



Sanford

Underground Research Facility

South Dakota Science and Technology Authority

Experiment Implementation Program

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Revision History

Rev	Date	Section	Paragraph	Summary of Change	Authorized by
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1.0 Purpose

Integral to the South Dakota Science and Technology Authority (SDSTA) institutional mission is the advancement of compelling underground, multidisciplinary research. This document describes the framework for implementing an experiment in an effective and efficient manner at the Sanford Underground Research Facility (SURF).

2.0 Scope

The Experiment Implementation Program applies to all groups or individuals seeking to perform activities at SURF in the areas of science, technology, engineering and mathematics (STEM), encompassing elements concerning compliance, safety and quality. While the level of review and extent of documentation is intended to be commensurate with the scope, complexity and risks associated with a given Experiment, the same general process applies regardless of discipline or location. Experiment activities are conducted with authorization from SDSTA as outlined below.

3.0 Definitions

Collaboration – A group of partners pursuing common goals associated with a specific Experiment at SURF. Members of a Collaboration can include (but are not limited to):

- Researchers (including faculty, staff and students from institutions of higher education or National Laboratories).
- Engineers, technicians and skilled workers.
- Educators.
- Members of nonprofit or for-profit private entities.

Individuals can be a member of more than one Collaboration, but separate documentation requirements may apply.

Experiment – A defined set of activities described by one or more of the following broad categories:

- Research, development and demonstration programs or activities in STEM.
- Commercial application programs or activities in STEM fields (including partnerships with nonprofit or for-profit private entities).
- Other technical activities (including some types of training or professional development).

Experiments can include activities underground and/or on the surface.

User – An individual requiring SURF access and/or resources who is connected with one or more Experiments at SURF. Users can include:

- A formal member of a Collaboration (note that not all members of a Collaboration are necessarily Users).
- A researcher (including faculty, staff or student), engineer, technician or educator affiliated with an Experiment as sponsored by the Collaboration.
- An individual otherwise associated with an Experiment such as a temporary worker (e.g., intern), vendor or contractor as sponsored by the Collaboration.

4.0 Responsibilities

- 4.1. SDSTA Executive Director
 - 4.1.1. Establishes the formal relationship with an Experiment; also serves as the SDSTA Risk Manager for the evaluation of insurance requirements.
- 4.2. SURF Laboratory Director
 - 4.2.1. Manages the overall operation of the laboratory, including allocation of facility resources.
- 4.3. Director of Science
 - 4.3.1. Manages the Experiment Implementation Program, including overall responsibility for integration and support of experiments (see 6.1).
 - 4.3.2. Ensures Users are informed of and comply with SDSTA policies and procedures and are aware of hazards and protocols in their workspaces.
 - 4.3.3. Convenes review committees (including both internal and external personnel) to review experiments as warranted.
 - 4.3.4. Assigns an individual to act as the Experiment Point of Contact (EPOC) for each experiment.
 - 4.3.5. Authorizes various stages of experiment implementation (can be delegated).
- 4.4. Experiment Point of Contact (EPOC)
 - 4.4.1. Member of the Science Department who assists with navigation of the Experiment Implementation Program, reviews project implementation documentation (Experiment Planning Statement, Hazard Assessments, inventories, etc.), reviews and approves procedures, and reviews documentation supporting authorization requests.
 - 4.4.2. Acts in a coordination role for other SDSTA resources (e.g., marshalling necessary support from other departments as needed).
- 4.5. Department Directors
 - 4.5.1. Review and provide feedback on Experiment proposals and other documentation.
- 4.6. Environment, Safety & Health (ESH) Department
 - 4.6.1. Reviews hazard and quantitative analyses.
 - 4.6.2. Provides User training and evaluates external training.
 - 4.6.3. Reviews and approves inventory items as appropriate.
 - 4.6.4. Participates in reviews and in some cases conducts reviews.
 - 4.6.5. Appoints the Experiment Health & Safety Manager.
 - 4.6.6. Appoints the SDSTA Radiation Safety Officer.
- 4.7. Engineering Department
 - 4.7.1. Provides cost estimates.
 - 4.7.2. Reviews hazard and quantitative analyses as appropriate.
 - 4.7.3. Reviews and approve inventory items as appropriate.
 - 4.7.4. Participates in reviews as appropriate.
- 4.8. Surface Operations & Utilities Department
 - 4.8.1. Provides cost estimates.
 - 4.8.2. Reviews hazard and quantitative analyses as appropriate.
 - 4.8.3. Reviews, approves, and coordinates inspections for inventory items as appropriate.
 - 4.8.4. Manages Facility Transition Management Plan (see 6.2), and participates in other reviews as appropriate.
- 4.9. Underground Operations Department

- 4.9.1.** Provides cost estimates.
- 4.9.2.** Reviews hazard and quantitative analyses as appropriate.
- 4.9.3.** Participates in reviews as appropriate, including access requirements to underground areas for personnel and equipment.

4.10. Hoists & Shafts Department

- 4.10.1.** Reviews access schedules and transport of equipment to the underground.
- 4.10.2.** Participates in reviews as appropriate.

4.11. Business Services Department

- 4.11.1.** Reviews Experiment relationship documents.

4.12. Collaboration

- 4.12.1.** Ensures Experiment is conducted in accordance with provisions of the Experiment Implementation Program.
- 4.12.2.** Disseminates relevant information and expectations related to the Experiment Implementation Program to Users.
- 4.12.3.** Ensures Users' compliance with the SURF Community Agreement (see 6.3).

5.0 Instructions

5.1. Experiment Phases

In general terms, an Experiment has the following phases: proposal, active, pre-installation, installation, commissioning, operation, and decommissioning. Depending on the scope of the Experiment, only a subset of phases as detailed below, may be appropriate.

