CSES 2019 Call for Proposals (FY20 New Starts)

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1 Introduction

The Center for Space and Earth Science (CSES) at Los Alamos National Laboratory (LANL) is one of the Science Institutes in the Lab's National Science Education Center (NSEC). It covers five specific science disciplines, each directed by a focus leader:

- Astrophysics and Cosmology (Chris Fryer; fryer@lanl.gov)
- Space Science   (Vania Jordanova; vania@lanl.gov)
- Planetary Science (new)   (Nina Lanza [acting]; nlanza@lanl.gov)
- Geophysics   (Char Rowe; char@lanl.gov)
- Earth Systems   (Sanna Sevanto; sanna@lanl.gov)

1.1 CSES Science Discipline Portfolio

Astrophysics and Cosmology - with the goal of advancing theoretical, modeling, computational and experimental sciences that map to capabilities needed 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).

Space Science - with the goal of advancing our understanding of the space environment from the Sun to the Earth and beyond, and particularly understanding how the space environment affects the systems in space that support security and quality of life in our increasingly technological society.

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.

Geophysics - with the goal of advancing theoretical, experimental, modeling, and simulation studies that address fundamental issues 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. Changes may include physical configuration of geomaterials, behavior of fractures, fluid migration, magnetic or electrical properties, and variations in density or material strength. The overarching goals of this focus is twofold: improving both our *sensing* capability and our *predicting* capability.

Earth Systems - with the goal of advancing and integrating theoretical, modeling, simulation, sensing, observational, and experimental sciences that push the frontiers of predictability of complex natural systems, their variability, interdependence and responses to forcing, as well as human interactions with these systems. These systems include the subsurface and soil, the biosphere,

biogeosphere, cryosphere, hydrosphere, atmosphere, and anthoposphere of planet Earth at multiple scales, as well as human interactions with these systems.

1.2   CSES Strategy

As one of the six strategic centers organized under the NSEC, CSES is chartered to foster high quality research efforts, specialized recruiting, and strategy development within its assigned scientific discipline areas.

The main purpose of strategic centers is to:

1. Focus, laboratory wide, on strategically important areas of science, engineering, or technology that span areas of expertise beyond that residing in any single management structure,
2. Provide external visibility and collaboration in strategic areas of need, that require a single laboratory voice,
3. Provide education of present and future scientists and engineers that are required to maintain LANL competency,
4. Help with recruitment or retention of technical talent.

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 ("Proud Legacy, Bold Future") 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, such as the DOE/NNSA "Prevent, Counter, and Respond—A Strategic Plan to Reduce Global Nuclear Threats (FY 2016–FY 2020)" report along with the DOE/NNSA "Stockpile Stewardship and Management Plan", the DOE "Strategic Plan 2014-2018", and the science research priorities as set out by the DOE Office of Science Funding Calls.

For CSES there is also a large overlap in the CSES science disciplines with NASA's Science Mission Directorates in the areas of Planetary Science, Earth Science, Astrophysics and Heliophysics, and CSES is interested in supporting capability 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 visible outlet for LANL excellence not available in other programmatic areas.

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.

Each CSES call for proposals highlights a set of focused science topics for each of the four 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 (See Section 2).

We particularly encourage young 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 LANL funding.

1.3   NEW / Changed in this call

Please pay particular attention to the following new or changed items.

1.3.1   New Focus Area

We introduce a new Focus area – Planetary Science. This area has been a poor cousin arbitrarily assigned to either the Space or Geoscience Focus area, but as a growing program at LANL, with one of the most visible projects being ChemCam on the Mars Rover, this area deserves its own Focus area and Focus lead. A new set of focused science topics have been added – see Section 2.3.

1.3.2   Program Elements Update

1. "Emerging Ideas" are dead, long live "Rapid Response"! CSES has been asked to align the name of this program with other centers (ISTI and IMS) who use the "Rapid Response" name. So with this call we follow suit (Section 3.3).

2. We introduce a new Program Element on NASA mission participation teaming and brainstorming. This is a new subset of the already existing Rapid Response Program Element, see section 3.3.2.
3. The *Chick Keller Postdoctoral Fellowship* (Section 3.2), will accept nominations at each one of the quarterly Postdoc Committee review meetings, starting with the December 2019 quarterly. CK Fellows are NOT solicited for the May and August 2019 quarterly.
4. The *Large University Program* is not offered in this call. Next opportunity will be in the FY20 call for FY21 new starts.

1.3.3 Chick Keller Post-Doctoral Fellow Caveats

In recent CK Submissions there has been some confusion on the requirements of the CK Memo, and the reasoning behind the 50/50 funding split - which is addressed in this call (Section 4.1.2). Please note that 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, that is part of the PostDoc submission package, the distinct work scope of the CSES related work must be clearly identified and be distinct form the general PostDoctoral research statement.

