CSES FY24 Guidebook

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1 Introduction

The Center for Space and Earth Science (CSES) at Los Alamos National Laboratory (LANL) is one of the six Science Institutes in the Lab's National Security Education Center (NSEC). CSES covers six specific science disciplines, plus a new cross-Center initiative, PI-SATS, each directed by focus leaders:

- Astrophysics & Cosmology (Ingo Tews; itews@lanl.gov)
- Heliophysics (Gian Luca Delzanno; delzanno@lanl.gov)
- Planetary Science (Ann Ollila; amo@lanl.gov)
- Geophysics (Youzuo Lin; ylin@lanl.gov)
- Earth Systems (Sanna Sevanto; sanna@lanl.gov, Turin Dickman; lee@lanl.gov)
- Biological Systems (Jeanne Fair; jmfair@lanl.gov)
- PI-SATS (Ann Ollila; amo@lanl.gov, Peter Bloser; pbloser@lanl.gov, Gian Luca Delzanno; delzanno@lanl.gov)

1.1 CSES Science Discipline Portfolio

Astrophysics & Cosmology - with the goal of advancing our understanding of astrophysical phenomena throughout the universe using theoretical modeling, data science, computational studies, and related experimental research and to develop capabilities that map to needs in divisions involved in weapon simulation (e.g., nuclear physics, radiation hydrodynamics, plasma physics, Magneto HydroDynamics (MHD), uncertainty quantification) and national security (e.g., nuclear detection, transients, sensing, imaging).

Heliophysics - with the goal of advancing our understanding of the space environment from the Sun to the Earth and beyond - with the particular goal of understanding how the space environment affects the systems in space that support security and quality of life in our increasingly technological society. We include here development of heliophysics mission concepts.

Geophysics - with the goal of advancing theoretical, experimental, modeling, and simulation studies in basic Earth processes as well as promoting capabilities needed for a better understanding the perturbation of natural geologic systems in response to human actions and how we can leverage observations of geophysical properties in response to natural or anthropogenic events. These perturbations include changes in pore pressure, temperature, permeability; fluid/gas chemistry; as well as density, rigidity, compressibility, electromagnetic properties and seismic propagation characteristics.

Earth Systems - with the goal of advancing our understanding of the Earth System, its components and their interactions using theory, modeling, and simulation in combination with observations and experiments that advance our abilities to 1) predict change, variability and evolution of Earth System components resulting from natural and anthropogenic forcings, 2) understand the impacts of these changes on climate, and 3) strengthen the resilience of interdependent infrastructures, both in today's and in future climate states.

Planetary Science - with the goal to advance our knowledge of planetary bodies beyond Earth, including surface properties and processes, internal structures, atmospheres, and evolution over

time. We seek to advance our abilities to design, build, and operate remote instruments in extreme environments. Planetary Science utilizes data from a broad swath of platforms, including satellite, airborne, in situ, and laboratory measurements.

Biological Systems - with the goal of advancing the study of biological systems as part of complex natural systems, and addressing the signatures of natural or human-induced phenomena on such biological systems, including disease dynamics at the human/environment interface. This includes observational, experimental and modeling approaches.

1.2 CSES Strategy

As one of the six strategic centers organized under NSEC, CSES supports the NSEC strategic plan. The NSEC mission is "to provide creative solutions for continuing education, research, and external interactions that promote mission-relevant multidisciplinary science, technology, and engineering innovation," in execution of the vision "to be the nation's leading workforce and talent incubator for national security science, technology & engineering."

In this call, CSES supports the following from the NSEC Strategy:

Critical Outcome 1: Multidisciplinary innovation: Initiate, foster and integrate cross-disciplinary technical innovations for transition into national security programs

Initiative 1: Influence and support for Laboratory Agenda & Science capability pillars
Initiative 2: Establish and Strengthen NSEC strategic partnerships across LANL
Initiative 4: Grow Multi-Center Science and Engineering Initiatives

Critical Outcome 2: Academic and regional community engagement: Develop innovative approaches to enable and sustain academic and regional community interactions

Critical Outcome 3: Workforce development: Attract, advance, and retain tomorrow's workforce through creative education and professional development activities

This call supports initial research through student, postdoc, and staff opportunities that build new capabilities or explore new approaches for the LANL mission, or that support anticipated future mission needs and new mission areas in the science disciplines supported by CSES. The science goals for the CSES disciplines are in support of the broader strategic goals of the Laboratory Agenda and the Science Pillars that map to it. The Laboratory's Signature Science goals encapsulated in the Science Pillars is the LANL response to a range of national strategic plans that cover LANL's mission area. CSES is particularly responsive to the Department of Energy's Strategy to Advance American Space Leadership (FY 2021–FY 2031), "Energy for Space." CSES supports the three strategic goals, "Solve the Mysteries of Space," "Support the Secure and Peaceful Use of Space," and "Enable the Development of Space."

There is also a large overlap in the CSES science disciplines with all NASA's Science Mission Directorates, and CSES is interested in supporting capabilities that would enable LANL participation in the NASA mission arena. LANL's involvement with NASA is an invaluable recruiting tool, helps retain highly qualified staff, pushes LANL technology to perform in

extreme environments, and provides a publicly visible outlet for LANL excellence not available in other programmatic areas. CSES also supports initiatives from the LANL Institutional Space Strategy, Space Science & Exploration Portfolio Action Plan, in particular the PI-SATS initiative.

While the CSES discipline areas contribute to many of the Los Alamos National Laboratory Science Pillars, they are particularly applicable to the Science of Signature (SoS) Mission:

"Characterize measures, signals and properties in or of complex systems. Detect or attribute change and predict behavior and impact across scales of space (subatomic to astronomic) and time (femtosecond to geologic)"

Signature Science addresses emerging challenges in the CSES disciplines by developing the scientific underpinning of signatures and backgrounds, new measurement techniques and strategies for signature identification, the discovery of alternate or nontraditional signatures, and new analysis and interpretation tools for development of knowledge from these signatures.

CSES also supports the Complex Natural and Engineered Systems (CNES) Pillar by:

"*Addressing the science of complex systems requires science and technology innovation, as well as an integrated experiment, theory, and modeling and simulation approach that is the cornerstone of the Los Alamos problem-solving tradition.*"

Focus areas are rooted in the physical and life sciences with aims to support interdisciplinary research and development.

Each CSES call for proposals highlights a set of focused science topics for each of the six discipline areas, which will change from year to year. These topics are selected based on challenges facing the international scientific community as well as on the strategic need to extend scientific excellence supporting the Los Alamos National Laboratory mission.

We particularly encourage early career staff scientists to submit proposals that will help them build research programs and establish productive collaborations with universities.

In order to encourage highly creative and innovative ideas and concepts, CSES encourages revolutionary and moderate to high-risk research. CSES funds collaborative research involving Laboratory staff members, postdocs, university PI's and their students. A small amount of funding may be provided to conduct a technical feasibility analysis of a revolutionary concept. While many collaborative projects extend up to three years duration, funding in each successive year is contingent upon adequate progress in the previous year and the availability of funding.

1.2.1 Policy and resources regarding inclusivity

CSES is committed to inclusivity and upholds the LANL statement, "diversity fuels our innovative, agile, and principled workforce that is essential to solving problems of global importance." We seek to create and uphold a positive, professional environment for all

participants and support the Director's Annual Diversity Memo (official Laboratory Policy (PD712 and P712-3) as well as all levels of LANL policies intended to support diverse groups and eliminate bias against groups. The aim of CSES is to reach out broadly across the laboratory and to engage with diverse groups. Tailored briefings for your line organization, ERG, Team, etc., on CSES opportunities are available by contacting the Director and/or the relevant Focus Lead.

CSES will assist PIs, as requested, with resources to elevate their IDEA (Inclusivity Diversity Equity and Accessibility) efforts related to their CSES proposals and projects. Please reach out to the relevant Focus Lead to discuss your specific needs. The Ombuds Office also has a number of resources that can be found on their internal website.

The CSES leadership team has completed one or more of the following trainings, which are available through Utrain or other external sources:

Team Psychological Safety
Active Bystander
Conscious Inclusivity Facilitator
Crucial Conversations
The Power of a Positive No
Halting Harassment for Workers: Rules of the Road for a Respectful and Inclusive Workplace
Preventing Sexual Harassment
Conflict Resolution
Giving Constructive Feedback
Addressing Equity and Inclusion
Creating an inclusive lab culture and onboarding new lab members

1.3 Updates for FY24

Please pay particular attention to the following new or changed items in this year's call.

1.3.1 Guidebook updates for FY24

1. Expanded IDEA statement with resource discussion for proposers (Section 1.2.1)
2. New Special Rapid Response topics (Section 2.8)
3. Updates to the focused science topics (Sections 2.1 to 2.7).
4. CSES Scholars, additional opportunities (Section 3.3.4).
5. New Strategic University Partnership (Section 3.4)
6. New Cover Sheet for proposals (CSES.lanl.gov)

2 Focused Science Topics

All CSES Proposals need to address the focused topics for FY24 in their science discipline area as outlined below.

Exception: for the Rapid Response Program. While proposals along the lines of this call's focused science topics are encouraged, the program element is open to all new ideas relevant to the CSES discipline areas.

Exception: for the Special Rapid Response Program. Proposals MUST address the relevant Special Rapid Response Topic as outlined in Section 2.8.

2.1 Astrophysics & Cosmology

The Astrophysics & Cosmology Focus Area in CSES is closely aligned with LANL's Nuclear and Particle Futures (NPF) Capability Pillar and in particular the two focus areas of "Nuclear, Particle, Astrophysics & Cosmology" (NPAC) and "High Energy Density Plasmas and Fluids" (HEDPF). Furthermore, research in the Astrophysics & Cosmology and Cosmology focus area is relevant to some of the goals described in the Science of Signatures Pillar; see https://www.lanl.gov/science-innovation/pillars/npf/index.php and http://www.lanl.gov/science-innovation/pillars/sos/index.php for further details.

The research in the Astrophysics & Cosmology Focus Area aims to advance our understanding of astrophysical phenomena throughout the universe by providing the necessary fundamental research and capability developments. Research in this Focus area entails theoretical modeling, data science, computational studies, and related experimental efforts with the goal to develop capabilities that map to needs in divisions involved in weapons research, national, and global security.

Focus area

We solicit proposals that aim to advance research in observation, theory, data analysis, simulation, and instrumentation and strive to achieve a fundamental understanding of the universe and its many exciting astrophysical processes. We particularly encourage proposals that emphasize interdisciplinary efforts combining the beforementioned fields or research at the boundaries of cosmology, astrophysics, nuclear physics, particle physics, plasma physics, computational physics, or general relativity.

