Advanced Simulation and Computing Campaign
Funding Profile by Subprogram and Activity

(Dollars in Thousands)

	FY 2012 Current	FY 2013 Annualized CR	FY 2014 Request
Advanced Simulation and Computing Campaign [a]			
Integrated Codes	160,945	145,702	157,507
Physics and Engineering Models	69,890	68,932	62,995
Verification and Validation	46,087	56,232	52,728
Computational Systems and Software Environment	181,178	151,121	135,593
Facility Operations and User Support	159,859	173,013	155,506
Total, Advanced Simulation and Computing Campaign	**617,959**	**595,000**	**564,329**

Out-Year Funding Profile by Subprogram and Activity

(Dollars in Thousands)

	FY 2014 Request	FY 2015 Request	FY 2016 Request	FY 2017 Request	FY 2018 Request
Advanced Simulation and Computing Campaign [a]					
Integrated Codes	157,507	167,766	173,338	176,918	180,507
Physics and Engineering Models	62,995	67,098	69,326	70,759	72,194
Verification and Validation	52,728	56,162	58,028	59,226	60,427
Computational Systems and Software Environment	135,593	144,424	149,221	152,304	155,393
Facility Operations and User Support	155,506	165,635	171,135	174,671	178,213
Total, Advanced Simulation and Computing Campaign	**564,329**	**601,085**	**621,048**	**633,878**	**646,734**

[a] This represents the proposed control level.

Public Law Authorizations

National Nuclear Security Administration Act, (P.L. 106-65), as amended
National Defense Authorization Act for FY 2013 (P.L. 112-239)
The Continuing Appropriations Resolution, 2013 (P.L. 112-175)

Overview

The Advanced Simulation and Computing (ASC) Campaign provides leading edge, high-end simulation capabilities to meet the requirements of weapons assessment and certification, including weapon codes, weapons science, computing platforms, and supporting infrastructure. Our ability to model the extraordinary complexity of nuclear weapons systems is essential to establishing confidence in the performance of our aging stockpile without new underground tests. The ASC Campaign underpins the Annual Assessment of the stockpile and is an integrating element of the Predictive Capability Framework (PCF), as described in the FY 2012 Stockpile Stewardship Management Plan.

The ASC tools are also used to address areas of national security beyond the U.S. nuclear stockpile. Through coordination with other Government agencies, ASC plays an important role in supporting nonproliferation, emergency response, nuclear forensics and attribution activities.

The $30.7M decrease between the FY 2013 Annualized CR level and the FY 2014 Request reflects the net effect of a number of increases and decreases. The basic increases are: 1) funding restoration for the Predictive Sciences Academic Alliances Program (PSAAP) following the deferral of the follow-on program in FY 2013; 2) expanded modeling to evaluate pit re-use options, and 3) expanded integrated code development to efficiently use evolving computer architectures. The basic decreases are: 1) a rate adjustment at Lawrence Livermore National Laboratory which was implemented in FY 2013, but is not reflected in the FY 2012 Current and the FY 2013 Annualized CR level, 2) a $24.8M reduction to reflect anticipated management efficiency and workforce restructuring reductions for Weapons Activities. Studies to identify the specific program effects are underway. When these studies are completed, NNSA will work with Congress to make any necessary program or funding level adjustments.

The Lawrence Livermore overhead rate adjustment is a return to a lab wide standard overhead rate.

Program Accomplishments and Milestones

In FY 2012, ASC accomplished four significant milestones in program management and/or program development. These accomplishments include: 1) continued investment in a common computing environment across the weapons laboratories; 2) progress toward initial conditions for boost milestone – a key enabler for re-use; 3) continued investment in activities supportive of joint Department of Energy (DOE) Office of Science/National Nuclear Security Administration (NNSA) collaboration relevant to NNSA's projected computing and simulation requirements and, 4) closer coupling with Directed Stockpile Work (DSW) deliverables and the PCF.