As one of the objectives 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 required CK 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.

2 Focused Science Topics

Proposals for Program Elements 0 (Student Fellow Program), 3.2(Chick Keller Postdoctoral Fellow Program) and 3.4 (Large University Program) need to address the focused topics in their science discipline area as outlined below.

Note Section 2.3: NEW Focus area for Planetary Science

2.1 Astrophysics and Cosmology

Astrophysics and Cosmology in CSES is closely aligned with the two of the focus areas of the Nuclear and Particle Futures (NPF) Pillar - Nuclear, particle, Astrophysics and Cosmology (NPAC) and High energy density physics and fluids (HEPF&F). Furthermore, Astrophysics and Cosmology are relevant to some of the goals described in the Science of Signatures Pillar as well.
See http://www.lanl.gov/science-innovation/pillars/sos/index.php and http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

Focus area

We emphasize advanced research in observation, theory, simulation, and instrumentation that strives to achieve fundamental understanding of the universe. In addition, this focus area benefits from and in turn strengthens its strong overlap with many on-going Laboratory programs in areas such as nuclear physics, particle physics, weapon physics, plasma physics, and condensed matter physics. It further utilizes and leverages the facilities and observatories both inside and outside of the Laboratory. We are interested in proposals that are innovative and forward-looking, especially those with strong potential leading to new capabilities and research directions.

It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory is involved:

1. Facilities such as the HAWC, Raptor, ZTF, LSST, LANSCE, etc.
2. Computational techniques, codes and resources, such as VPIC, FLAG, RAGE, Ristra, etc.
3. Broad knowledge base in a full range of physics that tie together theory, simulation, experiments, and observations

Specific Topics for new projects starting in FY20:

Overall theme is to conduct cutting-edge research that enables breakthroughs in our understanding of Astrophysical Transients through innovative uses of unique LANL observational, theoretical, numerical and experimental capabilities. The area of Astrophysical Transients is a rapidly developing field in astrophysics, e.g., discoveries of gravitational wave sources, fast radio bursts, etc. The likely engines for such transients are astrophysical compact objects such as black holes, neutron stars and stellar explosions. Most of these subjects are tied closely to LANL expertise. Transients connect much of the natural phenomena observable in our universe to similar physical processes in LANL programmatic areas of the high temperature and

pressure, often turbulent physical regimes, while being at the forefront of current astrophysical research, and having the capability of attracting the brightest minds to Los Alamos.

1. **Advancing theory and modeling capabilities.** Development that sheds light on understanding Astrophysical Transients will be emphasized. Some examples include:
   a. Nuclear Astrophysics (leveraging nuclear physics expertise at LANL).
   b. Applications of ASC codes to problems focused on astrophysical transients. Simulation codes in general that are suitable for Exascale Computing platforms to study systems with radiation magnetohydrodynamics, charge particle energization and transport connecting fluid and kinetic regimes
   c. Close collaboration between theory/modeling and observations of astrophysical transients.
   d. Potential applications include 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.

2. **Developing new technologies and tools.** Support activities that will develop new technologies and tools that contribute to new missions and facilities. These new missions and facilities should be strongly connected with Astrophysical Transit sciences. Some examples include:
   a. Data mining and machine learning for ground- and space-based detectors
   b. Optical, X-ray and gamma-ray transient detections (possible NASA missions)
   c. Laboratory plasma experimental innovations investigating astrophysical processes

3. **Supporting upcoming NASA Astrophysical Mission participation**. 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., AMEGO, the All-sky Medium Energy Gamma-ray Observatory, TAP - Transient Astrophysics Probe, LOX - Lunar Occultation Explorer, Astrophysical Transient Probe).

In addition, proposals that demonstrate strong collaborations (both internally and externally) as well as branch out to new Astrophysical Transit science areas are particularly encouraged.

2.2   Space Science

Space is one of the six leadership areas of the SoS pillar. The SoS strategy document lists goals for Space, and the topics chosen should relate to them. Space is also relevant to some of the goals of the Nuclear Event Characterization leadership area of the SoS pillar.
Refer to http://www.lanl.gov/science-innovation/pillars/sos/index.php for details.

The overarching research goals for this call in the Space Science focus area are to advance our understanding of the space environment (from the Sun to the Earth and beyond) and to advance our ability to operate systems in space that protect life and society. Space Science is distinct from other field, such as astrophysics or cosmology, in that Space Science utilizes in-situ

measurements from high altitude rockets, balloons and spacecraft or ground-based measurements of objects and conditions in space.