This focus area benefits from and in turn strengthens its strong overlap with many on-going Laboratory programs in these and other areas such as weapons physics and condensed matter physics. It further utilizes and leverages unique LANL capabilities, and facilities and observatories both inside and outside of the Laboratory. We are interested in proposals that emphasize innovative, forward-looking, and interdisciplinary research and that have a strong potential to lead to the development of new capabilities and research directions.

It is strongly encouraged that proposals exploit LANL's broad knowledge base in a full range of physics and tie together unique and/or underutilized resources at Los Alamos National Laboratory, for example:

1. LANL's strength in theoretical modeling of extreme astrophysical conditions,
2. Facilities such as the HAWC, Raptor, ZTF, Rubin Observatory, VLBA, JWST, SWGO, LANSCE, HET, NIF, Omega, etc.,
3. Computational techniques, codes, and resources, such as VPIC, FLAG, RAGE, Ristra, etc.

Specific Topics for new projects starting in FY24:

The overall theme is to conduct excellent cutting-edge research that enables breakthroughs in our fundamental understanding of Astrophysical Transients and their potential multi-messenger signatures. The likely engines for astrophysical transients are compact objects such as black holes or neutron stars, and stellar explosions. Their signatures might include gravitational waves, electromagnetic radiation (e.g., gamma rays, x rays, optical and radio signals) or neutrinos. The nascent field of multi-messenger astrophysics uses the complimentary observations of more than one such "messenger" from a single object or event, potentially across a variety of wavelengths and particle types, to probe different aspects of the astrophysical source. Because these events are rich in physical phenomena that span most of physics' sub-disciplines, extracting multi-messenger information from these astrophysical transients is a complex task and requires innovative and cross-disciplinary uses of unique LANL observational, theoretical, numerical and experimental capabilities.

Since the discovery of gravitational waves from compact-object mergers, the area of Astrophysical Transients and their multi-messenger signals is a rapidly developing field in astrophysics and will likely remain important for at least the next decades. This field attracts a large fraction of the workforce of the future, aiming to understand the many different aspects of these events and working on, e.g., ground- and space-based electromagnetic or gravitational-wave observations, theoretical modeling of dense matter and extreme astrophysical environments, computational simulations, data science, particle physics, neutrino physics, atomic physics, instrumentation and experiments. Most of these subjects are tied closely to LANL expertise. Astrophysical transients connect much of the natural phenomena observable in our universe to similar physical processes in LANL programmatic areas at high temperature and pressure, often in turbulent physical regimes, while being at the forefront of current astrophysical research. Hence, they have the capability of attracting and retaining the brightest minds to Los Alamos.

LANL is ideally suited to dominate this emerging astrophysics theme, especially with its existing capabilities and expertise in integrated systems (combining physics studies, experiment, computational work and detector development). This also ties well with multi-physics efforts within LANL's Advanced Simulation and Computing effort.
Relevant research in this Focus area includes applications to neutron stars, pulsar wind nebulae, supernovae, fast radio bursts, gamma-ray bursts, gravitational-wave sources, black hole formation, jets and flares, signatures from exoplanetary systems and protoplanetary disks, etc. In particular, a huge potential for new discoveries might be realized by the planned start of the next gravitational-wave observing run O4 in May 2023. In the next decade, the anticipated launch of

third-generation gravitational-wave detectors will further revolutionize the field. Hence, the following specific science topics are chosen for FY24:

1. **Developing Cross-Disciplinary Capabilities.** Projects that tie together two or more existing LANL capabilities, e.g., in theory, observation, instrumentation, simulation or data science, to understand aspects of multi-messenger signals originating from astrophysical transients that cannot be elucidated by one discipline alone.
2. **Extending LANL's Unique Capability base.** Projects that advance existing or create new individual capabilities that contribute to new missions and facilities necessary to understand Astrophysical Transients, including but not limited to:
    a. Applications of ASC codes or LANL's unique computational-physics capabilities to problems focused on astrophysical transients, e.g., simulation codes that are suitable for Exascale Computing platforms to study complex astrophysical systems (e.g., including radiation magnetohydrodynamics, charge particle energization and transport connecting fluid and kinetic regimes).
    b. Data mining and machine learning for multi-messenger astrophysics.
    c. Optical, X-ray and gamma-ray transient detections (possible NASA missions).
    d. Theoretical studies of extreme astrophysical environments and data science applications to astrophysical transients.
3. **Developing Capabilities for Future Multi-Messenger Campaigns**. Projects that focus on developing scientific capabilities necessary for the analysis of upcoming multi-messenger observations. For example, these can be related to LIGO's O4 run (including gravitational-wave signals and electromagnetic counterparts), to the science case for planned third-generation gravitational-wave detectors, but also to, e.g., neutrino observatories.
4. **Supporting expanded LANL participation in current and upcoming NASA Astrophysical Missions**. Work that builds the capability for mission participation from either a theoretical or preferably an instrument development angle, for upcoming missions of interest to LANL (e.g., x-ray or gamma-ray missions, or CubeSat missions through the NASA APRA or Pioneers programs). Applied projects in this area are encouraged to submit to PI-SATS (section 2.7).

Proposals that demonstrate strong cross-disciplinary collaborations and networking (both internally and externally) are particularly encouraged and will receive preferred funding and runtime.

2.2 Heliophysics

Here we rename the "Space Focus Area" to "Heliophysics" in order to provide some additional topical clarity and specificity. Note that CSES does not map to one to one to NASA Heliophysics within SMD.

The overarching research goals for this call in the Heliophysics focus area are to advance our understanding of the space environment (from the Sun to the Earth and beyond, including space weather – see https://science.nasa.gov/heliophysics) and to advance our ability to operate systems in space that protect life and society. Heliophysics is distinct from other fields, such as

astrophysics or cosmology, in that Heliophysics utilizes in-situ measurements from high altitude rockets, balloons, and spacecraft, or ground-based measurements of objects and conditions in space.

Heliophysics is part of the leadership areas of the SoS capability pillar (https://www.lanl.gov/science-innovation/pillars/index.php), and is also connected to the NPF and CSES pillars. The Strategic Investment Plan (https://int.lanl.gov/science/programs/ldrd/dr/sip/_assets/docs/FY24_LDRD_SIP_20221103.pdf) lists relevant goals and the topics chosen should relate to them. Refer to links listed above, noting that these documents use the more generic term ‘Space’ instead of 'Heliophysics'.

Focus area

We particularly encourage proposals that:

- support LANL participation in new and emerging programs, including future Heliophysics missions;
- make use of unique LANL datasets and modeling capabilities to enhance the scientific return of past and ongoing missions, and to make predictions for new missions;
- take advantage of unique LANL expertise (including in areas outside the traditional Heliophysics) to develop cross-disciplinary capabilities and innovative solutions to space physics problems ranging from fundamental science to national security.

The broad topic areas encompassing either existing or desired expertise at LANL in Heliophysics are: in-situ measurements and remote sensing capabilities, space-based experiments, development of multi-scale modeling capabilities, development of new data analysis techniques, exploration of short term (e.g. geomagnetic storms and substorms) and long-term (e.g. solar cycle) trends in LANL and other complementary datasets, and natural and artificially disturbed ionospheric and magnetospheric environments. The community is also invited to make the case for strategic areas that could be either enhanced or developed. Examples include effects of the space environment on space-born technology, use of accelerators in space, the development of novel materials for space applications, and orbital debris in space, noting that projects that focus on technology and technology maturation should be submitted to PI-SATS (Sec. 2.7).

It is strongly encouraged that proposals exploit unique resources at LANL which include:

a. LANL satellite experiments and data
b. LANL remote sensing experiments and data
c. LANL Heliophysics computer simulation codes and algorithms
d. Unique LANL facilities (e.g., LANSCE, Highly Charged Ion Beam Laboratory, HPC, …)

Specific Topics for new projects starting in FY24:

The overall theme is to conduct cutting-edge research that enables fundamental breakthroughs in our understanding of the space environment through new missions, advanced cross-disciplinary modeling capabilities and innovative uses of unique LANL data or numerical modeling resources. From the above topic areas, the following focused science topics are chosen for FY24:

1. **Exploration and support for LANL participation in future space-based missions:**
    a. Development of novel science mission concepts
    b. Novel uses of commercial small satellite and ground system capabilities.
    c. Remote sensing and in-situ measurements of the space environment, especially the low-energy particle populations.

2. **Advance computational and data analysis capabilities:**
    a. Development of cross-scale data analysis and modeling capabilities.
    b. Development of cross-disciplinary capabilities (for instance, in-situ visualization, inference, artificial intelligence, and data science).

3. **Innovative uses of unique LANL data or capabilities:**
    a. Use of LANL energetic particle measurements and models to complement other scientific studies using NASA data.
    b. Use of LANL radio frequency or optical measurements to enhance scientific studies.

4. **Research and development in support of orbital debris research:**
    a. Detection, characterization and tracking of orbital debris

5. **Research and development in support of understanding anthropogenic and natural ionospheric variability and its effect on communications**

2.3 Planetary Science

Planetary Science is an interdisciplinary field that overlaps with many of the six leadership areas of the Science of Signatures (SoS) pillar, in particular Space Signatures and Chemical and Materials Signatures. The SoS strategy document lists goals for each of the six leadership areas, and the topics chosen should relate to them. Refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.
Planetary Science represents a high visibility area for LANL with high-profile ongoing and future NASA mission participation, and has been an exciting growth area at LANL. This focus area is a hybrid since the technology used is similar to the Space Focus area, while the scientific topics of planetary evolution and geology relate to the Geophysics Focus area.

The goal of the Planetary Science focus area is to advance our knowledge of planetary bodies beyond Earth, including surface properties and processes, internal structures, atmospheres, and evolution over time. Planetary Science utilizes data from a broad swath of platforms, including satellite, airborne, in situ, and laboratory measurements. Note that the PI-SATS topic area (section 2.7) now covers applied research, such as instrument development. Proposals seeking to advance our capabilities to design, build, and operate instrumentation in extreme environments may be submitted to PI-SATS with a Planetary Science focus.

Focus area

We encourage research in observation, measurement, and data analysis to understand planetary environments and processes. Projects should primarily address planetary bodies within the Solar System, although research on exoplanets will be considered. This focus area has significant overlap with other laboratory-relevant programs that may provide new techniques or novel applications of existing techniques for planetary problems. Although research that deals primarily with the Earth environment are not solicited, projects that utilize Earth analogs (including field studies) and laboratory experiments for planetary applications are encouraged. All NASA planetary missions make their data available to the public; projects that develop new analysis methods for these data are relevant to this focus area. Also of interest are projects that leverage unique Los Alamos facilities or capabilities. We strongly encourage proposals that pursue new, innovative scientific research and that enable future planetary missions.