5.1.1. Proposal

- All Collaborations must provide documentation describing the proposed Experiment and required interfaces with the facility. Experiment representatives are encouraged to contact the SDSTA as early as possible as conceptual plans are developing for projects envisioned for the facility. Ideally, communication would begin when projects are seeking funding to ensure that SDSTA can meet expectations, including access to specific facilities or locations. In addition to understanding an Experiment's facility requirements, documentation reviewed during the Proposal phase is used to determine the feasibility of an Experiment for implementation at SURF. Site-selection trips to facilities or locations are possible (with appropriate training and acknowledgement/waivers), but no work may be performed during this phase (i.e., no activities that require a written hazard analysis per SDSTA's Work Planning and Control Standard, see 6.4).

5.1.2. Active

- In this phase, formal agreements are in place, and space is formally allocated for a fixed period, subject to the availability of funding for both the facility and the Experiment. All Experiments must meet the requirements in this phase; however, some Experiments not installing significant equipment or equipment for long periods of time and/or with only low-hazard activities (e.g., basic biological sampling) may not need to advance beyond this phase. Site-selection trips to facilities or locations are possible during this phase (with appropriate training and acknowledgement/waivers). For Experiments that will move on to subsequent phases (e.g., installing significant equipment, etc.), limited, relatively low-hazard work (possibly still requiring a hazard analysis) may be performed at this stage at the discretion of the Director of Science (or designee).

5.1.3. Pre-Installation

- Prior to the installation of significant equipment or equipment for long periods of time and/or work activities requiring multiple ESH documents (hazard analysis/work planning and controls, inventories, quantitative analyses, etc.) that constitute the Installation phase of the Experiment, SDSTA shall formally authorize the proposed activities.

5.1.4. Installation

- Significant Experiment activities onsite at SURF begin following authorization at the end of the Pre-Installation phase. Hazard analysis/work planning and controls apply per SDSTA policy; some low-hazard activities may be authorized in previous stages as described above.

5.1.5. Commissioning

- After the Installation phase, some activities may be performed, and some equipment may be operated to test and otherwise commission aspects of an Experiment. Hazard analysis/work planning and controls apply per SDSTA policy. While Commissioning may be viewed as an intermediary phase, it is possible that many or all the project hazards will be encountered during this phase, with the corresponding documentation requirements.

5.1.6. Operation

- In this phase, the Experiment is aiming to meet its primary goals. Hazard analysis/work planning and controls apply per SDSTA policy; all project hazards will have been encountered in the activities leading up to and including this stage. If applicable, a facility Certificate of Occupancy is necessary by this stage of the Experiment (note that it may be required for prior phases based on hazard assessment, the Facility Transition Management Plan (see 6.2), and/or the Authority Having Jurisdiction).

5.1.7. Decommissioning

- During this phase, the Experiment completes the removal of all Experiment equipment and restores the site to its initial condition unless formal agreement is reached on certain specific exceptions. Hazard analysis/work planning and controls apply per SDSTA policy.

5.2. Project Documentation

Specific documentation is required to identify interfaces with the facility and address any hazards within the SDSTA approval framework. The documents that establish and define a relationship between an Experiment and SDSTA are outlined below.

5.2.1. Expression of Interest

- An Expression of Interest (EOI) reflects that a Collaboration has contacted SDSTA expressing interest in conducting an Experiment at SURF but does not establish a formal relationship. EOIs can come in various forms but must be written (as opposed to verbal). While there is no formal template for the EOI, the Experiment Planning Statement (see Section 5.2.2) serves as a useful guideline for the EOI even though many details may not be available.
 - o Support Letter
 - ◆ Requests for support letters require that at least an initial draft Experiment Planning Statement (see Section 5.2.2) be completed. If SDSTA determines that an Experiment can be performed both technically and safely at the facility, the SURF Laboratory Director will issue a formal letter to support a funding request. In return SDSTA requests a copy of the final proposal narrative for our records. Experiments are welcome at SURF even without prior interactions or a prior support letter.
 - o Cost Estimate (Initial)
 - ◆ Requests for cost estimates require that at least an initial draft Experiment Planning Statement (see Section 5.2.2) be completed. To meet project goals, initial site-preparation details should be discussed, and there may be associated costs that

need to be reflected in any funding proposal. As resources are available, SDSTA personnel may be able to assist with the development of cost estimates for performing work at the facility (including nominal estimates for contracted services).

5.2.2. Experiment Planning Statement

- The Experiment Planning Statement (EPS) is used by SDSTA to understand whether an Experiment is feasible based on Experiment requirements as well as critical interfaces between the Experiment and SURF. EPS elements include the following: project description (including purpose, scientific merit and scope), efforts and considerations on inclusion, diversity, equity and access (IDEA), funding status (including duration of award(s)), personnel (including which institutions intend to have personnel onsite), lists of equipment and various inventory items (ultimately incorporated into dynamic inventories as outlined in Section 5.3.2), space and infrastructure needs (including location/depth, site preparations and environment, required services and logistics), description of hazards and integrated safety management, personnel access requirements, project schedule, operational considerations and an initial decommissioning plan. SDSTA maintains a form for the EPS (see 6.5).
- Additional EPS documents or other technical documents may be subsequently required to describe significant activities beyond the baseline scope outlined in an initial EPS (especially if the new activities present new types of hazards).
- SDSTA will use the EPS to indicate any additional requirements, such as an Experiment Hazard Assessment Summary document, quantitative analyses and review(s) (see Section 5.3.1). Groups requesting significant SDSTA resources or significant changes to the capacities and/or capabilities of the facility may be subject to external review and evaluation, which will be indicated as well (see 5.4).
- SDSTA will use the EPS to classify proprietary Experiments (e.g. those that do not publish results in open scientific journals). Full cost recovery is required for proprietary experiments as outlined in the Experiment Integration and Support Standard (see 6.1).
- The completed EPS will indicate reviews by the Directors (or designees) of Science, Operations Division (Surface Operations & Utilities, Underground Operations, Information Technology, Hoists & Shafts and Engineering), Environment, Safety and Health (ESH). Reviews by other SDSTA departments may be requested based on specific interfaces and it may be appropriate for external groups to review EPS documentation. The SURF Laboratory Director will sign for final acceptance of the EPS.