Focus area

We particularly encourage proposals that: enhance LANL participation in future space science missions; make use of unique LANL datasets and modeling capabilities to enhance scientific analyses of past and on-going missions; and develop advanced cross-disciplinary capabilities that combine simulation, modeling, machine learning, data assimilation and data analysis concepts; enhancement of collaborations across the field of space science (e.g. LANL participation in mission proposals, scientific analysis of results from ongoing and/or past missions) as well as an emphasis on cross-disciplinary collaborative efforts that merge together diverse computational and data-based capabilities. The latter is particularly appropriate as some of the relevant models evolve toward exa-scale computing environments.

The following broad topic areas encompass either existing or desired expertise at LANL in space science:

- Active experiments in space (e.g. particle beams, active control of wave-particle-interactions, chemical releases, etc.)
- Remote-sensing capabilities (e.g. Multi-species Energetic Neutral Atom (ENA) imaging, RF Tomography, Multi-spectral Auroral Imaging (x-ray, UV, visible, IR), Soft X-ray imaging of high-charge state ions.)
- In-situ composition measurements in the magnetosphere. Particularly the low energy populations (e- and positive ions) that have yet to be properly quantified (important for S/C charging studies.)
- Novel uses of LANL CubeSat technology.
- Use of novel observing locations (e.g. L4, L5 Lagrangian points for observations, lunar platforms, L1 halo orbits, solar sail pole sitters.)
- Development of hybrid modeling capabilities that combine first principles simulations with empirical models and data assimilation techniques.
- Development of cross-disciplinary capabilities for in-situ visualization, inference, machine learning, and model steering.
- Development of new multi-scale modeling capabilities for space plasmas. Particularly adaptive models that account for both fluid and kinetic plasma effects.
- Development of reduced-complexity empirical models from large-scale simulation results.
- Low-beta kinetic plasma turbulence (or kinetic turbulence near the Sun or in support of Solar Probe).
- Use of LANL energetic particle measurements to compliment other scientific studies using Van Allen Probes (RBSP), Magnetospheric Multi-Scale (MMS), THEMIS spacecraft or THEMIS ground component missions (etc.).
- Use of LANL modeling capabilities to interpret measurements from ongoing or past missions.
- Exploration of long-term trends (e.g. solar-cycle) in LANL datasets and development of physical understanding and empirical models.

- Use of LANL energetic particle measurements to compliment other scientific studies using Van Allen Probes (RBSP), Magnetospheric Multi-Scale (MMS), THEMIS spacecraft or THEMIS ground component missions (etc.).
- Use of LANL modeling capabilities to interpret measurements from ongoing or past missions.
- Exploration of long-term trends (e.g. solar-cycle) in LANL datasets and development of physical understanding and empirical models.

Specific Topics for new projects starting in FY20:

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 FY20:

1. **New Missions**. Exploration and support for LANL participation in future space-based missions. Specifically, work that explores novel new mission concepts that could include LANL participation or work that supports LANL mission involvement in upcoming missions or mission proposals.
   a. Active experiments in space exploring applications beyond the current CONNEX and HANE remediation applications.
   b. In-situ composition measurements in the magnetosphere and heliosphere.

2. **Advance Simulations**. Cross-disciplinary simulation, modeling and data analysis for space plasmas.
   a. Development of new multi-scale modeling capabilities (e.g., models that account for both fluid and kinetic plasma effects).
   b. Development of cross-disciplinary capabilities (e.g., in-situ visualization, inference, machine learning, and model steering).

3. **Innovative uses of unique LANL data or numerical modeling resources**.
   a. Use of LANL energetic particle measurements to compliment other scientific studies using Van Allen Probes (RBSP) and Magnetospheric Multi-Scale (MMS) data.

It is strongly encouraged that proposals exploit unique resources at Los Alamos National Laboratory which include:

a. LANL satellite experiments
b. LANL satellite data
c. LANL space science computer simulation codes, and algorithms.

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 is called out as a new, separate Focus area in CSES since this is 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. We also 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.

Focus area

The Planetary Science Focus Area is an interdisciplinary call that encourages research in observation, measurement, instrumentation, 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. Projects that align with NASA's Astrobiology Roadmap in ways that enhance planetary exploration are in line with specific topics in the proposal call (https://astrobiology.nasa.gov/research/astrobiology-at-nasa/astrobiology-strategy/). This focus area has significant overlap with other laboratory-relevant programs that may provide new techniques or novel applications of existing techniques or instrumentation for planetary problems; solving problems of interest to planetary science may also lead to the development of new techniques for applications beyond planetary science. 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.