Specific Topics for new projects starting in FY24:

1. Foundational research and technology/instrument development related to objectives of the Planetary Science and Astrobiology Decadal Survey 2023-2032: The National Academies recently released the Decadal Survey that outlines the key science questions and mission priorities for the next decade (https://www.nationalacademies.org/our-work/planetary-science-and-astrobiology-decadal-survey-2023-2032). We encourage proposals related to addressing the science and/or technology goals outlined therein. Priorities for the large class missions are the Uranus Orbiter and Probe and the Enceladus Orbilander. New Frontiers medium class mission priorities include Centaur orbiter and lander, Ceres sample return, Comet surface sample return, Enceladus multiple flyby, Lunar Geophysical Network, Saturn probe, Titan orbiter, Venus In Situ Explorer, and Triton Ocean World Surveyor. Proposed work may include laboratory, terrestrial analog, and/or data analysis projects. Also encouraged are proposals that would support research in areas related to upcoming NASA Participating Scientist solicitations. Proposals are encouraged in the following topics:

a. Advanced computation techniques – this includes modeling of large-scale planetary processes as well as novel interface tools and uses of large planetary mission data sets to solve planet formation and evolution science questions, including chemical and physical states of planets. This also includes planetary dynamic processes, such as impacts.

b. Analog studies – this includes fieldwork to planetary analog locations to collect and analyze materials that may be used for proof-of-concept studies or to valid remote sensing data. Development of Concept of Operations (ConOps) strategies using existing instrumentation are also relevant.

c. Experimental work – this includes fundamental laboratory experiments that address to outstanding planetary science objectives and unresolved questions.

d. Tool development – this includes software that enables fundamental research to be more efficiently and effectively accomplished.

2. **Support the Artemis lunar exploration program.** The Artemis program is a NASA-led initiative to return humans to the Moon. The goal is to establish a sustainable human presence on the Moon. Fundamental R&D that supports the goals of Artemis (e.g. studies on the

lunar environment and/or resources relevant to the sustainment of human life on the Moon) should be submitted to Planetary Science while applied science (e.g. development of power supplies or additive manufacturing systems for In Situ Resource Utilization (ISRU)) should be submitted to PI-SATS. Due to the nature of the program, cross-collaboration with other CSES focus areas, e.g. Biological Systems, Geophysics, or Heliophysics are encouraged. See https://www.nasa.gov/specials/artemis/ for additional details on the Artemis program.

2.4 Geophysics

The Geophysics Focus Area is grounded in two of the lab's science pillars – *Integrating information, science, and technology for prediction (IS&T), and Science of Signatures (SoS).* The integration of information science and the evaluation of signatures provides an avenue for improving LANL's capability in *sensing* (improved extract of useful information from data and detection of small events in noisy data sets) and *predicting* (improved understand of the behavior of complex Engineered Natural Systems despite inherent uncertainty) - informed by observational efforts over variations in spatial or temporal scale.

See http://www.lanl.gov/science-innovation/pillars/ist/index.php for details; and *Science of Signatures (SoS),* refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

The overall theme for the Geophysics Focus Area is research to help expand capabilities related to national security and energy security. Newly emerging interests among Federal agencies include next-generation AI and physics-informed machine learning (ML) techniques for proliferation detection and subsurface energy exploration, geophysical techniques to address border security, subsurface characterization for both near-surface and deep reservoir applications, robust data acquisition using remote methods in hazardous regions, and extending the footprint of our sensing capability by leveraging new sensor technology. Studies that integrate theoretical, observational, experimental, modeling and simulation efforts to address technical challenges in understanding the earth's surface and/or subsurface are of particular interest. Geoscience topics that play a fundamental role in supporting LANL's core mission include change detection for surface or subsurface signatures (temporal, chemical, biological, physical, geodetic), and anomaly detection for these signatures. Particularly important is building our capacity to integrate the independent signatures and apply their combined interpretation in novel environments to extend the reach of our models and detection capability.

Focus Area

The Geophysics focus area supports basic and applied research concerning the Earth's surface and lithosphere. This research includes numerical, experimental, and field studies of the structure, properties, processes, and dynamics of the Earth. It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

a) Sensor technology capabilities resident in C, EES, ISR, and N divisions
b) Los Alamos National Laboratory high-performance computing resources and/or innovative exploitation of LANL interfaces with modern cloud computing resources
c) Geochemical analyses facilities resident in EES and C divisions
d) Emerging field surveying advances such as UAV data acquisition

Specific Topics for new projects starting in FY24:

1. **Real-time decision-making for monitoring subsurface dynamics**. Many subsurface applications rely on making critical decisions efficiently and accurately. For example, during geothermal exploration, monitoring induced seismicity is critically important for the successful development of commercial geothermal systems. Existing monitoring tools usually yield unsatisfactory results due to high costs in computational models, insufficiency in handling large-scale data volumes, and limitations in computing facilities. This topic is particularly interested in developing new and advanced approaches that would provide better, faster, and more effective techniques by leveraging existing geophysical data acquisition techniques.
2. **Multi-fidelity geophysical data analysis.** Subsurface is complex and full of uncertainty. Various data including physics simulations and field measurements are generated/acquired to help with a better understanding of the subsurface. However, those data can be very different in their physics characteristics, spatio-temporal scale, representation, etc. One challenging question is how to incorporate and fuse those disparate data sources for the target tasks. Below, we are particularly interested in two topics.
    a. Geophysical "Sim2Real". Given that data are scarce in subsurface geoscience, full-physics simulations provide some compensation for this lack of data. How to bridge the "knowledge gap" (the gap between physical simulations and real applications) by utilizing machine learning and the underlying physics is a scientifically important question that needs to be carefully addressed.
    b. Multi-physics and multi-scale data fusion. Different physical measurements or measurements across different spatio-temporal scales may be able to compensate for one another. This topic focuses on developing new data fusion methods to account for those differences in the data.
3. **New developments in subsurface energy science - particular emphasis on new R&D efforts to address existing issues related to hydrogen, carbon sequestration & storage, and geothermal energy exploration.** LANL has developed extensive capabilities for understanding subsurface energy problems. That includes unique geophysical monitoring and imaging tools, predictive models of rock behavior, and surrogate models that can predict complex physics phenomena. The Lab has been adapting those capabilities to various applications of hydrogen, carbon sequestration & storage, and geothermal resources. With recent advances in sensing and computing, and the availability of more and better geophysical data, we look for innovations that would provide us with better solutions for addressing existing issues in subsurface energy science.

2.5 Earth Systems

The Earth Systems focus area advances understanding and predictability of complex natural systems and the use and interaction of these systems by/with humans from the sub-surface to the top of the atmosphere. It contributes to three of LANL's capability pillars: Science of Signatures (SoS), Complex Natural and Engineered Systems (CNES), and Information Science & Technology (IS&T). Within these pillars, Earth Systems addresses SoS Signatures of natural and anthropogenic phenomena impacting national security (SoS Challenge #3) with critical outcomes in Climate and Clean Energy, and CNES Non-Nuclear Threats (CNES challenge #3), with critical outcomes in Threat Reduction. Within IS&T, Earth Systems contributes to Computational Science and Data Science applied to subsurface networks, as well as acquisition, use, and modeling of large datasets for energy security, climate modeling, and terrestrial systems.

Focus Area

The Earth Systems focus area emphasizes invention promoting progress from understanding to predictive capability. Earth Systems focuses on process integration that allows up- and down-scaling within or between phenomena in complex natural systems. It promotes understanding of interactions between natural and human systems and developing capabilities to strengthen system security and resilience. Integration of experiments, data science, and modeling to fill outstanding gaps in prediction of environmental responses of sensitive and high-impact regions, or environmental responses affecting energy security, human health, security and resilience is encouraged.

It is encouraged that proposals exploit unique LANL and DOE resources such as:

a) LANL high performance computing
b) LANL developed or DOE-sponsored models such as HiGrad/FIRETEC, Amanzi-Advance Terrestrial Simulator, CICE and E3SM
c) LANL experimental, and user facilities such as LANSCE, the High Magnetic Field Laboratory, the Geochemistry and Geomaterials Research Laboratory (GGRL), radiological chemistry, and greenhouse capabilities
d) LANL 'omics capabilities and DOE-sponsored 'omics datasets
e) LANL and DOE-sponsored environmental datasets and monitoring systems such as NGEE Arctic, NGEE Tropics, ARM, SUMO, LTER-network and CAFÉ.

Specific topics for new projects starting in FY24:

1. **System stability and identification of stable states:** Studies on revolutionary experimental, modeling and data science approaches that allow 1) determination of system stability, 2) identification of stable states, or 3) quantification of system memory that influences the outcome of current disturbances for natural and managed Earth system components. These components include, but are not limited to the atmosphere, the cryosphere, and terrestrial and aquatic ecosystems and their components. Studies focusing on indirect signatures, integrating or coupling two or

more components or addressing how one component leads to outcomes in another are highly encouraged.

2. **Complex coupled processes:** Development of new methods or algorithms for scaling up and down, or integration of models, observations, and experimental studies to improve prediction of system responses to change and the impacts on human well-being, with an emphasis on climate change impacts on sensitive processes and regions, such as the Arctic and coastal areas at multiple scales, and in response to catastrophic events such as drought, fire, armed conflict or epidemics.
3. **Solutions for natural resource security and resilience:**
    a. Studies on new experimental, modeling or data science techniques to quantify climate change impacts on natural resources, system resilience or human well-being. Topics of interest include greenhouse gas emissions and emission control, verification, or mitigation, flooding, food and water shortages, and erosion..
    b. Studies on model-observation integration that provides foundation for modeling natural resource resilience and threat mitigation strategies.

2.6 Biological Systems

The Biological Systems focus area advances the study of biological systems as part of complex natural systems. It transcends three of LANL's capability pillars: Science of Signatures (SoS), Complex Natural and Engineered Systems (CNES) and Information Science & Technology (IS&T) by addressing signatures of natural or human-induced phenomena on biological systems. This includes developing data-intensive computing approaches to advance a fundamental understanding of the behavior of microbial systems (across all scales) in response to environmental perturbations as well as their roles in bioenergy, bioremediation, carbon cycling, and the health of the human/environment interface. Many of the approaches rely on LANL's long-standing expertise and established strengths in microbiology, genomics, and bioinformatics. Furthermore, understanding the contribution of environmental reservoirs to the transmission of human disease could help to predict hot spots for emergence of microbial infections. For example, there is currently great interest in the survivability of viruses, such as the SARS-CoV2 virus, for understanding mechanisms of transmission and establishing disease detection methods in a community.