Program Planning and Management

The ASC, in conjunction with the DSW program and other Campaigns, coordinates its work and funding priorities with NNSA and DOE strategic objectives. Clear alignment is attained by developing and adhering to the program's strategy documents and alignment with the PCF. This process enables effective resource allocations to consistently achieve ASC's goal of funding the highest priority work and addressing near-term and out-year challenges using an enterprise solution approach amongst Defense Programs (DP). As a way to reduce program costs, ASC has reduced and stretched future platform procurements and extended by one year the service life of current and future supercomputers.

Strategic Management

Through the ASC program, the Department will implement strategies to deliver integrated codes, physics and engineering models, verification and validation methods and assessments, computational systems and environments, and computing centers to address stockpile commitments. There is a new emphasis on plutonium and re-use that places strong importance on material models and common system models.

External factors present the strongest impact to the overall achievement of the program's strategic goal:

- Life Extension Program (LEP) count and schedule.
- Industry technology roadmaps and business plans.
- Acquiring, mentoring, and retaining right-sized critical skills.

Major Outyear Priorities and Assumptions

Outyear funding levels for the ASC Campaign total $2,502,745,000 for FY 2015 through FY 2018.

Out-year priorities and assumptions are governed by the mission to provide leading-edge, high-end simulation capabilities needed to meet weapons assessment,

certification, and national security requirements. The major assumption is that funding for the ASC program will suffice to support the LEP schedules (as approved by the Nuclear Weapons Council) through 2030. Exactly what constitutes national security requirements will evolve as emerging threats develop and change.

Program Goals and Funding

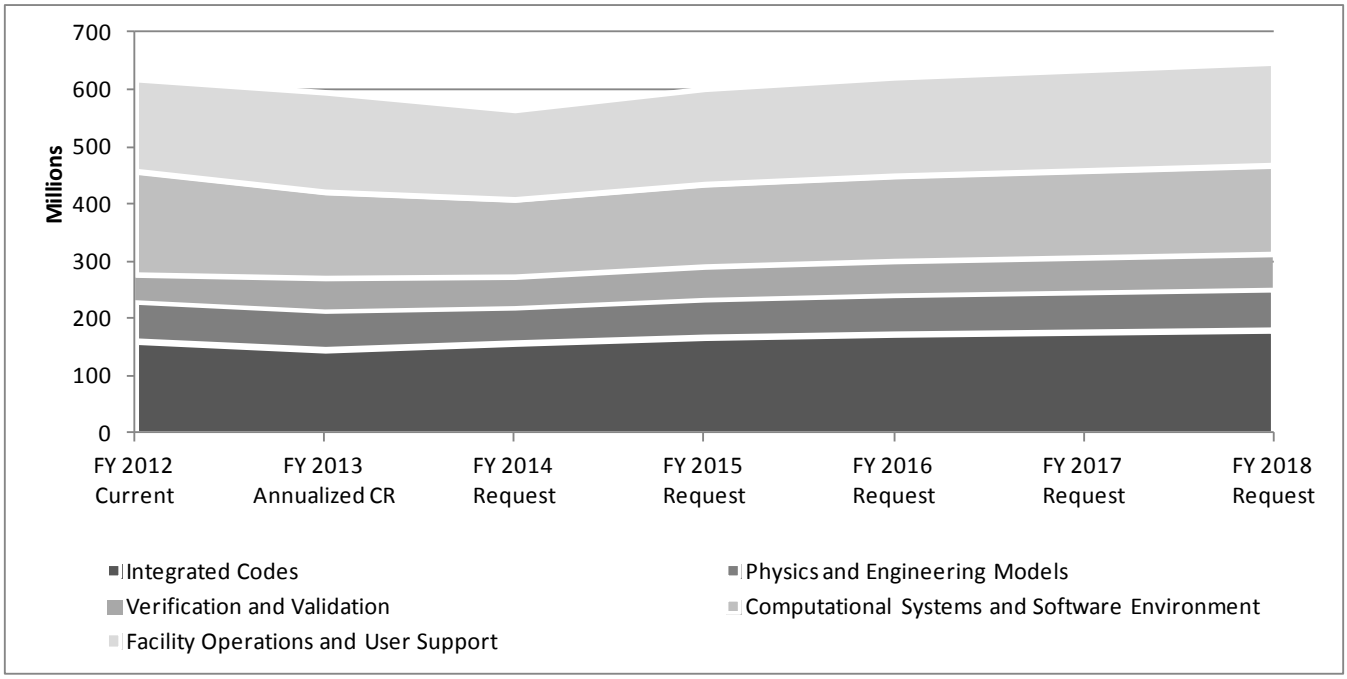
The goal of the ASC program is to deliver accurate simulation and modeling tools, supported by necessary computing resources, to maintain nuclear deterrence.