5.2.3. User Agreement

- The User Agreement (UA) establishes a baseline relationship between the Experiment and the SDSTA, operator of SURF. The UA outlines general expectations of both the SDSTA and the Experiment, including insurance requirements, adherence to the applicable requirements defined in the SDSTA ESH Manual (see 6.6), and a nominal decommissioning plan. Expectations relating to environment, safety and health, site access, material handling and operations, and physical infrastructure are also addressed. Details regarding reporting requirements and publications are also included in the UA; a separate document is required for specific intellectual property agreements. The UA may be signed by Experiment representatives (PI or supervisor) or institutional administrators. SDSTA maintains a template for the UA (see 6.7).
- The UA document will be updated as necessary if significant changes are proposed to the baseline or to capture significant expectations. The UA specifies particular sites (facilities and location(s), both on the surface and underground) for Experiment activities, and any significant change in that scope requires an update to the UA. UAs will be reviewed at least every five years.

- The UA is reviewed by the Director of Science (or designee) and is signed by the SDSTA Executive Director. The fully executed UA document is the formal allocation of space at SURF for the duration specified in the UA. Occupancy of shared laboratory space(s) is coordinated by, and any conflicts will be managed and resolved by the SDSTA (see also 5.9).
- 5.2.4. User access**
- User access request
 - User information will be collected by Science department personnel or Experiment representatives to support various elements such as ID access badging, IT accounts and training. Onsite Experiment personnel are also asked to provide personal and institutional contacts to expedite any emergency communication. Individuals not affiliated with a recognized institution may be required to provide additional documentation.
 - Acknowledgement of Risk and Waiver
 - Prior to undertaking any Experiment activities at SURF, Users are required to sign the “Acknowledgement of Risk” and “Release, Agreement Not to Sue and Waiver” documents (see 6.8).
 - Insurance
 - Evidence of both General Liability and Workers’ Compensation coverage is required from each institution with Users at SURF. SDSTA insurance requirements are specified in the UA. SDSTA will deny site access to individuals who do not have current and acceptable insurance coverage. Insurance coverage is reviewed by Business Services Department. The SDSTA Risk Manager will assess liability requirements and provide any waivers as appropriate.
- 5.2.5. Decommissioning Plan**
- A plan for how the Experiment will be decommissioned is required prior to commencement of activities at SURF. General decommissioning requirements are outlined in the UA and an initial decommissioning plan is required in the EPS document (initial decommissioning details can also be added to the UA as a separate attachment). Prior to the end of an Experiment, a more detailed description of decommissioning is required according to the Experiment Decommissioning Plan form (see 6.10). The final Experiment Decommissioning Plan is reviewed and accepted by the Directors (or designees) of the Operations Division (Surface Operations & Utilities, Underground Operations, Information Technology, Hoists & Shafts and Engineering), ESH and Science.
- 5.2.6. Service Agreement(s) [if applicable]**
- The SDSTA offers a basic level of support to all Experiments, which is often sufficient for smaller Experiment groups with modest requirements (see Experiment Integration & Support in 6.1). Requirements beyond the general level of support are specified in separate services agreements. A General Services Agreement (GSA) outlines respective responsibilities (especially those with financial implications) for SURF and the Experiment for each facility or location with significant Experiment occupancy. GSA documentation is updated annually, typically in alignment with the SDSTA DOE operations funding fiscal year (Oct 01 – Sep 30). The GSA lists the SURF indirect rate as well as other applicable formal charges or fees. Contracts may be needed for specific labor or non-labor arrangements (e.g., labor requiring SDSTA to backfill capacity, site-preparation activities, and materials, etc.) based on cost estimates provided by the Operations Division. Projects or specific institutions with fiduciary responsibilities within a project may wish to supplement GSAs with contracts that specify particular funding amounts. Services agreements (GSA and/or contracts) are reviewed by the Director of Science (or designee)

and the Business Services Department; the agreements are signed by the SURF Executive Director.

5.2.7. National Environmental Policy Act [if applicable]

- Before federal funds awarded to an Experiment can be expended to affect the environment at SURF, there may need to be formal consideration of the National Environmental Policy Act (NEPA). This may include an environmental assessment (EA), environmental impact statement (EIS). Alternatively, the scope of Experiment actions may qualify for a categorical exclusion, for which neither an EA nor an EIS is normally required. Experiment representatives should check with their federal agency program manager.

5.3. Environment, Safety and Health (ESH)

All activities performed at SURF must be conducted in a manner that ensures protection of personnel (workers and the public), equipment and the environment. Project goals must be accomplished safely by following a process of integrated safety management.

5.3.1. Hazard Analysis

Per the SDSTA Work Planning & Control standard, work planning and hazard analysis are required for all work at the facility, including Experiment activities.