Focus Area

We emphasize approaches that integrate computation and experiment with independent data analysis approaches that can leverage advances in areas such as artificial intelligence and machine learning.

It is encouraged that proposals exploit unique LANL resources such as:

a. LANL high performance computing
b. DOE-sponsored climate models or other research supporting the DOE Bioassurance Program
c. LANL experimental capabilities in genomics and bioanalytical chemistry such as mass spectrometry, NMR or Mass Spec Center for Integrated Multiomics
d. Synthetic biology approaches to regulate biological systems for a re-directed purpose

Specific topics of interest for new projects starting in FY24:

1. **Multiomics and Bioinformatics:** new approaches to elucidate interspecies interactions.
    a. Between single or multicellular organisms in response to significant change in their environment. Identifying unique and independent signatures and potentially leveraging the new Los Alamos Mass Spec Center for Integrated Multiomics.
    b. Space and human health science
    c. Soil ecology and patterns of microbial and biochemical processes
2. **Impacts and consequences:** approaches for understanding impacts of significant events or environmental change
    a. growth of harmful algal blooms as a result of adjacent agricultural practices or effluents; biofuel algal cultures and ponds as a result of microbial invasion
    b. extreme patterns or impacts of climate and environmental change on biological systems
3. **Disease dynamics at the human/environment interface:**
    a. Establish methods of environmental testing to include highly complex environmental matrices. Understand persistence of pathogenic microbes in the environment and subsequent risks to the human population.
    b. Visualizing, forecasting and understanding epidemic and outbreak dynamics.

2.7 PI-SATS

The Pipelining Initiative for Space Applied Technology and Science (PI-SATS) is a cross cutting NSEC topic with the purpose of providing a more centralized and recognizable pathway for space technology development and applied science. The goals of PI-SATS align with those in the NSEC Education and Research Strategic Plan, and thus support recruitment, pipelining, and workforce development. Both of these senses of "pipelining" – technology development and workforce development – are directly responsive to the LANL Institutional Space Strategy (LISS) goals and objectives. The relevant goals and objectives of the LISS, and of the related LANL Space Science & Exploration Portfolio, are summarized in the table below.

LANL Institutional Space Strategy	
Goals	Objectives
IG-1: Enhance the effectiveness of LANL in serving national space interests.	IO-1.2. Increase attention to technology maturation and mission utility. IO-1.4. Develop the current workforce of space professionals towards more effective service of national space interests.
IG-2: Advance technical capabilities needed to overcome national space challenges.	IO-2.1. Advance fieldable data-to-information processing technologies. IO-2.2. Advance sensing capabilities serving evolving national space interests. IO-2.3. Advance capabilities to rapidly develop, demonstrate, and operationalize space technologies and systems.

IG-3. Grow LANL contributions to national space endeavors.	IO-3.1. Increase the external visibility of LANL space contributions to promote recognition and future growth opportunities. IO-3.2. Enhance the exploitation of broad and unique LANL capabilities towards future space growth opportunities. IO-3.3. Grow the workforce of space professionals to enable increased LANL contribution to national space endeavors.
LANL Space Science & Exploration Portfolio	
Goals	Objectives
PG-1. Pursue fundamental and applied R&D science and technology	PO-1.1. Workforce retention and professional development PO-1.2. Strong foundation for mission development
PG-2. Provide a clear pathway for sustainable Technology Readiness Level (TRL) development	
PG-3. Support and sustain space mission-related science and operations facilities critical to ongoing and future space missions	

While fundamental R&D will remain within Focused Science Topics 2.1-2.6, the PI-SATS portfolio will contain ***applied*** projects from Focused Science Topics 2.1-2.6 (as well as topics below) relevant to enhancing our competitive advancement of Technology Readiness Level (TRL) for space missions. The commonly used NASA definitions of TRL levels can be found here:

https://www.nasa.gov/directorates/heo/scan/engineering/technology/technology_readiness_level

All CSES program elements and calls may submit to PI-SATS. **Proposals must show a strong pipelining component and/or workforce development**, such as student or postdoc involvement, Early Career staff leadership roles, and/or engagement of LANL staff new to space technology development. The most competitive proposals will have excellent student and/or postdoc engagement.

Technology Development Resources

A major goal of PI-SATS is to help new PIs get their ideas off the ground. For example, a CSES Rapid Response project that is relevant to PI-SATS could provide a proof-of-concept for a low-TRL (TRL ~1-2) technology in preparation for a larger-scale LDRD or NASA technology development proposal. More mature technologies already demonstrated in the laboratory (TRL ~3-4) could be tested in a more relevant environment (TRL ~5-6) utilizing unique LANL resources (see below), qualifying them for space mission proposals.

Some familiarity with LANL and NASA strategic plans and space technology development goals is required to craft a competitive PI-SATS proposal. For the Lab, consult the Laboratory Agenda and other resources on the LDRD webpages. For NASA, some resources on technology development priorities and funding opportunities relevant to the CSES Focused Science Topics are listed here:

- Astrophysics: Technology priorities can be found at https://apd440.gsfc.nasa.gov/technology.html . Relevant funding programs include Astrophysics Research & Analysis (APRA) and Strategic Astrophysics Technology (SAT).

- Heliophysics: The NASA Heliophysics Technology Program is described at https://science.nasa.gov/heliophysics/programs/technology . Relevant funding programs include Heliophysics Instrument Development for Science (H-TIDeS) and Heliophysics Flight Opportunities Studies (HFOS).
- Planetary Science: Relevant funding programs include Planetary Instrument Concepts for the Advancement of Solar System Observations (PICASSO), Maturation of Instruments for Solar System Exploration (MATISSE), and Development and Advancement of Lunar Instrumentation (DALI).
- Earth Science and Geophysics: The technology maturation process and priorities can be found at https://esto.nasa.gov/funding-process/ . Relevant funding programs include Instrument Incubator Program (IIP), Advanced Component Technologies (ACT), and In-Space Validation of Earth Science Technologies (InVEST).

These NASA technology development funding programs are part of the omnibus Research Opportunities in Space and Earth Science (ROSES) solicitation, released annually. Program descriptions and due dates for 2023 can be found here:

http://solicitation.nasaprs.com/ROSES2023

Specific PI-SATS topics of interest for new projects starting in FY24:

Projects are sought that would leverage unique and emerging LANL space exploration capabilities (such as ISR's hand-launch balloon platforms, irradiation facilities at LANSCE or TA-36, or use of accelerators in space), would strengthen LANL competitive advantage (such as concept studies for CubeSat/SmallSat science missions, utilizing the expertise of ISR Division's Agile Space Team), and/or address national and global security concerns (such as competition in the cis-lunar environment). While any applied space-relevant project may be submitted from other Focus Areas (2.1-2.6), specific examples of topics appropriate and sought for PI-SATS are:

1. **Propulsion** – including development of new propellants, enhanced maneuverability of space craft, or new methods of impulse/thrust control
2. **Detectors** – including development of novel materials for detectors, data integration at the sensor, quantum sensing capabilities
3. **Advanced Manufacturing** – including production of needed components via In-Situ Resource Utilization (ISRU) of materials either on-orbit or on the lunar surface, or manufacturing processes in extreme environments
4. **Space Systems Engineering** – including development of technologies for autonomous spacecraft/space instrument operations, new power sources that would enable new space science and exploration missions, new thermal control systems, etc.
5. **Mitigation of Orbital Debris** – including development of technologies for active debris removal

2.8 Special Rapid Response Topics

For FY24 CSES has defined one Special Rapid Response (SRR) topic (see Section 3.3.2 for program description).

2.8.1 Biosphere Security

This year's Special Rapid Response call is cross-cutting with Bioscience-Earth Systems-Geophysics. In alignment with LANL climate and clean energy mission, we are calling for proposals for proof-of-concept R&D studies on the following topics receiving increased attention from sponsors. Proposals are sought that address water and/or agricultural security.

Water security studies:
1) Novel techniques to map water resource at local and regional scales
2) Predicting water resource changes and watershed evolution
3) Techniques to remotely monitor water quality
4) Sustainable techniques to manage water availability and quality.

Agricultural security studies on experimental, modeling and data science approaches that address plant pathogen:
1) detection and identification
2) mitigation of infestations
3) remote detection of infestation in agricultural systems
4) other modeling for crop security
5) other epidemiological investigations of important agricultural pests or crop security

3 Program Elements

Updated in the FY24 call:

1. *The Student Fellows Program* (Section 3.1) may submit a CSES Scholar Addendum.
2. The *Chick Keller Postdoctoral Fellowship* (Section 3.2), will accept nominations at the December 2021 and May 2022 quarterly, conditional on available funding.
3. *CSES Scholars* – additional opportunities (Section 3.3.4).
4. *Strategic University Partnership* – new for FY 24 (Section 3.4)
5. *New Proposal Cover Sheet* (CSES.lanl.gov)

Current CSES program elements:

1. **Student Fellow Program**. Needs to address the CSES Focused Science Topics for this call. One call per year.
2. **Chick Keller Postdoctoral Fellow Program**. Needs to address the CSES Focused Science Topics for this call. Submissions through LANL Postdoc Program, up to two times a year.
3. **Rapid Response Program**. While alignment to the CSES Focused Science Topics is encouraged, this program element is open to all emerging scientific ideas in the CSES science disciplines. At least one selection during the FY, typically starting at the beginning of the new FY. A second round may be offered dedicated to supporting summer students. See the latest R&D Central Announcement for the most current information.
4. **Institutional Program Development**. Must align with LANL strategic needs. No due date.
5. **CSES Scholars.** May be supported by S/RR, IPD, Student Fellows addendum.
6. **Strategic University Partnership.** May be aligned with 1, 3, 4, or 5 above.

Each program element is described below and lists the typical maximum budget and the anticipated number of awards that can be made. Proposals requesting less than the maximum budget will have a competitive advantage.

All R&D programs described below are funded through a LDRD-DR project managed by CSES and are administered as tasks of this DR. As such, all work must adhere to LDRD rules as dictated by DOE Order 413.2C, particularly:

- All Tasks must be in the forefront areas of science and relevant to DOE/NNSA missions
- Tasks must not require the addition of non-LDRD funds to accomplish their goals – i.e. augmentation is not permitted

Details of the proposal writing and submission process are in Section 4.