The following broad topic areas encompass either existing or desired expertise at Los Alamos in Planetary Science:

- Novel mission concepts for NASA programs such as Explorer, New Frontiers, and Discovery, including developing enabling external partnerships
- New techniques or novel applications of existing techniques or instrumentation for planetary problems of interest
- Leveraging current Los Alamos expertise to develop novel propulsion or power technologies for long-duration space missions

- Novel technologies or techniques to enable sample return from a range of planetary environments
- Methods to mitigate the effects of radiation on hardware and/or human health for long-duration space flight.
- New analysis methods and tools for publicly available NASA mission data sets
- Hypothesis testing for extraterrestrial planetary bodies that utilizes Earth analogs, including both field studies and laboratory experiments
- Methods for discovering or elucidating biology external to Earth (exobiology) using in situ or orbital data
- Techniques for remotely assessing the habitability or potential for extant life on exoplanets
- Development of partnerships for commercial space applications

Specific topics of interest for new projects starting in FY20

From the above topic areas, the following focused science topics are chosen for FY20:

1. **NASA Exploration Priorities**. We invite teaming and strategy proposals that aim to partner LANL with other institutions to produce the technical basis to respond to for upcoming NASA Explorer, New Frontiers, and Discovery program calls. We seek to support research projects that are relevant to bodies with a significant component of water, such as Europa. Proposed work may include laboratory, terrestrial analog, and/or data analysis projects.

2. **Enabling Technologies or Methods for Future Missions.** We seek development of novel instruments or new applications of technologies and methods currently in use for other applications that make possible new options for future missions. Of particular interest are projects that address sample return (e.g., Mars 2020, OSIRIS-REx, CAESAR, and others), or operations in extreme environments. Projects may address either robotic or human exploration.

3. **Developing Opportunities for Commercial Space Partnerships.** We seek proposals that build capabilities for interaction with the commercial space industry (including concepts such as Lunar Gateway, https://www.nasa.gov/topics/moon-to-mars/lunar-outpost). This work may develop or advance new sensors or platforms, or may develop novel analysis methods for commercial data sets. Ideally proposals could culminate in a final product or idea that is relevant to commercial space exploration. Projects that support NASA efforts to develop commercial partnerships are also encouraged, for example the NASA Lunar Surface Instrument and Technology Payloads (LSITP) program to integrate science payloads onto commercial lunar landers (see NASA ROSES Appendix C.28).

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)
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.

Broader Challenge. The core capability challenge addressed by LANL Geosciences is improving and optimizing our understanding of how natural (geologic) systems are perturbed by, or can affect, human activity. Los Alamos is concerned with two broad areas of such systems: National Security and Energy Applications. In particular, the CSES Focus Area seeks to improve LANL's capability to extract more knowledge from both new and existing data and improve our ability to predict the phenomena that will be diagnostic in characterizing the surface or subsurface (physics-based models and the integrity of their predictions based on fit to observations).

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 FY20:

The overall theme for the Geophysics Focus Area is research to help expand capabilities related to national security. Newly emerging interests among Federal agencies include geophysical techniques to address border security, shallow subsurface characterization relevant to military operations, robust data acquisition using remote methods in hazardous regions, and extending the footprint of our sensing capability by leveraging new sensor technology, new data extraction methods and improved access for hazardous or traditionally denied regions. Studies that integrate theoretical, 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 (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.

1. **Exploiting advances in robotics and automation for geophysical, geochemical or surface feature data.** New techniques in remote sensing, data acquisition and digital data

analysis that provide information used in modeling of surface or subsurface characteristics. Exploration of these resources and demonstrable exploitation of their benefits can pave the way for extending our understanding of traditionally inaccessible areas as well as improving the efficiency and cost-effectiveness of surveys for dynamic change detection.

2. **Exploitation of combined independent signatures to inform static and dynamic geological models.** Leveraging novel combinations of data types (for example, LIDAR images and subsurface resistivity derived from EM methods, combined to identify underground geological, anthropogenic or fluid-generated anomalies).

3. **Detection of Low-Magnitude Signals for Real-Time Monitoring of Phenomena.** Development of techniques to characterize background and distinguish signals from noise; leveraging HPC and cloud computing for prompt (real-time) evaluation of the signals and importation into dynamic modeling and monitoring applications.

In these topical areas, proposals that address the following future challenges are particularly encouraged:

- **Complementary or joint evaluation of data**. Rarely is a single measured parameter sufficiently unambiguous when evaluating a complex source or system. We encourage innovative methods to combine traditionally independent data sets for a more robust answer to a modeling or source question, with application of careful assessments of measurement and model uncertainties.

- **Extracting Relevant Information from a Noisy World.** Typical problems of interest for the Lab/Sponsors are data collected from a large area (100's of km), small signals, lots of noise, keep costs down, and provide feedback in real time. Relevant questions: Are there new signatures we are not using? How to optimize existing signatures? This problem can be addressed with novel data processing / signal analysis methods or with improved sensor deployment and design. For instance, an array of sensors could be optimized to enhance signal in the face of persistent or dynamic noise.