- Experiment Hazards Assessment Summary [if applicable]
 - For projects with significant hazards, the completed EPS document will indicate that an Experiment Hazard Assessment Summary (EHAS) is required. The EHAS lists Experiment hazards for all relevant sites and for all phases of the project with associated control measures and mitigation strategies identified for each hazard. The mitigation measures are not expected to be in place when the EHAS is developed, rather the EHAS communicates the Experiment's plan. SDSTA maintains a template for the EHAS (see 6.11); similar reports required by other external agencies may be acceptable such as the DOE Hazards Analysis Report (HAR).
 - The EHAS document is reviewed by Science and ESH personnel (nominally the Experiment Health & Safety Manager); review by subject matter experts (such as Operations, Engineering and other ESH personnel) may also be warranted and will be coordinated by the EPOC (or alternate Science representative). The final reviewed version of the EHAS is formally received by the Director of Science (or designee).
- Quantitative Analysis [if applicable]
 - Some SDSTA policies and procedures relevant to Experiment activities require quantitative analysis for hazards such as oxygen deficiency hazards (ODH) and pressurized or mechanical systems.
 - Quantitative analyses are reviewed by ESH (nominally the Experiment Health & Safety Manager) and Engineering representatives; review by subject matter experts (such as Operations and other Engineering and ESH personnel) may also be warranted and will be coordinated by the EPOC (or alternate Science representative). The final reviewed version of an Experiment's quantitative analysis report is formally received by the corresponding EPOC (or alternate Science representative).
- Certifications [if applicable]
 - Engineering documentation is required for some equipment such as pressure and mechanical systems and hoisting & rigging equipment.
- Procedures
 - Experiments are required to document work steps and associated hazards and mitigations (precautions, procedures, controls, and safe work practices) in a procedure per the SDSTA Work Planning and Controls Standard of the ESH Manual (see 6.6). Forms are available for a job hazard analysis (JHA, see 6.12); other formats are acceptable provided the above elements are sufficiently addressed and acceptable to SDSTA (see 6.13).

- o Experiments are responsible for developing and performing an internal review and approval of their procedures. Experiment approval authorizes members of the Collaboration to conduct tasks outlined in the procedure pending SDSTA oversight approval, which mainly ensures compliance with the SDSTA ESH Manual, including work planning and controls.
- o All Experiment procedures are reviewed by SURF ESH and Science representatives; review by subject matter experts (such as Operations, Engineering and other ESH personnel) may also be warranted and will be coordinated by the EPOC. The EPOC approves corresponding Experiment procedures. At least one Experiment representative also signs procedures as an approver.

5.3.2. Inventories

- Experiments are required to maintain inventories of items with safety implications (some of which require inspections), including chemicals, electrical equipment, hoisting & rigging equipment, pressure vessels and radioactive materials. The EPOC ensures relevant details are communicated for approvals or inspections as necessary and provides oversight to ensure the inventories are maintained by Experiment representatives. Specific additional considerations are addressed below (also note that associated training may be required; see Section 5.3.3).
 - o Chemicals
 - ◆ All chemicals (including compressed gases and cryogenic materials) must be approved by ESH (Environmental Manager and Industrial Hygienist) and added to a chemical inventory before they can be brought onto SURF property. The inventory shall include the name of the responsible person, arrival date at SURF, storage information (quantities, locations, and containment descriptions) and an indication of whether the chemical is considered hazardous waste. Approved chemicals must have a recent Safety Data Sheet (SDS) on file. SDSTA maintains an inventory template for chemicals (see 6.13). Personnel with Experiments using chemicals should be familiar with the Hazard Communication Standard in the SDSTA ESH Manual. Other relevant SDSTA ESH Manual policies may include Waste Management, Lead (Pb) Program, Compressed Gases, Cryogenic System and Oxygen Deficiency Hazards.
 - o Electrical Equipment
 - ◆ All electrical equipment requires an inspection (nominally performed by SDSTA Operations or Engineering representatives) prior to use on SURF property. The inventory shall include information such as the model and serial number of equipment as well as voltage, current, power consumption, the location of use and the equipment owner. The inventory will also reflect the date of SDSTA inspections (if available, documentation of inspection/testing by other organizations should be provided). SDSTA maintains an inventory template for electrical equipment (see 6.13). Personnel with Experiments using electrical equipment should be familiar with the Electrical Safety and the Lockout/Tagout policies in the SDSTA ESH Manual.
 - o Hoisting & Rigging Equipment
 - ◆ Experiment-owned hoisting and rigging equipment may need to be inspected on a regular basis. The SDSTA Surface Operations & Utilities department coordinates inspections and requires that an inventory of equipment be maintained for each Experiment. The inventory shall include a description of the items (manufacturer, model, and serial number, if applicable) as well as location. SDSTA maintains an inventory template for hoisting and rigging equipment (see 6.13). Personnel with Experiments using hoisting and rigging equipment may need to be familiar with the SDSTA Cranes and Hoists Standard and Below-The-Hook Devices and Slings/Rigging Hardware Standard in the ESH Manual.

- o Pressure Vessels
 - ◆ Pressure vessels (including owned, leased and/or rented units) need to be inspected regularly. The SDSTA Surface Operations & Utilities department coordinates inspections and requires that an inventory of equipment be maintained for each Experiment. The inventory shall include information such as a description of the equipment, including manufacturer, model, serial number, manufacture/purchase date, institution owner, certificate of authorization number, national board number and any supporting documentation, including a copy of the ASME certificate. Items entered in the SDSTA database will be assigned an asset ID. SDSTA maintains an inventory template for pressure vessels (see 6.13). Personnel with Experiments using pressure vessels may need to be familiar with the Compressed Gases Standard and the Cryogenic System Standard in the SDSTA ESH Manual.
- o Radioactive Materials
 - ◆ All radioactive materials (including NRC-exempt sources) must be approved by the SDSTA Radiation Safety Officer (RSO) and included on an inventory. The inventory shall include the isotope, manufacturer, physical description, activity, owner, primary emission, arrival date and storage location. SDSTA maintains an inventory template for radioactive materials (see 6.13). Personnel with Experiments using radioactive materials should be familiar with the SDSTA Radiation Safety Standard in the ESH Manual. Transportation of radioactive sources to or from SURF property must be coordinated with the SDSTA RSO, and only individuals approved by the SDSTA RSO are authorized to handle radioactive sources on SURF property. Note that new radioactive sources may need to be added to the SDSTA NRC license, and license amendments can take up to 90 days.