3.1 Student Fellow Program

University and LANL collaborative research program. *Open to Graduate, PostBacc and PostMasters Students*. Frequency of call: Once a year. **Tentative timeline and dates below. See the latest R&D Central Announcement for the most current information.**

Submission: April, 2024
Selections: May, 2024
Program New Starts: at start of FY25

The number of new starts anticipated in the CSES Student Fellow Program is approximately 4-6 across all Student types and all CSES discipline areas. This number is dependent on the current number of Student Fellows and overall funding of CSES. In general, up to 4 Student Fellows can be supported per Focus Area per year.

New for FY24, an addendum for support of a CSES Scholar may be requested as part of the proposal submission. This could take the form of either sabbatical support for the University PI at LANL or an extended visit by the LANL PI to the university. Priority will be given to those currently holding or seeking a Joint Appointment.

CSES will organize a CSES Symposium at end of summer for presentation of all projects in a given focus area. *Presentations, publications, and copies of any resulting proposals submitted should be sent to CSES.*

3.1.1 Graduate Program Outline

- Each proposal is required to have a University Student Researcher, a University Principal Investigator (PI) and a Los Alamos National Laboratory PI/Mentor.
- The University Graduate Student Researcher must be enrolled in a Graduate program, have an identified thesis topic and university mentor, and have passed their qualifiers if a Ph.D. student.
- The University PI may be any university scientist entitled by the university to be a Ph.D. program supervisor.
- Visiting scientists, adjunct faculty, and postdocs do not qualify as University PIs.
- A Los Alamos National Laboratory PI/Mentor is any Los Alamos Staff Member.
- The collaborative University-LANL research project will typically consist of a jointly agreed Ph.D. thesis research project.
- **Projects are typically 2-3 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a University Student Researcher to perform part of their thesis work at Los Alamos National Laboratory in close collaboration with their Los Alamos PI.

The funding profile for this program is flexible, but typically consists of four parts:

1. Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos. GRA support and travel for a ~16-week stay at LANL cost ~$45K. Note that the student can be at LANL at any time(s) during the year, and while summers are typical, we encourage other times as much as possible. Preferred by CSES would be a spring or fall timeframe.
2. Support for the Los Alamos PI to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).
3. Support for the Los Alamos PI to visit the university for periods of 1-2 weeks/year and support to the University PI to visit LANL for periods of 1-2 weeks/year (~$10K travel).
4. CSES Scholars Addendum for extended visits/sabbaticals (up to 30K, negotiable but dependent on available funding)

The individual funding items are negotiable with a total cap for the above not to exceed $70K/year of LDRD-type funding.

This program element does not support direct university funding (i.e. no subcontracts are awarded) of any kind unless exceptional circumstances are met (see below as an example). Note that while no direct funds flow to a LANL university partner, there are benefits to the University PI and the student:

a. The University Student Researcher requires no university financial support during the time spent at LANL (typically ~4 months/year).
b. LANL GRA rates are typically higher than many Universities' graduate salaries, helping to attract students to both the university and the CSES Student Fellow Program.
c. Exposure of the student to an outside organization with many career opportunities for post-doctoral work and beyond.
d. University PI travel support for LANL visits.

Only under exceptional circumstances, for example, when some of the required Ph.D. thesis work cannot be done at LANL (e.g. use of a unique university facility), will CSES be prepared to write a university subcontract for that part of the work. This must be clearly described in the proposal, with justification for why no alternatives are possible to complete the work.

Successful proposals need to include some form of matching support for the student from their universities or other institutions. Acceptable forms of matching support may be, but are not restricted to, those accepted by the National Science Foundation or other Federal research funding agencies.

Note that "matching support" here refers to university support (e.g., an assistantship provided by the university, waived or reduced academic fees, and travel or conference support) for the student at and from their university, to support the student outside of the time covered by the Student Fellow project at LANL. *The Student Fellow award is not intended to cover a student's full annual university-related expenses.*

Proposals may be submitted for collaboration with any national or international university.

Expectations

The Graduate Program's aim is to build and foster new and/or long-term relationships with University Researchers. This program is to be viewed as a stepping-stone for both the student (as a prospective LANL postdoc or staff member) and the LANL and University PI to build a strong relationship. The work performed here should be able to form the basis for a follow-on joint proposal by the LANL and University PI to a Lab internal or external funding source.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC summer schools. The student is expected to give a presentation on their work at a LANL internal seminar. The University PI is encouraged to offer a lecture in a NSEC summer school as part of their visit to LANL. The university PI is also encouraged to give a topical seminar on their research area during their visit to LANL.

3.1.2 PostBacc Program Outline

- Each proposal is required to have a Post Baccalaureate Student Researcher, and a Los Alamos National Laboratory PI/Mentor.
- The Post Baccalaureate Student is encouraged to continue with Graduate studies after their PostBacc or other career goals that align with LANL pipelining and external partnerships.
- The LANL PI / Mentor must be willing to use their academic and laboratory connections to help place the PostBacc into a downstream academic Graduate Program, assist on the path to conversion, and/or other career enhancing activities for the student.
- The LANL PI/Mentor and PostBacc student are encouraged to utilize other CSES programs for downstream Graduate work (e.g. the CSES Graduate program, Section 3.1.1)
- **Projects are typically 2 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a PostBacc Student Researcher and to help them be placed into a graduate program or staff career path of interest to LANL.

The funding profile for this program typically consists of two parts:

1. Support for the PostBacc Student Researcher for 50% of their annual cost (~$35-40K). A 50% cost sharing from line or program is required.
2. Support for the Los Alamos PI/Mentor to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).

The total cap for this program is not to exceed $55K/year of LDRD-type funding.

Expectations

The PostBacc Program's aim is to build and foster long-term relationships with Students that have shown an interest in working at LANL. This program is to be viewed as a stepping-stone

for both the student and the LANL PI/Mentor or a continuing relationship that follows the student through down-stream Graduate studies and possible downstream Postdoctoral or employment opportunities at LANL.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC center's summer schools. The student is expected to give a presentation on their work at a LANL internal seminar.

3.1.3 PostMasters Program Outline

- Each proposal is required to have a Post Masters Student Researcher, and a Los Alamos National Laboratory PI/Mentor.
- The Post Masters Student needs to have expressed a desire to continue with Ph.D. studies after their PostMasters at LANL or other career goals that align with LANL pipelining and external partnerships.
- The LANL PI / Mentor must be willing to use their academic and laboratory connections to help place the PostMasters into a downstream academic Graduate Program, assist on the path to conversion, and/or other career enhancing activities for the student.
- The LANL PI/Mentor and PostMasters student are encouraged to utilize other CSES programs for downstream Ph.D. work (e.g. the CSES Graduate program, Section 3.1.1)
- **Projects are typically 2 years in length.**
- **The Los Alamos National Laboratory PI/Mentor must submit the proposal.**

The objective of this program is to support a PostBacc Student Researcher and to help them be placed into a graduate program or staff career path of interest to LANL.

The funding profile for this program typically consists of two parts:

3. Support for the PostMasters Student Researcher for 50% of their annual cost (~$45-50K). A 50% cost sharing from line or program is required.
4. Support for the Los Alamos PI/Mentor to devote a significant fraction of their time to the collaborative research project and student mentoring (~$10-15K).

The total cap for this program is not to exceed $65K/year of LDRD-type funding.

Expectations

The PostMasters Program's aim is to build and foster long-term relationships with Students that have shown an interest in working at LANL. This program is to be viewed as a stepping-stone for both the student and the LANL PI/Mentor for a continuing relationship that follows the student through down-stream Graduate studies and possible downstream Postdoctoral or employment opportunities at LANL.

If offered and applicable, the student should be encouraged to participate in one of the CSES or other NSEC center's summer schools. The student is expected to give a presentation on their work at a LANL internal seminar.

3.2 Postdoctoral Program

3.2.1 Chick Keller Postdoctoral Fellow

LANL Named Postdoctoral Fellow program. Frequency of call: Typically, twice per year; at the December and May LANL Postdoc program Quarterly meetings, dependent on funding. Prospective applicants are advised to check with the CSES Leader to confirm whether applications for postdoctoral fellows are being accepted for a particular call.

Submission: Conforming to the LANL Postdoc's Office Quarterly meeting schedule
December Review - Submit early November, outcome mid-December, starts early in calendar year
May Review - Submit early April, outcome mid-May, starts next FY
http://www.lanl.gov/careers/career-options/postdoctoral-research/postdoc-program/postdoc-appointment-types.php

Selections: At the Quarterly meetings.
Program New Starts: As soon as both Postdoc Candidate is available and funding permits.
Program duration: 2-year maximum or 1 year for a 3rd year extension of an existing CK Fellow.

CSES may have a roster of up to 12 CK Fellows at any one time, about 1-2 per focus area. Approximately 2-4 new CSES Postdoctoral Fellows can generally be funded each year, although this number will fluctuate with available funding and number of applicants each year.

CSES will organize a CSES Symposium at end of summer for presentation of all projects in a given focus area. Presentations, publications, and copies of any resulting proposals submitted must be sent to CSES.

Program Outline

This program is aligned with the Lab's prestigious named Postdoctoral Fellow Program (Director's, Distinguished, Agnew, Metropolis). Candidates must meet the fellow's quality bar of the postdoctoral committee in order to be considered for the Chick Keller fellowship. CSES solicits postdoctoral research proposals from Los Alamos National Laboratory mentors for postdoctoral research on a new, independent, revolutionary scientific idea in the CSES focus areas. The emphasis here is on supporting new, emerging scientific areas rather than supporting postdocs in ongoing research areas.

- **Support is limited to 50% of the postdoc's salary in the first two years of the postdoc appointment. Third year support is limited to 25% of the postdoc's salary and is subject to a new proposal.**
- New postdocs or postdocs in their first year at Los Alamos are eligible.
- *While the proposed CSES work can be related to the research funding providing the balance of support to the postdoc, it cannot directly support tasks from the statement of work of that research funding. The CSES work must be clearly delineated from the other 50% of the postdoc's work.*

- **A Los Alamos National Laboratory Mentor must submit the proposal**. It is expected that the named postdoc provides a significant contribution to the writing of the proposal.

Expectations

The CSES postdoc program is designed to strongly align with LANL mission and downstream employability of the postdoc is a strong consideration. The postdoc is encouraged to present their work as part of internal seminars series.
The LANL mentor is expected to have identified funding from other program resources prior to submission to the CSES Postdoctoral Fellow Program. For 3rd year postdocs a viable path to conversion is expected to be in place, with strong programmatic support, which is why the CSES support level drops to 25%.

Eligibility

The CK fellows follow the general eligibility rules for Fellows as set out by the LANL postdoc program (https://int.lanl.gov/employees/postdoc-program/package-requirements/index.shtml).