- **Leveraging recent advances in distributed computing, remote data acquisition and novel data transmission techniques.** Significant expansion of data volumes will arise from the mandate to extend our observational capability beyond current limitations. The need to automate surveying to remove humans from potentially hazardous field operations while at the same time optimizing the density, precision, and timeliness of analyses, requires innovative leveraging of cutting edge technologies.

2.5   Earth Systems

The Earth Systems Focus Area contributes to two of LANL's science pillars: The Information Science & Technology (IS&T), and The Science of Signatures (SoS). Climate, biological and energy signatures are the three leadership areas within SoS. Complex biological and subsurface

networks, as well as acquisition, use, and modeling of large datasets for energy security, climate modeling and understanding biological systems are the main areas within IS&T. For more detail, please refer to http://int.lanl.gov/science/science-pillars/index.shtml.

Focus Area

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

It is recommended that proposals exploit unique Los Alamos National Laboratory resources, which include:

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

Specific Topics for new projects starting in FY19:

Overall theme is to conduct cutting-edge research that enables fundamental breakthroughs in our understanding of Earth Systems signatures and impacts, and secure and resilient response strategies, through integration of LANL's theoretical, experimental, measurement, and numerical modeling resources.

1. **Signatures**: Revolutionary sensors, and novel use of sensor networks, existing datasets or omics' approaches for identifying signatures of change or interaction between components of complex natural systems.
   a. Signatures of interaction, and function of regulatory systems in and between single cells and their environment, or the microbiome and their environment including other organisms.
   b. Signatures of atmospheric, biogeochemical or hydrological change in sensitive regions or during and after extreme or catastrophic events that allow prediction of rate of change or identification of potential system tipping points.
2. **Complex coupled processes**: Integration of models and observations, or field and laboratory studies to improve, and develop missing physics parameterizations that will improve capability to predict system responses to change at multiple scales

    a. In coupled ocean-land-ice-atmosphere processes at the coastal interface and high latitudes

    b. In response to extreme or catastrophic events such as drought, fire, epidemics

3. **System security and resilience**: Development of novel experimental, modeling and data science tools

    a. To quantify system security and resilience, recovery rates or acclimation capacity for problems relevant to food, water and energy security, and human health.

    b. To allow robust information transfer between temporal and spatial scales, and coupling of models of different scales for problems relevant to climate, food, water and energy security, and human health.

3 Program Elements

New/changed in the 2019 call:

1. "Emerging Ideas" are dead, long live "Rapid Response"! CSES has been asked to align the name of this program with other centers (ISTI and IMS) who use the "Rapid Response" name. So with this call we follow suit (Section 3.3).
2. We introduce a new Program Element on NASA mission participation teaming and brainstorming. This is a new subset of the already existing Rapid Response Program Element, see section 3.3.2.
3. The *Chick Keller Postdoctoral Fellowship* (Section 3.2), will accept nominations at each one of the quarterly Postdoc Committee review meetings, starting with the December 2019 quarterly. CK Fellows are NOT solicited for the May and August 2019 quarterly.
4. The *Large University Program* is not offered in this call. Next opportunity will be in the FY20 call for FY21 new starts.

Current CSES program elements:

1. **Student Fellow Program**. Needs to address the CSES Focused Science Topics for this call. One selection per year.
2. **Chick Keller Postdoctoral Fellow Program**. Needs to address the CSES Focused Science Topics for this call. Submissions through LANL PostDoc Program, four 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. Up to three selections during the FY.
4. **Large University Program**. Needs to address the CSES Focused Science Topics. One call every three years.

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. Frequency of call: Once a year.

Submission: April 5, 2019
Selections: April 26, 2019
Program New Starts: at start of FY20
Program duration: 1 year, 2 years or 3 years

Program Outline

- Each proposal is required to have a University Student Researcher, a University Principal Investigator (PI) and a Los Alamos National Laboratory PI.
- The University Postgraduate Student Researcher needs to be enrolled in a Ph.D. program, and ready to embark on their Thesis project (passed their qualifiers).
- 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 is any Los Alamos Technical Staff Member.
- The collaborative University-LANL research project will typically consist of a jointly agreed Ph.D. thesis research project.
- **The Los Alamos National Laboratory Mentor must submit the proposal.**

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

The funding profile for this program consists of three parts:

1. Support for the University Student Researcher to spend a significant fraction of the year at Los Alamos. GRA Support for a typical 12-week summer stay at LANL cost ~$35K. 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 (~$15K).
3. Support to the University PI to visit LANL for periods of 1-2 weeks/year (~10K travel and subsistence).

The individual funding items are negotiable with a total cap for this program not to exceed $60K/year of LDRD-type funding.