5.3.3. Training

- Some ESH hazards associated with the Experiment may be mitigated through training. The Experiment is required to identify, manage and track training for all Collaboration personnel, including task-specific training (see also the ESH Training Standard of the ESH Manual).
- SURF Training
 - o SDSTA provides some general safety and awareness training (“General Safety – Basic” and associated Annual Refresher Training for those individuals performing work onsite for 40 hours or more per year) as well as site-specific training for facilities or locations accessed by Experiment personnel. If appropriate, SDSTA provides additional Facility Guide training. SDSTA also provides some oxygen deficiency hazard and chemical awareness training (including lead) as well as some on-the-job training related to topics such as fall protection and hoist operation.
- Experiment Training Plan [if applicable]
 - o For some topics (e.g., pressure safety), the Experiment must arrange to provide training for its personnel and manage equivalences if there are various options to receive the training; such training must be acceptable to SDSTA (reviewed by ESH department, with formal receipt by the Science department).
- Recordkeeping
 - o SDSTA tracks training that it provides, e.g. via an online learning management system. However, since additional Experiment resources may be needed in order to provide some required training, and this training may not be integrated into the learning management system, SDSTA training records may not be complete. Experiment representatives must be able to provide proof of training if requested by SDSTA and ensure that onsite Experiment personnel are current on all required training. An example of a matrix used for tracking personnel training is maintained by SDSTA (see 6.13).

5.4. Reviews

Various types of reviews support Experiment activities, including reviews of facilities as well as Experiment equipment and processes, and they are intended to be commensurate with the associated hazards. Considerations for safety reviews are outlined in the SDSTA ESH Manual and include the following: computer or PLC control systems that have safety implications for personnel, property or the environment, cryogen systems, electrical systems (equipment that is non-commercial, modified or operated at greater than 600 V), significant quantities of combustibles and smoke-generating materials (including cable insulation, liquid scintillator, etc.), flammable gases or gas mixtures, custom/modified tools or equipment, lasers (> Class 3b), mechanical hazards, pressure/vacuum systems, radiation hazards, significant chemicals including lead (Pb) and other toxic materials. Additional classification of hazards can also be found in the SDSTA Work Planning and Controls Standard of the ESH Manual; multiple high-risk hazards may warrant additional reviews. All hazards are reviewed by appropriate ESH and Science personnel, with other SDSTA resources identified as appropriate (e.g., Engineering, Operations, etc.).

5.4.1. Facility Reviews

- Facility Transition Management
 - Following changes to SURF facilities a facility transition management plan is developed (see 6.2), in which the facility status is reviewed to ensure that the facility will support Experiment equipment and activities. This review may take place in a staged manner, aligned with different phases. Experiments may propose activities prior to the formal Certificate of Occupancy being issued by the Authority Having Jurisdiction (AHJ), which for SURF is the City of Lead. The Facility Transition Manager coordinates with the AHJ to determine requirements for phased occupancy; the formal Certificate of Occupancy is required by the Operation phase (and possibly sooner based on assessment).
- ESH Facility Review
 - SDSTA ESH personnel may conduct a facility review such as a “Pre-Startup Safety Review” (see 6.14).
- Site-Specific Materials
 - Science personnel are responsible for coordinating with SDSTA representatives (ESH, Engineering, Operations, etc.) to review and compile site-specific materials prior to significant Experiment activities in each location or facility. In some cases, interpretations of SDSTA policy may be necessary, and Science representatives will also review and facilitate SDSTA consideration of requested policy waivers (e.g., PPE waivers for certain activities/areas based on risks and hazards) or specific policy interpretations.

5.4.2. Walk-Through Inspection

- The Director of Science (or designee) may coordinate a walk-through inspection prior to one or more phases of an Experiment’s implementation, typically to review hardware installations and ensure hazards are appropriately described and accounted for in documentation. Collaborations are also encouraged to conduct their own walk-through inspections, leveraging institutional expertise in relevant areas.

5.4.3. Monitoring

- The SDSTA Work Planning and Control Standard may specify that SDSTA experts be present to monitor activities during particular steps or processes. In addition, the Director of Science (or designee) may coordinate a similar level of oversight during certain activities.

5.4.4. Readiness Reviews

- Reviews to assess various categories of readiness may be useful throughout the course of an Experiment, including (but not limited to) the specific reviews listed below.
 - Safety Readiness Review
 - ◆ The Director of Science will convene a Safety Readiness Review Committee for complex projects or those with significant hazards. One or more reviews may be held for a given Experiment and may align with specific stages or locations. A charge to the review committee will be developed by the Director of Science and recommendations or action items resulting from reviews are tracked using SDSTA database tools. As necessary, the Directors of Science and ESH determine which recommendations need to be closed to support authorization for a specific phase of Experiment implementation; review recommendations are closed with concurrence by both the Directors of Science and ESH.
 - Operation Readiness Review
 - ◆ Prior to entering the Operation phase of an Experiment, a review of activities from previous phases will be conducted by the Experiment to assess topics such as lessons learned, incidents and associated corrective actions, procedures, training, configuration control, ergonomics, housekeeping, critical spares and maintenance planning, and ongoing staffing and Collaboration support. Typically, the Operation Readiness Review is conducted by the Experiment with SDSTA personnel as observers. Recommendations are tracked and closed by the Experiment with input from SDSTA as appropriate.

