance and the Site Use Permit framework [DOE RFI, Mar 2025].
- **Environmental and Mission Coexistence Brief**: Synthesis of environmental, mission, and security constraints that must be respected in any further analysis.
- **Readiness and Decision Framework**: Criteria and decision gates for determining whether SRS should proceed from conceptual planning to more detailed studies.

Timeline as Phases

The timeline is expressed purely as qualitative phases and does not introduce any dates beyond the general temporal framing of the RFI, which references potential construction and operation windows in broad terms [DOE RFI, Mar 2025].

- **Phase 0 – Concept and Modeling**: Finalize S1–S3 templates and complete initial proxy modeling, including the stability proxy lens and sensitivity assessments.
- **Phase 1 – Site and Governance Refinement**: Coordinate with SRS site management to align conceptual enclave locations with potential land-use areas and Site Use Permit considerations; identify key data gaps in environmental, mission, and infrastructure information.
- **Phase 2 – DOE/NNSA Decision**: Use the planning outputs and readiness framework to decide whether SRS should move to detailed technical, environmental, and governance studies for an AI enclave.
- **Phase 3 – Pre-Solicitation Studies**: If warranted, undertake detailed studies under existing DOE/NNSA procedures; this phase is outside the scope of the current planning document and includes no presumption of solicitation or deployment.

Risks, Assumptions, and Mitigations

Representative Assumptions

- Any AI footprint at SRS will remain small relative to the approximately 310-square-mile site, as noted in the RFI [DOE RFI, Mar 2025].
- The Site Use Permit process will remain the primary mechanism for screening and approving activities on any SRS land [DOE RFI, Mar 2025].

- AI enclave operations will remain conceptually isolated from tritium, nuclear, and other mission facilities, with no operational integration.

Key Risks

- **Mission Coexistence**: Even conceptually, an AI enclave could be perceived as interfering with or complicating mission operations if not carefully defined and governed.
- **Environmental Constraints**: More detailed environmental data could reveal that some conceptual footprints are not viable or would require substantial mitigation.
- **Long-Horizon Uncertainty**: Changes in mission priorities, regulatory requirements, or technology could alter the desirability or feasibility of an AI enclave over time.

Mitigation Approaches

- Keep the AI enclave modest in scale and phased, allowing reevaluation at each step.
- Treat Site Use Permit outcomes and environmental findings as hard constraints.
- Embed reversibility into S1–S3 templates so DOE can pause or adjust planning paths based on new information.

No-Fabrication Assurance

This revised Savannah River Sovereign AI Campus proposal is derived solely from: (1) the provided draft planning-only document; and (2) public information explicitly attributable to DOE's March 2025 "AI Infrastructure on DOE Lands" RFI and its Savannah River Site appendix [DOE RFI, Mar 2025]. No new site-specific facts have been introduced beyond what is stated in the RFI, except for rewriting and structural refinements. No additional numbers for power, water, line ratings, acreage (beyond the approximately 310-square-mile description), capacities, budgets, or timelines have been added. When information is not specified in the RFI or clearly public DOE materials, it is explicitly treated as "Not specified in the RFI" and handled qualitatively. The entire document remains within a planning-only, unclassified, proxy-modeling frame; it does not propose or imply any operational control, facility interfacing, deployment commitment, procurement action, or vendor selection.

View Implementation Guide (Planning) (Manual link: https://ucdpforge.com/pdfs/NLIG/SRS_AI_Campus_Impl_Guide.pdf)