No direct funding support to a University is envisaged under this program. 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 ~3 months/year).
b. LANL Graduate Assistant Student rates may be higher than many Universities' postgraduate salaries, helping to attract students to both the University and the CSES Student Fellow Program.
c. Exposure of student to an outside organization with many career opportunities for post-doctoral work and beyond.
d. University PI travel support for extended LANL visits.

Only under exceptional circumstances, 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 motivated in the proposal.

Successful proposals need to include some form of matching support for the student from their universities or other institutions. Acceptable forms of matching support are the same as, but not restricted to, those accepted by the National Science Foundation or other Federal research funding agencies. This can include waived or reduced academic fees, and travel or conference support.

Note that "matching support" here refers to university support for the student at and from his university, to support the student outside of the time covered by his/her Student Fellow project at LANL.

Proposals may be submitted for collaboration with any national or international university. Collaborations with New Mexico universities are particularly encouraged and may qualify for support through The New Mexico Consortium, such as housing help, travel help or sabbatical funds for the student's university mentor.

The number of new starts anticipated in the CSES Student Fellow Program is approximately 4-6 across all CSES discipline areas.

Expectations

The Student Fellow 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) 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 summer schools. The University PI should be encouraged to offer a lecture in a CSES summer school as part of his/her visit to LANL. The university PI should also be encouraged to give a topical seminar on his research area during his visit to LANL.

CSES will organize a CSES Focus area workshop for the presentation of all projects in a given focus area. Reports and/or presentations and copies of any proposals submitted need to be sent to CSES. In addition, CSES will collect project metrics from each PI through a fillable PDF form.

3.2   Chick Keller Postdoctoral Fellow Program

LANL Named Postdoctoral Fellow support. Frequency of call: Typically four times per year.

NOTE: CK fellows NOT solicited for the May and August 2019 Quarterlies.

Submission: Conforming to the LANL PostDoc's Office Quarterly meeting schedule
> February Review - Submit early December, outcome mid February
> May Review - Submit early March, outcome mid May
> August Review - Submit early June, outcome mid August
> December Review - Submit mid September, outcome mid-December
> http://www.lanl.gov/careers/career-options/postdoctoral-research/postdoc-program/postdoc-appointment-types.php

Selections: One week after the Quarterly meetings.
Program New Starts: As soon as PostDoc Candidate is available.
Program duration: 2-year maximum or 1 year for a 3rd year extension of an existing CK Fellow.

Program Outline

This program is aligned with the Lab's prestigious named Postdoctoral Fellow Program (Director's, Distinguished, Agnew, Metropolis and now with the Chick Keller Fellows in Earth and Space Sciences). Candidates must meet the fellows 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. Preference will be given to new postdocs starting at Los Alamos.
- *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.*
- **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.

CSES strives to have a roster of ~8 CK Fellows at any one time, about 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.

Expectations

CSES will organize a CSES Focus area workshop for the presentation of all projects in a given focus area. Reports and/or presentations and copies of any proposals submitted need to be sent to CSES. In addition, CSES will collect project metrics from each PI through a fillable PDF form.

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%.

3.3 Rapid Response Program

Formerly known as "Emerging Ideas Program"

Small LANL project support. Frequency of call: once at the start of the FY with at most 2 additional calls depending on proposal pressure and available funding.

Rapid Response Institutional Program Development Call
Rapid Response NASA Mission Teaming and Planning
Rapid Response Research & Development

Call Submissions:
      Round one - September 13, 2019 for October 7, 2019 Start
      Round two   - TBD (Jan/Feb timeframe)
      Round three - TBD (May/Jun timeframe)

Selections: Up to 3 selections a year (every four months, see above). Program duration: 3 or 6 Months, need to be completed in FY20

Every ~4 months CSES will assess its stock of received proposals and make selections based on number of proposals received and/or new funds becoming available.

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 and be considered again and the next selection date together with any new proposals received.
3. Do not fund – proposal is denied and can only be submitted again after a significant re-write.

3.3.1 Rapid Response Institutional Program Development

The Rapid Response Institutional Program Development Program (RR-IPD) is funded out of the CSES G&A portfolio and ***cannot*** be used to support technical work.

Program Outline

CSES solicits proposals for three or six-month studies that support activities such as proposal writing, white paper idea development, literature searches, small equipment purchases, publication costs, and collaborative visits.

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.

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.

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

Funding maximums are $20K for a 3-month and $40K for a 6-month study, and the program is open to Los Alamos National Laboratory Technical Staff Members and/or Los Alamos National Laboratory postdocs.
We anticipate that 4-6 RR-IPD studies may be supported throughout the fiscal year, although this number will fluctuate depending on available funding.

Expectations

CSES will organize a CSES Focus area workshop for the presentation of all projects in a given focus area. Reports and/or presentations and copies of any proposals submitted need to be sent to CSES. In addition, CSES will collect project metrics from each PI through a fillable PDF form.