Note that while CK Fellow applications can be submitted for a current LANL Postdoc within one year of hiring on at LANL, for Fellow application the Postdoc Office Package submission deadline must still be within the 5-year limit of completing all requirements for the Ph.D.

3.2.2 Research Associate

All Chick Keller candidates submitted to the postdoc office undergo an additional review by an internal CSES panel. Candidates that pass the Postdoc Program's Fellow screening process and that are also selected by the CSES panel will be awarded Chick Keller Fellowships, candidates that do not pass the Postdoc program's Fellow screening process but are selected by the CSES panel will be awarded as CSES Research Associates (RAs).

The RA is awarded where there are strategic programmatic considerations for a given candidate that make that candidate a particularly good fit for CSES. The RA operates in an analogous fashion to the CK fellow program. There is no special application process for the RA position; candidates should apply through the normal CK Fellowship (Section 3.2.1).

3.3 R&D and IPD Programs

3.3.1 Rapid Response Program

Small LANL project support. Open to all LANL staff , postdocs, and students to propose as PIs. **Timing and dates below are tentative. See the latest R&D Central announcement for the most up to date information.**

Rapid Response Research & Development (RR-R&D)
Frequency of call: once or twice per year, at the end of the FY for a Q1 start and in February/March for a Q3 start.
FY24 Submissions:

Round one - September, 2023 for October, 2023 Start
Round two - March, 2024 for April, 2024 Start
Round two supporting summer students - March, 2024 for April, 2024 Start

Special Rapid Response Research & Development (SRR-R&D)
Frequency of call: typically once per year.

FY24 Submissions:
September, 2023 for October, 2023 Start

Selections: Two weeks after submission. Projects must be completed in FY24.

At each selection date, proposals will be divided into three categories:

1. Fund Now – these will go forward immediately
2. Defer – these will remain on the books for this FY and be considered again at either the next selection date (together with any new proposals received), or if new funding becomes available. However, the PI is encouraged to resubmit the proposal at a new call, taking advantage of reviewer comments and discussion with the Focus Lead to strengthen the proposal. ***The deferred status expires at the end of the fiscal year at which point the proposal must be resubmitted to the new FY call***.
3. Do not fund – proposal is denied and can only be submitted again after a significant re-write.

We anticipate that up to ~12 S/RR-R&D studies may be supported throughout the fiscal year across all focus areas, although this number will fluctuate depending on available funding and number of proposals submitted. Projects with great student/postdoc involvement will be given priority, particularly those that could transition to a Student Fellows.

CSES will organize a CSES Symposium at end of summer for presentation of all projects in a given focus area. Presentations and copies of any resulting proposals submitted need to be sent to CSES.

While proposals along the lines of this call's focused science topics are encouraged, the program element is open to all new ideas relevant to the CSES discipline areas.

The Rapid Response Research and Development Program (RR-R&D) is funded out of the CSES LDRD (Funding type: LDRD) portfolio and ***can*** be used to support technical work.

Program Outline

CSES solicits proposals for studies that support small but crucial projects in support of new, high-risk ideas, feasibility studies or other basic R&D in support of upcoming proposal opportunities across the spectrum of LANL programs, and in the CSES Focus Areas. Scientific feasibility analyses are reserved for revolutionary scientific ideas that are mission relevant, at their early stage of development, and involve a multi-disciplinary approach.

Funding maximums for both RR and SRR are $70K, and the program is open to participation by all Los Alamos National Laboratory staff, postdocs, and students.

Expectations

We encourage new ideas and high-risk concepts – and here failure (showing what will not work) is considered a success. Work should be aimed at upcoming new proposal opportunities and other LANL mission or strategic initiatives.

CSES will organize a CSES Symposium at end of summer for presentation of all projects in a given focus area and for each RR and SRR-R&D topic. Participants will also be asked to present their work in topical seminar areas internally. Presentations and copies of any resulting proposals submitted need to be sent to CSES.

3.3.2 Special Rapid Response R&D

The Special Rapid Response Research and Development Program (SRR-R&D) is funded out of the CSES LDRD (Funding type: LDRD) portfolio and ***can*** be used to support technical work.

Program Outline

This is a special subset of the normal RR-R&D program designed to address special topical and strategic opportunities for which there is a desire to nucleate LANL capability. Topics are more narrowly defined typically multi-disciplinary and straddling more than one of the CSES science disciplines or related disciplines, if not multi-Center across NSEC.

CSES will define a few SRR-R&D topics in each call for proposals, but is open for new SRR topics that may arise throughout the FY and for which new funding can be identified.

Projects are formally evaluated at the end of year Symposia and by the CSES leadership team. The form of follow on funding is flexible, but student involvement is particularly encouraged and conversion to a Student Fellows award is an option. The intent is to support new and promising research topics/ideas to the point of maturity that makes them eligible for other, larger funding opportunities and programmatic support outside of CSES.

Cross division teaming is required for SRR proposals.

3.3.3 Institutional Program Development

The Institutional Program Development Program (IPD) is funded out of the CSES G&A (Funding type: Indirect) portfolio and ***cannot*** be used to support technical R&D work.

Program Outline

CSES solicits proposals for appropriate indirect support. We further invite proposals that meet the requirements laid out in the TED (Technology Evaluation and demonstration) Fund

Call, specifically projects that catalyze innovation in the CSES Science discipline areas. This includes technology assessments; activities performed to evaluate and assess the applicability of capabilities and existing technologies for institutional or multi-program use. Exploring whether known scientific or engineering technologies, approaches or techniques are applicable to current and emerging needs:

1. Analysis of practicality
2. Technology evaluation – assessing capabilities of existing technology, including reuse in new applications or at extended scales
3. Demonstrations where the cost and benefits of a system are being validated for a specific use case.
4. Other activities appropriate for indirect funding such as workshops, as proposal writing, white paper idea development, and collaborative visits, etc.

Again, no research development can be undertaken in these projects, as the objective is to demonstrate performance for existing technologies, not to develop new technologies.

Funding maximum is up to $45K, though projects are typically funded in the $5-$10K range. The program is open to Los Alamos National Laboratory staff, postdocs, and students. Requests are evaluated as received throughout the FY, with no due date.

Expectations

The PD work is expected to be strongly aligned with upcoming proposals opportunities or other LANL strategic initiatives.

3.3.4 CSES Scholars

This work may be funded by a combination of R&D and/or Indirect funds, depending on the work to be performed (see sections 3.3.1 - 3.3.3)

Program Outline

CSES in its previous incarnations as IGPP historically supported an occasional visiting scientist. This element is now formalized as "CSES Scholars," supporting either academic visitors on sabbatical to LANL or LANL staff extended visits to universities. Priority will be given to LANL staff or university researchers who have or are seeking Joint Appointments.

Funding maximum is defined in Student Fellows, Rapid Response, and/or Program Development (sections 3.1.1, 3.2.3, and 3.2.4). Cost sharing outside of CSES required.

Expectations

The Scholar's work is expected to be strongly aligned with upcoming proposals opportunities or other LANL strategic initiatives, and should pave the way for expanded collaborative opportunities.

3.3.5 NASA Mission teaming and planning

CSES received a small windfall in the form of donated prize money from Michelle Thomsen's (ISR-1, retired, Lab fellow) 2019 National Academy of Sciences (NAS) Arctowski Medal. Award. Michelle set up the following statement of work for these funds:

"The incoming funds from the National Academy of Sciences will be used to support conference, workshop and seminar travel for scientists and instrument engineers in the field of Space and Planetary Science, with the aim of fostering new and existing collaborations to eminent research universities and institutions. The funds will be administered through NSEC at the Center for Space and Earth Science supporting CSES workshops, conferences, and seminar series."

We invite here special Program Development (PD, see Section 3.3.1) proposals specifically aimed at teaming and brainstorming activities with outside institutions with the aim of positioning and partnering LANL for new opportunities in NASA Missions.

The NAS funds can be used for inviting and supporting travel by external SME's to LANL, particularly for small workshop attendance.
RR-IPD funds can be used to support the organizational activities by the LANL proposer/team.

Proposers are asked to prepare a normal PD proposal in which they specifically list and cost the set of external SME's supported by NAS funds.

3.4 Strategic University Partnership

New for FY 24, this element seeks to enhance LANL partnership with a university that has an existing Institutional Agreement with LANL as a ReACT partner. Currently, University of Alaska, Fairbanks is the designed Strategic Partner. This partnership will be evaluated at the cadence of CSES external reviews as indicated in the NSEC charter, at which time the partnership will either continue or another university will be identified.

Program Outline

CSES program elements Student Fellows, S/RR, IPD, Scholars may indicate connectivity to the Strategic Partner University on the cover page form. The main purpose for this program element is to establish new and significant university partnerships in areas of research that LANL wants to develop in partnership with the university. One aim is to provide access to LANL to areas of scientific expertise that are weak or lacking at the lab but for which there is a clear strategic need.

Expectations

One or more of the LANL and university participants should have or be actively pursuing a Joint Appointment. The participants in this program should be able to identify how the evolving partnership would fulfill broader LANL strategic objectives.

4 Proposal Process

4.1 Proposal Preparation

Each program has unique proposal requirements described below. Please refer to your specific program element to be sure your proposal is in compliance, particularly within page limits. Proposals not in compliance with the requirements may be returned without review. PIs are strongly encouraged to read the review criteria and work with the relevant Focus Area Lead on proposal development in order to enhance the potential success of their submissions.

4.1.1 Student Fellow Program

Cover Sheet. Please use the CSES fillable PDF cover sheets, available on the CSES website, CSES.lanl.gov. To ensure receipt of the proposal, please send completed package to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic.

I. Page one
   a. General information
II. Page Two
   a. Roles of Proposing Team
      i. Role of LANL PI, including efforts at mentoring
      ii. Role of University Principal Investigator, if applicable
         1. Indicate if either of the above are seeking CSES Scholar support
      iii. Role of student
      iv. Other participants
   b. PI-SATS
      i. If applicable, pipelining/workforce development components, other information relevant to the focus area and program element
   c. Strategic University Partnership
      i. If applicable, description of the connectivity to the current Strategic University Partner
      ii. Goals specific to this partnership

Proposal Package. Use the following formatting outline for the proposal, with a **five page** limit for sections I-V, no page limit for references (VI), **one page** limit for VII (Scholars Addendum, if applicable), **one page** limit for VIII (budget), and **one page** per staff/PI bio sketch (IX).