5.4.5. External Evaluation Review(s)

- SDSTA may convene an external advisory committee to review and evaluate Experiments when appropriate. SDSTA resources are limited, and, as needed, allocation of space and resources will be prioritized using SDSTA-developed criteria such as technical readiness, scientific impact, exploitation of SURF's unique characteristics, etc. See 6.15.

5.5. Authorization

At a basic level, all work at SURF is performed according to the SDSTA Work Planning and Controls Standard described in the ESH Manual, in which hazard analyses for tasks are reviewed, authorized and released to be performed (also see 5.3).

5.5.1. Authorization To Proceed

- To manage and provide appropriate oversight for the installation of significant equipment and any associated significant hazards, a formal Authorization-To-Proceed (ATP) is issued by the Director of Science (or designee).
 - Initial Installation of Significant Equipment at Location or Facility
 - ◆ A formal ATP will be issued for the installation of significant equipment at a location or facility in conjunction with various implementation elements prepared in the Pre-Installation phase such as project documentation (i.e., maintaining Active status), the Experiment Hazard Assessment Summary document, quantitative analyses, safety readiness review recommendations, procedures with significant hazards and/or special mitigations, special training, etc. An ATP will be issued for the installation of significant equipment at each separate location or facility, and as appropriate the ATP will reflect the status of the facility transition plan for new or renovated facilities.
 - Activities Requiring Multiple Implementation Elements
 - ◆ A formal ATP will be issued for subsequent activities or phases that involve a combination of implementation elements, such as a new or significantly updated EPS and/or Experiment Hazard Assessment Summary document(s), quantitative analyses, safety readiness review recommendations, procedures with significant hazards and/or special mitigations, special training, new facility systems or

infrastructure. An example of an activity requiring an ATP is cryogen use since it requires an ODH analysis, procedures (both facility and Experiment), special training, various inventories, facility sensors/calibrations, and possibly review recommendations. Other examples could include operation of equipment with significant hazards such as mechanical, pressure, radiation, etc.

- SDSTA maintains a template of the generic authorization request memo (see 6.13). The Experiment request is evaluated by the Science EPOC. It is not necessary that all work planning elements be complete to receive over-arching authorization. For instance, some procedures may still be under review at the time of the authorization request, with the expectation that work steps for those procedures are not authorized until the procedures are approved using the standard work planning and control approval process that includes Science and ESH representatives as well as subject matter experts as appropriate.
- Following identification of the hazards for an Experiment (nominally once the Experiment Hazard Assessment Summary document has been finalized) and in conjunction with the review process as appropriate, a list of authorization steps for subsequent activities or phases will be formally developed by the Director of Science (or designee) with input from Experiment representatives.

5.6. Experiment Phases and Implementation Requirements

Different elements of the implementation documentation described above serve as the basis for authorization at different phases of an Experiment. Documentation related to activities and hazards associated with a given Experiment phase is reviewed by various SDSTA resources as described throughout this document (also see 5.8 for a summary). In addition, for each phase and for authorization step(s) associated with significant hazard(s) within phases, the main project documentation as well as ongoing operational documentation (such as training documents and various inventories) is reviewed to verify that information is complete and up to date. A summary of implementation requirements for each Experiment phase is presented in Table 1.

Experiment Phase	Implementation Elements	
	Deliverable to SDSTA	Deliverable to Experiment
1. Proposal	Experiment Planning Statement (EPS)	EPS receipt, incl training, additional documentation and/or review requirements <i>Optional:</i> Support Letter, Cost Estimate (Initial) for funding proposal
	Review: external evaluation (if applicable)	Yes/no
2. Active	User Agreement (UA)	Space allocation per agreement
	Services Agreement(s), NEPA (if applicable)	Services per agreement/contract
	Access: access request, acknowledgement/waiver, insurance	Training (per EPS and access request) Approval to perform low-hazard work per work planning & controls
	Hazard analysis: procedure(s)	
3. Pre-Installation	Project documentation renewals: UA, services agreements(s),	Maintain “Active” status

	insurance; update EPS as necessary	
	Hazard analysis (as applicable per EPS): EHAS, quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Initial Activities for Specific Facility	Authorization To Proceed: Initial Activities for Specific Facility; occupancy (possibly limited)
4. Installation	Project documentation renewals: UA, services agreements(s), insurance; update EPS as necessary	Maintain "Active" status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Various (activities requiring multiple implementation elements)	Authorization To Proceed: Various (activities requiring multiple implementation elements); occupancy (possibly limited)
5. Commissioning	Project documentation renewals: UA, services agreements(s), insurance; update EPS as necessary	Maintain "Active" status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance

	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring, Operation Readiness; associated recommendations	Recommendations and associated tracking
	Request for Authorization: Various, including Operations	Authorization To Proceed: Various, including Operations
6. Operation	Project documentation renewals: UA, services agreements(s), insurance; update EPS as necessary	Maintain “Active” status
	Hazard analysis (as applicable per EPS): Quantitative analyses, certificates, procedures(s)	Acceptance
	Training plan (if applicable per EPS)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials), prior to use (electrical, hoisting & rigging, pressure vessels)
	Reviews (if applicable): Facility (Transition, ESH), Safety Readiness, Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Request for Authorization: As needed based	Authorization To Proceed: As needed
7. Decommissioning	Project documentation renewals: UA, services agreements(s), insurance	Maintain “Active” status
	Hazard analysis (as applicable): Procedures(s)	Acceptance
	Inventories (as applicable): chemical, electrical, hoisting & rigging, pressure vessel, radiation	Approvals prior to shipping (chemicals, radioactive materials)
	Reviews: Walk-through, Monitoring; associated recommendations	Recommendations and associated tracking
	Experiment Decommissioning Plan	Acceptance

Table 1: Details of SDSTA implementation deliverables for each Experiment phase.