3.3.2 Rapid Response NASA Mission teaming and planning

CSES recently 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 Rapid Response Institutional Program Development (RR-IPD, 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 Heliophysics and Planetary Missions.

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

Funding maximums per workshop are up to 5K of RR-IPD funds for the LANL proposer/team and up to 20K of the NAS funds for inviting and supporting external SMEs.

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

3.3.3   Rapid Response Research and Development

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

Program Outline

CSES solicits proposals for three or six-month 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.

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

Funding maximums are $30K for a 3-month and $60K for a 6-month study, and the program is open to Los Alamos National Laboratory Technical Staff Members and/or Los Alamos National Laboratory postdocs.
We anticipate that 8-10 RR-R&D studies may be supported throughout the fiscal year, although this number will fluctuate depending on available funding.

Expectations

CSES will organize a CSES Focus area workshop for the presentation of all projects in a given focus area. Reports and/or presentations and copies of any proposals submitted need to be sent to CSES. In addition, CSES will collect project metrics from each PI through a fillable PDF form.

3.4 Large University Program

Frequency of call: Three yearly in step with CSES LDRD cycle (FY18, FY21, FY24…)

Not offered in FY20

However: PI's are encouraged to plan ahead for a submission to this program element by building new relationships with prospective university partners through the Student Fellow Program (Section 3.1).

Program Outline

The CSES research portfolio is funded by a single LDRD-DR sized proposal that is re-competed every three years. In each cycle, the overall scientific goals for the CSES science disciplines will be renewed, and the science areas themselves will be up to review with disciplines changing or being updated. The start of a new CSES cycle offers the opportunity for new and exciting science thrust areas to be highlighted, in step with or ahead of the LANL strategic planning landscape.

Each CSES discipline will have the opportunity in this program to propose for a single, large three-year project that addresses a discipline science thrust area as identified in Section 2. This large program will be structured around 2-3 Student Fellow Programs (See Section 3.1) involving an intensive collaboration with a single university. Total budget is not to exceed 180K/year. This project can involve up to three LANL Investigators (one of them identified as Project Lead, PL) and up to three University Investigators.

It is anticipated that at most 1-2 Large University Programs will be awarded in each 3-year cycle, with at most one Large University Program per CSES science discipline. *Note that for the science discipline that gets awarded a Large University Program no normal Student Fellow Programs will be awarded in the same year.*

Expectations

The main purpose for this program element is to establish new and significant university partnerships in new areas of research that LANL wants to develop. The goal 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.

The Project Lead is expected to present progress in the form of a seminar per year, given to an audience of their peers and relevant lab management and program directors. Seminars presented by the Student Fellows are preferred, and depending on the scope of the project more than a single seminar is encouraged.

The seminar presentation need to be submitted to CSES and serve as the technical report on the project. In addition, CSES will collect project metrics once a year from each PL through a fillable PDF form.

4 Proposal Process

4.1 Proposal Preparation

4.1.1 Student Fellow Program

Cover Sheet. Please use the CSES fillable PDF cover sheet, available at
http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/cses-proposal-cover-sheet.pdf

Main Body Use the following formatting outline for the main body; *please limit to five total pages* of text and figures (for Sections I through VIII), plus one budget page and biographical sketches:

I. Theoretical, numerical, or experimental activity
II. Methods used, history of problem, scientific debate, hypotheses to test
III. Any relevant leveraging or necessary coordination, e.g., other projects or facilities
IV. Resources to be used in the project such as resources at Los Alamos National Laboratory, at the University, if relevant
V. Statement of Work
   i. Tasks to be performed
   ii. Milestones
   iii. Schedule of visits at Los Alamos National Laboratory
VI. Proposing Team
   i. Role of University Principal Investigator
   ii. Role of LANL PI, including efforts at mentoring
   iii. Role of graduate student
   iv. Other participants
VII. 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?
VIII. References
IX. Budget summary (1 page max). PEM sheets not required. Totals by fiscal year and cumulative for multiyear projects. Not to exceed $60K/year.
   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 his time to the collaborative research project.
   iii. Support to the University PI to visit LANL
   iv. Other Travel
   v. Supplies & Equipment, including Computer usage costs

X. Biographical sketches of PIs including already identified graduate 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.

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
- How the proposed CSES 50% work differs from the main Postdoc Research proposal
- What the envisaged funding mix is for the postdoc

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. A double basic research funding split may be considered for exceptional PostDocs.

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 Program

Cover Sheet. Please use the CSES fillable PDF cover sheet, available at
http://www.lanl.gov/projects/national-security-education-center/space-earth-center/_assets/docs/cses-proposal-cover-sheet.pdf

Main Body Use the following formatting suggestions for the main body; *please limit to two total pages* of text and figures (for Sections I through V), plus one page biographical sketches:

    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.   Which targeted funding opportunity does this work support
    V.   Short budget justification. PEM sheets not required.