I. Theoretical, numerical, or experimental activity. Methods used, history of problem, scientific debate, hypotheses to test
II. Any relevant leveraging or necessary coordination, e.g., other projects or facilities
   i. Building upon previous CSES RR/SRR projects
III. Resources to be used in the project such as resources at Los Alamos National Laboratory, at the university, if relevant
IV. Statement of Work (Tasks to be performed, Milestones)
V. Significance and timeliness
   i. How does this research support the CSES focused science topics?

ii. What is the significance of the project? Why Now? Who will use the results?

VI. References

VII. CSES Scholars addendum, if applicable

i. Description of the work to be performed by CSES Scholar

ii. What is the expected broader impact of this portion of the proposal? How will this engagement enhance LANL institutional objectives?

iii. Brief budget justification for this portion of the proposal

VIII. Budget summary (1 page max). *PEM sheets not required*. Totals by fiscal year and cumulative for multiyear projects. See Appendix A: Scientist/Researcher Student Salary Structure and Appendix B: Indirect and LDRD Salary Rates for budget information to help you estimate your T&E on your project.

i. Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos.

ii. Support for the Los Alamos PI to devote a significant fraction of their time to the collaborative research project.

iii. Support to the University PI to visit LANL, if applicable

iv. Other Travel

v. Supplies & Equipment

IX. Biographical sketches of PIs including already identified student, ~1 page each. Note: Identification of a named student is desirable but not essential for top tier selection.

4.1.2 Chick Keller Postdoctoral Fellow Program

New CK Fellow Applications

New Chick Keller Fellowship application will be administered through the Los Alamos Postdoc Program in an analogous manner to the already existing named Postdoctoral Fellow programs (Director's, Agnew, Metropolis). Please prepare a normal Postdoc Named Fellows package as outlined by LANL's PostDoc program.

https://www.lanl.gov/careers/career-options/postdoctoral-research/postdoc-program/postdoc-application-process.php

A LANL mentor needs to submit the package, together with the CSES memo (see below).

CSES memo

As part of your submission you are required to submit a one-page CSES justification memo. This memo needs to address the following:

- How the proposed research contributes to the focused science topics of CSES (includes PI-SATS)
- How the proposed CSES 50% work differs from the main Postdoc Research proposal. ***The CSES project must be clearly delineated from the other 50% of the postdoc work.***

Because of the 50% CK / 50% Other dual funding nature of the CK Fellowship Proposers MUST exercise care in differentiating the work scope between the work performed for the two funding sources. In the required CK memo, the distinct work scope of the CSES related work must be clearly identified and be distinct form the general Postdoctoral research statement. Topics may be related, but cannot have overlapping work statements.

As one of the objective of the CK Fellow Program is pipelining for staff conversion, CSES also looks at the particular mix of funding, which should be highlighted in the memo. The 50/50 funding objective is to have one half of the funding come from somewhat more programmatic and more long-term source at LANL, which ideally should help with conversion prospects for the PostDoc, while the CSES funding covers more basic research aspects.

Third year CK Fellow Applications:

Follow the normal PostDoc program directions for submitting the third year extension memo (http://int.lanl.gov/employees/postdoc-program/mentors/extensions/third-year-extensions.shtml), and submit this memo to both the postdoc office and to CSES@lanl.gov.

In addition, a CSES memo as outlined above also needs to be submitted to CSES. Third Year CK funding is generally intended for PostDocs that have a clearly identified path towards conversion.

4.1.3 Rapid Response/Special Rapid Response R&D

4.1.3.1 R&D Program

Cover Sheet. Please use the CSES fillable PDF cover sheet, available at the CSES website, CSES.lanl.gov. To ensure receipt of the proposal, please send completed package to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic. Please download the PDF to fill in and submit, do not fill in on the browser. **Note cross division teaming is required for SRR proposals.**

I. Page one
   a. General information
II. Page Two
   a. Roles of Proposing Team
      i. Role of LANL PI and team
         1. CSES Scholar support brief justification
   b. PI-SATS
      i. If applicable, pipelining/workforce development components, other information relevant to the focus area and program element
   c. Strategic University Partnership
      i. If applicable, description of the connectivity to the current Strategic University Partner
      ii. Goals specific to this partnership

Proposal Package. Use the following formatting suggestions for the main body, limited to **two pages** of text and figures (for Sections I through V), no page limit for references (VI), **one page budget justification**, plus **one page** biographical sketches for each team member (VII).

I. Statement of problem to be addressed (please indicate any time constraints, e.g. proposal deadlines).
II. Statement of Work
III. Significance and Timeliness
IV. Description of follow on support and funding opportunities (beyond CSES) appropriate to the work with relevance to lab mission and future programmatic support
V. Short budget justification, **can be a full additional page**. *PEM sheets not required*. See Appendix A: Scientist/Researcher Student Salary Structure and Appendix B: Indirect and LDRD Salary Rates for budget information to help you estimate your T&E on your project.
NOTE:
RR-R&D and SRR-R&D proposals should be priced with LDRD labor rates
RR-IPD proposals should be priced with Indirect labor rates
VI. References
VII. Bio sketches. No more than 1 page per team member

4.1.3.2 IPD Program

Submissions to the IPD program will utilize the template common to Division and Program Offices. Please contact the CSES Program Coordinator for a copy of the template. See Section 3.3.3 for description of the IPD Program Element. To ensure receipt of the proposal, please send completed form to CSES@lanl.gov and the Focus Area Lead(s) relevant to your topic.

4.1.4 General Instructions

While CSES may be able to support publication page charges, such charges are NOT to be included in the proposed budget. PI's are asked to send an email to the CSES Director requesting funds on an as needed basis to cover publication page charges. Note that funds are limited to support publication costs and are generally capped at ~$500, so care should be taken when considering where work will be published and additional sources of support for publication costs should be exhausted first.

4.2 Submission process

Proposals (cover pages and completed proposal package) must be submitted by email to be received by the proposal's program element deadline. **See the latest R&D Central announcement for the most up to date deadline information.**

NOTE: All Student Fellow, Rapid Response, Special Rapid Response, and Institutional Program Development proposals must be submitted to CSES through the Los Alamos Principal

Investigator. Chick Keller Postdoc packages are submitted to the LANL postdoc office, including the required CK CSES memo.

Please mark the subject line of your email with the program element and science discipline area, for example:

Subject: CSES Student Fellow/Astro Proposal Submission

Send to: CSES@lanl.gov with copies to the appropriate discipline leader:

- Astrophysics & Cosmology (Ingo Tews; itews@lanl.gov)
- Heliophysics (Gian Luca Delzanno; delzanno@lanl.gov)
- Planetary Science (Ann Ollila; amo@lanl.gov)
- Geophysics (Youzuo Lin; ylin@lanl.gov)
- Earth Systems (Sanna Sevanto; sanna@lanl.gov, Turin Dickman; lee@lanl.gov)
- Biological Systems (Jeanne Fair; jmfair@lanl.gov)
- PI-SATS (Ann Ollila; amo@lanl.gov, Peter Bloser; pbloser@lanl.gov, Gian Luca Delzanno; delzanno@lanl.gov)

A confirmation of receipt will be sent by email to the Principal Investigators of each proposal.

4.3 Review Process

All proposals undergo peer review. There is a separate review panel for each discipline area or Special Rapid Response Call, which consists of the Focus Lead or SRR coordinator and their team, and which is augmented by external review members of subject matter experts primarily from academia when needed.

4.3.1 Review Criteria

For R&D proposals, we follow here a similar set of criteria in the spirit of the Laboratory's LDRD review process, scaled and adjusted to the size and scope of CSES projects and programs, see Table 1.

Table 1: RR-R&D Criteria

	Mission Agility (15%)	**Technical Vitality (50%)**	**Research Approach (15%)**	**Follow on and Development (20%)**
	Will the proposed work create new S&T approaches and capabilities that are relevant for Los Alamos emerging missions?	*Is the proposed work innovative and creative? Will it make an impact on its technical field as appropriate for the scale of the investment? Is the work high-risk, high return?*	*Does the proposal demonstrate sufficient background research and knowledge to conduct the work? How well conceived and organized is the proposed activity?*	*Is there a well identified and feasible sponsor for follow on proposals? Does the proposal provide opportunities for pipelining and/or leadership development?*
5	High quality in nearly all respects, should be supported if at all possible.	Potential for fundamental advance and/or a new approach to expanding our knowledge; and/or new methods, processes, tools or devices. **Work is truly innovative and high-risk.**	Clear and well-designed research approach. Background is well justified and clearly described.	Appropriate follow on sponsor identified, good chance of success. Excellent student/EC involvement and opportunities for growth.
3	Very Good proposal with important objectives	Work may need to be distinguished more clearly from previous efforts. Innovation less than striking.	Research approach may be somewhat unclear, or of incompatible scope.	Some follow on sponsors mentioned, moderate chance of success. Some pipelining/workforce development.
1	Lacking in one or more critical aspects. Lack of innovation, key issues not addressed, no follow on, no workforce development, unclear plan - rendering the proposal uninteresting.			

For Institutional Program Development proposals we use the criteria as listed in Table 2 below, again using the 1-5 scale for ranking.

Table 2: IPD Criteria

	Overall	Application / Impact on Mission	Project Approach
5	Excellent with at most minor strategic weaknesses, deserves highest priority for support	Potential for high impact on mission, Targets an important opportunity	Clear and well-designed demonstration approach
3	Very Good proposal with important objectives	Potential impact clear but limited	Approach may be somewhat unclear, or of incompatible scope.
1	Lacking in one or more critical aspects. Approach not feasible, or impact lacking, rendering the proposal uninteresting.		

In particular, reviewers are asked to judge proposals on these additional points specific to CSES:

- This call establishes the Mission relevance of the CSES focused science topics, and the proposal must clearly address these topics and show relevance to CSES goals.
- **CSES programs are intended to be innovative and risk tolerant**. Proposals clearly need to address a new and innovative aspect, and while high-risk is encouraged, the proposal needs to justify these risks.
- CSES programs support NSEC's goals of growing university interactions, educating present and future scientists and engineers, and recruitment or retention of technical talent.
    - **Student Graduate Fellow–** show how the project will be used to build university interactions and if there is a viable onward path for the students into LANL.
    - **Student PostBacc and PostMasters Fellow –** show path towards into a downstream academic Graduate Program or as LANL staff
    - **Rapid Response –** show how this project aides the career development of its PI and/or participants.
    - **Chick Keller Postdoc –** show that the Postdoc's work is in an area that could provide a "landing zone" for conversion.
    - **All submissions to PI-SATS** – in addition to meeting criteria of an "applied" project, proposals must demonstrate strong student/postdoc involvement and/or workforce development
    - **CSES Scholars** – show that the work supports the Joint Appointment program and/or strengthens LANL university partnerships
    - **Strategic University Partner** – proposals must demonstrate how the proposed work would strengthen the partnership and the key role the university plays in the work
- While for Rapid Response program relevance to the CSES focused science topics *is desired, it is not required.* Highly innovative and new proposals that go beyond the specific topics identified in this call are encouraged, but have additional requirements:

- The proposal needs to outline why the proposed work is, or should be, mission and CSES relevant.
- The proposal needs to address "why LANL" and "why now".