5.7. Experiment Implementation Program Flowchart

A flowchart highlighting key implementation elements required in various Experiment phases is shown in Figure 1. Experiments that plan to install significant equipment are managed through additional phases that include associated Authorizations To Proceed (ATPs), culminating in acceptance of the Experiment Decommissioning Plan.

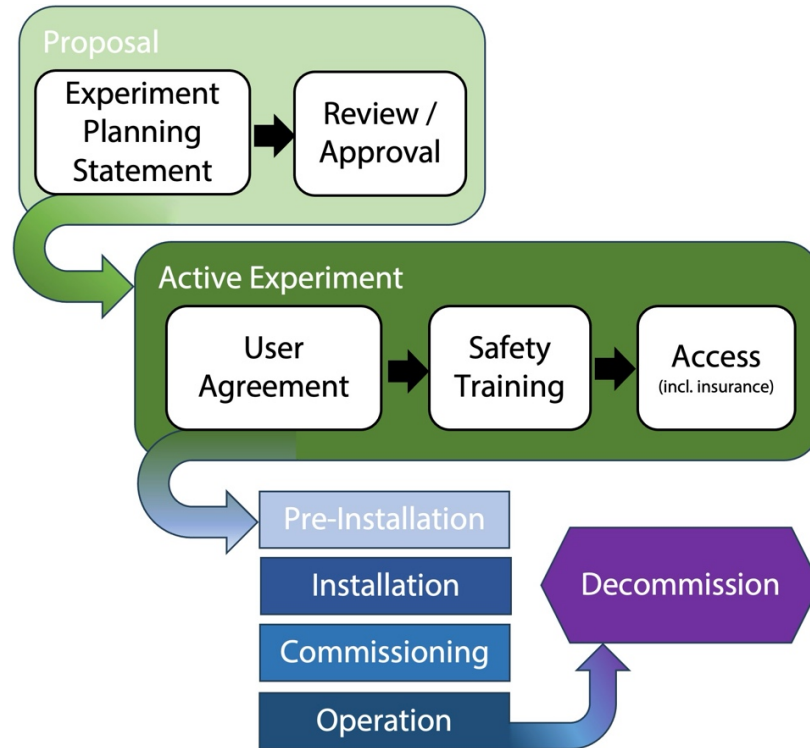


Figure 1: Summary of SDSTA implementation elements for each Experiment phase. Experiments not installing significant equipment may not need to advance past the Active phase. The Installation and Operations phases have associated Authorizations to Proceed (ATP); other ATPs may be associated with specific facilities, equipment, significant hazards or other stages that require multiple implementation elements.

5.8. Summary of Implementation Responsibilities

A summary of Experiment Implementation Program elements and associated Sanford Laboratory responsibilities is included in Table 2.

Implementation Element	Department Responsibility	
	Review	Approval/Oversight
Project Documentation		
1. Experiment Planning Statement (EPS) also support letter and initial cost estimate	Science, Operations/ Engineering, ESH; Business Services (initial cost estimate)	Laboratory Director (EPS, support letter); Operations/Engineering (initial cost estimate)
2. User Agreement (UA)	Contracts & Business Services, Science	Executive Director

3. Services Agreements (incl General Services Agreement (GSA), contracts)	Science, Business Services, Operations/Engineering (cost estimates); others as appropriate	Laboratory Director
4. Insurance	Business Services, Science	Laboratory Director (Risk Manager)
5. Decommissioning Plan	Initial plan (see EPS, UA); Final plan: ESH, Operations/Engineering, Science	Initial plan (see EPS, UA); Final plan: ESH, Operations/Engineering, Science
Environment, Safety & Health		
1. Hazard Analysis:		
a. Experiment Hazard Assessment Summary (EHAS)	ESH, Science; other subject matter experts as appropriate	Science (oversight)
b. Quantitative Analyses (incl ODH, pressure, mechanical, etc.)	ESH, Engineering; other subject matter experts as appropriate	Science (oversight)
c. Procedures / JHAs	ESH, Science; other subject matter experts as appropriate per Work Planning & Controls	Science (also Experiment)
2. Inventories:		
a. Chemical	Science (communication), ESH (review)	ESH (approval), Science (oversight)
b. Electrical Equipment	Science (communication), Operations/Engineering (inspection)	Operations/Engineering (approval), Science (oversight)
c. Hoisting & Rigging Equipment	Science (communication), Operations (inspection)	Science (oversight)
d. Pressure Vessel	Science (communication), Operations (inspection)	Science (oversight)
e. Radioactive Material	Science (communication), Radiation Safety Officer (review), Science (review)	Radiation Safety Officer (approval), Science (oversight)
3. Training	ESH	Science (site-specific for Experiment areas, oversight)
Reviews		
1. Facility: Transition, ESH, Site-Specific	Transition: AHJ, Operations, Subject Matter Experts (incl Science, ESH, Operations/Engineering) ESH: ESH, Subject Matter Experts (incl Science, ESH, Operations/Engineering) Site-Specific (for Experiment areas): Science, ESH, Subject Matter Experts (incl Science, ESH, Operations/Engineering)	Transition: Operations, Science (coordination) ESH: ESH, Science (coordination) Site-Specific (for Experiment areas): Science

2. Walk-Through Inspection	ESH, Subject Matter Experts (incl Science, ESH, Operations/Engineering)	Science (coordination/oversight)
3. Monitoring	ESH, Subject Matter Experts (incl Science, ESH, Operations/Engineering)	Science (coordination/oversight)
4. Readiness Reviews: Safety, Operation		Safety: Science (committee selection, report), ESH & Science (recommendation closure) Operation: As appropriate
5. External Evaluation		Laboratory Director & Science (committee selection, recommendation closure), Science (report)
Authorization		
1. Initial Installation of Significant Equipment at Location or Facility	Various representatives as outlined above for specific elements	Science
2. Activities Requiring Multiple Implementation Elements	Various representatives as outlined above for specific elements	Science