4.1.4   Large University Program

Since this program element consist of essentially three bundled Student Fellow Programs, the proposal guidelines are the same as for the Student Fellow Program, with the following changes / additions:

1. The main body of the proposal can be up to 10 pages.
2. Budget justification can be up to 2 pages
3. The project should have a LANL and University Lead PI but can include up to two additional LANL and two additional University Co-Is.
4. The LANL lead PI takes responsibility for the overall execution of the program and submits the proposal.

4.1.5   General Instructions

While CSES supports 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.

4.2   Submission process

Proposals (one PDF for cover page, one PDF for main body including budget) must be submitted by email to be received by the proposal's program element deadline.

1. Student Fellow program   Apr 5, 2019|

2. Chick Keller Postdoctoral Fellow Program
   Follows the Quarterly Postdoc committee Meeting Schedule.
   Upcoming deadlines:

May 2019:	not offered
Aug 2019:	not offered
Dec 2019 :	October 30, 2019

3. Rapid Response Program

Round one:	September 13, 2019
Round two:	TBD
Round three:	TBD

4. Large University Program   Not Offered

NOTE: All Student Fellow, Rapid Response and Large University 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 and Cosmology (Chris Fryer; fryer@lanl.gov)
- Space Science   (Vania Jordanova; vania@lanl.gov)
- Planetary Science   (Nina Lanza [acting]; nlanza@lanl.gov)
- Geophysics   (Char Rowe; char@lanl.gov)
- Earth Systems   (Sanna Sevanto; sanna@lanl.gov)

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

4.3 Review Process

4.3.1 New Proposals

All new proposals undergo peer review. There is a separate review panel for each discipline area, which consists of the Focus Lead and his/her team (typically ~5 LANL staff), and which is augmented by external review members of subject matter experts primarily from academia when needed.

Review Criteria

For R&D proposals, we follow here a similar set of criteria in the spirit of the Laboratory's LDRD-ER pre-proposal process (see https://int.lanl.gov/science/programs/ldrd/er/_assets/fy20-er-assessment-criteria.pdf) scaled and adjusted to the size and scope of CSES projects and programs, see Table 1.

Table 1: RR-R&D Criteria

1 to 3 Scale	Overall	Application / Impact on Mission	Research Approach
3	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.	Clear and well-designed research approach.
2	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.
1	Lacking in one or more critical aspects. Lack of Innovation, key issues not addressed, rendering the proposal uninteresting.		

For Institutional Program Development proposals (i.e. RR-IPD) we use the criteria as listed in Table 1 below, again using the 1-3 scale for ranking.

Table 2: RR-IPD Criteria

1 to 3 Scale	Overall	Application / Impact on Mission	Project Approach
3	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
2	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 tolerated, the proposal needs to clearly outline these risks.
- CSES programs support NSEC's goals of growing university interactions, educating present and future scientists and engineers, and to help with recruitment or retention of technical talent.
    - **Student Fellow / Large University Proposals** – show how the project will be used to build university interactions and if there is a viable onward path for the students into LANL PostDoc programs.
    - **Rapid Response** – show how this project aides the career development of its PI.
    - **Chick Keller PostDoc** – show that the PostDoc's work is in an area that could provide a "landing zone" for conversion.
- 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.
- Willingness for risk – even the answer "now we know we can't do it this way" is a successful outcome.
- 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.

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 Advisory 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.

4.3.3 Written Proposal Feedback

All CSES proposal will receive a short written email feedback within a few weeks of review. Unsuccessful PIs are encourage 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 to the Center.

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).

CSES assumes that the proposal cost is accurate and 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 PI or postdoc can only start once a valid program code has been established for the project. University student visits cannot commence before that time.

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 about two months (no earlier than December 1 of a given year) when the "start work" order is issued. Invoices submitted for work conducted prior to the "start work" order will not be reimbursed.

If your Student Fellow / Large University project involves a subcontract you are encouraged to start the subcontract process as soon as possible in order to have the subcontract in place at the beginning of the fiscal year.

4.5.2 Security considerations

Classified work is not supported under the Student Fellow Program or the University Large Program.

4.5.3 Policy regarding prejudice and bias

There is no prejudice based on race, gender, or nationality, for PI's, postdocs, and students.

4.5.4 Further information

CSES Center: cses.lanl.gov
CSES general email: cses@lanl.gov (preferred)

Melissa Martinez, Professional Staff Assistant: melissamtz@lanl.gov, 505- 665-0391
Reiner Friedel, Director, rfriedel@lanl.gov, 505-695-8894