Notification of proposal award will be made according to the schedule for the program element as outlined in Section 3. For proposals utilizing the following fiscal years funding, please be aware of the budget caveats (Section 4.4).

In preparing proposals, PIs should be aware of these factors that contribute to successful proposals:

- Proposals that are genuinely new, innovative, and not incremental.
- High-risk, with potentially high-reward down the road – even the answer "now we know we can't do it this way" is a successful outcome for our awards.
- Great university interaction as evidenced by significant student time at LANL, PI visits to the university (present seminar), university Mentor visits to LANL (present seminar).
- Good use of unique LANL facilities.
- Has strategic value to LANL.
- Identified follow on to the project in external proposal opportunities and/or internal programmatic support
-

4.3.2 Conflict of Interest

CSES is committed to a fair review process and will adopt guidelines similar to those used in the Lab's LDRD proposal review process. In addition:

1. CSES Director and Focus Leads are not allowed to submit or be PI of CSES proposals.
2. CSES External Review Committee Members may not be external reviewers if their institution is a University partner on any of the CSES proposals in a given discipline area.
3. LANL reviewers may not be PIs, Co-PIs on proposals they review.
4.

4.3.3 Written Proposal Feedback

All CSES proposals will receive a short written email feedback within a few weeks of review. Unsuccessful PIs are encouraged to discuss their proposal with their respective Focus Lead to develop strategies that can lead to a successful future CSES submittal.

4.4 Budget Caveats

CSES will make every effort to honor the budget requests in the original proposal. However, CSES is dependent on budget resources that at most are known for the current fiscal year only. The CSES research portfolio is funded by the Lab's Laboratory Directed Research and Development Program (LDRD), which is subject to Congressional approval. Thus, CSES project funding will always be subject to available funding from the LDRD Office.

New or renewal proposal awards will always be subject to some uncertainty on the available funding. This can lead to awards with a reduced budget, or in the worst-case award cancellation. CSES will inform awardees of final proposal budget as soon as the next year's budget is known, typically within a few weeks of the start of the fiscal year (October). For multi-year or follow on awards, subsequent budget allocations will be based on previous year spending patterns.

CSES aims to support as many projects as are deemed meritorious by the review process and this often causes some fluidity and uncertainty within a given FY for these many small projects supported by the Center. It's typical for PIs to start the FY at a lower than requested amount and then receive additional funds once their initial allocation is spent. Additional fund priority is given to PIs that begin their projects early in the FY and have made significant progress by Q3.

CSES assumes that the proposal cost is accurate when a project is approved for funding; CSES expects the out year budgets to be as originally proposed and approved. Requests for changes in funding must be well justified and will be considered on a case-by-case basis.

4.5 Miscellanea

4.5.1 Authority to start work

Because all CSES funding is dispersed at LANL, any work by a LANL employee can only start once a valid program code has been established for the project. University student visits cannot commence before that time. Projects do not officially begin work until after the Project Kickoff Meeting has been held so the CSES Director and PI may review the project for any special considerations (see also 4.5.2 below).

For the rare cases where a project involves a University subcontract, work cannot begin until the Los Alamos contracting officer formally authorizes the initiation of work. There will likely be a delay of a number of months (no earlier than December 1 of a given year, but commonly up to 9 months) when the "start work" order is issued. Invoices submitted for work conducted prior to the "start work" order will not be reimbursed.

4.5.2 Facility, Safety, and Security considerations

It is the responsibility of the PI to ensure all facilities indicated in the proposed work will be accessible to the team and work will be able to be completed safely and timely in order to achieve project success.

CSES does not typically support rad work. If a rad code is required to perform some or all of the proposed work, the PI must discuss logistical practicalities of this with the Director well in advance of the proposal submission.

Classified work is not generally supported within CSES. If a proposing team wishes to submit a classified proposal, this must be discussed well in advance with the Director to determine feasibility of proposal review and project execution.

4.5.3 Further information

CSES: http://CSES.lanl.gov
CSES general email: CSES@lanl.gov

Sarah Balkey, Professional Staff Assistant, slbalkey@lanl.gov, 505-667-8777
Lisa Danielson, Director, ldanielson@lanl.gov, 505-695-4514

Appendix A: Scientist/Researcher Student Salary Structure

This table is current as of February 2022 version can be found at
http://int.lanl.gov/employees/education/mentors-liaisons/index.shtml

Scientist/Researcher Salary Structure

High School Internship Program		Annual	Hourly
High School/PostHigh School	High School Senior	$29,111	$14.00

Undergraduate Program: Students pursuing Associate's and/or Bachelor's Degrees		Annual	Hourly
HS+0	HS Grad & Acceptance to College	$33,280	$16.00
HS+1	Completion of first academic year and a minimum of 24semester hours	$35,360	$17.00
HS+2	Completion of second academic year and a minimumof 48 semester hours (salary cap for students pursuing an Associates Degree)	$39,811	$19.14
Post Associates 1	Post Associates 1 Completion of an Associate's Degree, not continuingonto a Bachelors program (Limited to a 2-year appointment)	$42,682	$20.52
Post Associates 2	Post Associates 2 Completion of an Associate's Degree, and one year as a LANL Post Associates Intern (Limited to a 2-year appointment)	$45,552	$21.90
HS+3	Completion of third academic year and a minimum of72 semester hours (15 hours must be upper-division coursework)	$51,771	$24.89
HS+4	Completion of fourth academic year and a minimum of96 semester hours	$57,990	$27.88
Post Baccalaureate 1	Bachelor's Degree Awarded (Limited to a 2-year appointment)	$60,278	$28.98
Post Baccalaureate 2	Bachelor's Degree Awarded and completion of one year as a LANL Post Baccalaureate Intern (Limited to a 2-year appointment)	$62,566	$30.08

Graduate Program: Students pursuing Masters and/or PhD Degrees		Annual	Hourly
BS+0	Bachelors Degree Awarded Accepted/Enrolled In a Graduate Program	$64,854	$31.18
BS+1	Completion of first academic year and a minimum of 12hours of Graduate coursework	$67,142	$32.28
BS+2	Completion of second academic year and a minimum of24 hours of Graduate coursework (salary cap for students pursuing a Masters Degree)	$69,389	$33.36
Post Masters 1 BS+3 or MS+0	Master's Degree Awarded or completion of third year in aPhD program (Post Masters, limited to a 2-year appointment)	$72,800	$35.00
Post Masters 2	Master's Degree Awarded and completion of one year as a LANL Post Master's Intern (Post Masters limited to a 2-year appointment)	$76,960	$37.00
BS+4 or MS+1	Satisfactory progress towards doctoral degree (e.g.dissertation/thesis work - -1hr. minimum credit per semester)	$79,123	$38.04
BS+5 or MS+2	Satisfactory progress towards doctoral degree (e.g.dissertation/thesis work- - 1hr. minimum credit per semester) (Salary cap for PhD students)	$80,475	$38.69

PPO 2/14/22

Appendix B: Indirect and LDRD Salary Rates

This table is current as of February 2020. Indirect rates are used for the Rapid Response IPD program, LDRD are used for all other programs.

Use your salary and your student's / postdoc's salary from Appendix A to find the corresponding salary range in the "Funding Type" Column below. Read across to find the corresponding cost for indirect / LDRD projects.

Example: A postdoc that earns $90K a year puts in for a $70K RR R&D project, of which $40K is for the PostDoc. Their hourly rate on LDRD is $71.12 and they can thus spend 562 hours (~14 weeks) on the project.

FUNDING TYPE			INDIRECT		LDRD RAD/NON-RAD	
Resource Name	FTE	Hours	ANNUAL	PER HOUR	ANNUAL	PER HOUR
HS COOP 20000 - 34999.99	1.00	1,828	32,355.60	17.70	37,620.24	20.58
Student 20000 - 34999.99	1.00	1,828	40,874.08	22.36	47,509.72	25.99
Student 35000 - 49999.99	1.00	1,828	57,874.48	31.66	67,270.40	36.80
Student 50000 - 64999.99	1.00	1,828	77,324.40	42.30	89,882.76	49.17
Student 65000 - 79,999.99	1.00	1,828	91,363.44	49.98	106,206.80	58.10
Student - 80,000 - 94,999	1.00	1,828	109,040.20	59.65	126,753.52	69.34
Postdoc 65000 - 79999.99	1.00	1,828	103,592.76	56.67	120,428.64	65.88
Postdoc 80000 - 94999.99	1.00	1,828	111,837.04	61.18	130,007.36	71.12
Postdoc 95000 - 109999.99	1.00	1,828	129,038.52	70.59	150,005.68	82.06
Postdoc 110000 - 999999.99	1.00	1,828	150,608.92	82.39	175,085.84	95.78
35000 - 49999.99	1.00	1,757	72,739.80	41.40	138,504.31	78.83
50000 - 64999.99	1.00	1,757	89,290.74	50.82	170,007.32	96.76
65000 - 79999.99	1.00	1,750	110,565.00	63.18	210,507.50	120.29
80000 - 94999.99	1.00	1,750	132,947.50	75.97	253,137.50	144.65
95000 - 109999.99	1.00	1,750	154,735.00	88.42	294,612.50	168.35
110000 - 124999	1.00	1,750	178,167.50	101.81	339,237.50	193.85
125000 - 139999	1.00	1,737	199,581.30	114.90	380,003.49	218.77
140000 - 154999.99	1.00	1,737	222,058.08	127.84	422,803.17	243.41
155000 - 169999.99	1.00	1,737	245,594.43	141.39	467,617.77	269.21
170000 - 184999.99	1.00	1,737	267,741.18	154.14	509,774.76	293.48
185000 - 199999.99	1.00	1,737	291,138.57	167.61	554,328.81	319.13
200000 - 214999.99	1.00	1,737	305,920.44	176.12	582,468.21	335.33
215000 - 229999.99	1.00	1,737	327,268.17	188.41	623,114.01	358.73
230,000-244,999	1.00	1,750	352,747.50	201.57	671,632.50	383.79
Non manager >=245,000	1.00	1,750	412,090.00	235.48	740,932.50	423.39
Management >= 245,000	1.00	1,750	449,732.50	256.99	808,622.50	462.07