Table 2: Summary of SDSTA department formal responsibilities for the Experiment Implementation Program

5.9. Prioritizing Resources and Managing Conflict

A number of documents and tools exist for identifying needs for limited resources of SDSTA:

- User Agreement
 - As noted in 5.2.3, UA statement that occupancy of shared laboratory space(s) is coordinated and any conflicts will be resolved by the SDSTA. An UA is signed by all Experiments.
- Science Integration
 - A number of forums exist to promote discussion at various levels, including electronic mailing lists and regular scheduled meetings. Discussion of issues related to conflicts for resources is encouraged. See also the SDSTA Experiment Integration & Support document (see 6.1).
- Coordination
 - Members of the SDSTA staff (typically members of the Science department) are assigned to act in a coordination role either as the Laboratory Coordinator or as the Experiment Point of Contact. In both cases, the individuals in those roles manage resources and the potential for conflict. See also the SDSTA Experiment Integration & Support document (see 6.1).
- Online databases
 - Online tools have been developed to manage the transportation of personnel and materials (see also the SDSTA Experiment Integration & Support document, 6.1). The SURF Trip Plan database is used to manage cage occupancy, and the total underground population. The Director of Underground Access has indicated the following priorities that apply to both the Yates and Ross Shafts: SDSTA personnel responsible for operations/maintenance/safety, Experiment personnel, new construction, and finally optional trips such as tours. The Director of Hoists and Shafts manages the

transportation of materials, especially limited opportunities for using the main access shafts.

The Director of Science (or designee) will endeavor to manage conflicts with Experiment groups. The SURF Laboratory Director has oversight responsibility for all facility resources and will adjudicate issues that cannot otherwise be resolved. Specific instances may require the Laboratory Director (or designee) to define allocations of the total underground occupancy to specific groups when occupancy numbers near the underground personnel limit per the SDSTA Facility Access Standard of the ESH Manual.

5.10. Summary of authorization and communication routes

A schematic showing routes for communication and authorization is shown in Figure 2. Solid lines indicate formal responsibility; informal communication is also encouraged between different groups.

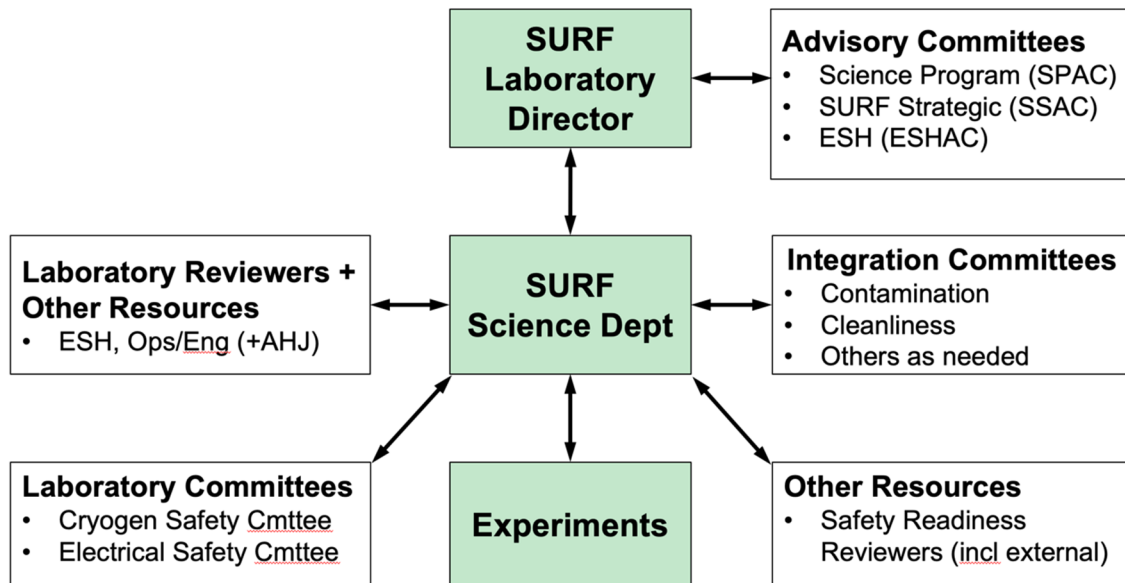


Figure 2: Schematic showing routes of communication and authorization.

6.0 Documented Information/Related Documents

- 6.1. SCI-(1000-S)-135416 Experiment Integration & Support Standard
- 6.2. Facility Transition Management Plan - Document-98261
- 6.3. SURF Community Agreement – Document-210511
- 6.4. ESH-(2000-S)-73320 Work Planning and Control Standard
- 6.5. SCI-(1000-F)-34460 Experiment Planning Statement
- 6.6. SDSTA ESH Manual: <https://sanfordlab.org/esh>
- 6.7. SCI-(1000-F)-69617 SURF User Agreement
- 6.8. EL-(1000-F)-71460 Acknowledgement of Risk Waiver
- 6.9. EL-(1000-F)-71462 Release, Agreement Not to Sue, and Waiver
- 6.10. SCI-(1000-F)-125942 Experiment Decommissioning Statement
- 6.11. Experiment Hazards Assessment Summary - Document-98635
- 6.12. ESH-(2000-F)-198730 Job Hazard Analysis
- 6.13. Information for Researchers: <https://docs.sanfordlab.org/docushare/dsweb/View/Wiki-272>
- 6.14. Pre-Startup Safety Review (PSSR) Completion Form - Document-73331
- 6.15. SURF Proposal Process - Document-210512