To achieve this program goal, ASC provides simulation capabilities and computational resources through a balanced program that includes technical staff, hardware, simulation software, and computer science solutions. The products of ASC integrate all aspects of the nuclear security enterprise from weapons design and analysis to the manufacture, deployment, and assessment of proliferant devices and their effects. Funding is expected to increase as needed to support the full national security mission.

Performance Measures

Performance Goal (Measure)	**Reduced Reliance on Calibration** - The cumulative percentage reduction in the use of calibration "knobs" to successfully simulate nuclear weapons performance.		
Fiscal Year	**2012**	**2013**	**2014**
Target	40% cumulative reduction in the use of calibration "knobs"	45% cumulative reduction in the use of calibration "knobs"	50% cumulative reduction in the use of calibration "knobs"
Result	**Not Met** - 38		
Endpoint Target	By the end of FY 2024, 100% of selected calibration knobs (non-science based models) affecting weapons performance simulation have been replaced by science-based, predictive phenomenological models. Reduced reliance on calibration will ensure the development of robust ASC simulation tools. These tools are intended to enable the understanding of the complex behaviors and effect of nuclear weapons, now and into the future, without nuclear testing.		

Figure 1: Relative Out-Year Funding Priorities in Weapons Activities – Advanced Simulation and Computing Campaign



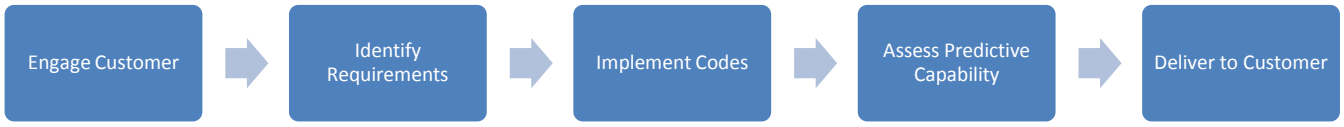
Explanation of Funding and/or Program Changes

	(Dollars in Thousands)		
	FY 2013 Annualized CR	FY 2014 Request	FY 2014 Request vs. FY 2013 Annualized CR
Advanced Simulation and Computing Campaign			
Integrated Codes	**145,702**	**157,507**	**+11,805**
The increase reflects the net effect of a rate adjustment between FY 2013 and FY 2014 at LLNL, restoration of funding for the Predictive Sciences Academic Alliances Program (PSAAP) following the deferral of the follow-on program in FY 2013, expansion of modeling to evaluate re-use options, expansion of integrated code development to efficiently use evolving computer architectures, along with a reduction to reflect anticipated management efficiency and workforce restructuring reductions across program elements.			
Physics and Engineering Models	**68,932**	**62,995**	**-5,937**
The decrease reflects the effect of a rate adjustment at LLNL between FY 2013 and FY 2014 and a reduction to reflect anticipated management efficiency and workforce restructuring reductions across program elements.			
Verification and Validation	**56,232**	**52,728**	**-3,504**
The decrease reflects the effect of a rate adjustment at LLNL between FY 2013 and FY 2014, B61 Life Extension Program simulation-related workload, work associated with the W78/88-1 study, and a reduction to reflect anticipated management efficiency and workforce restructuring reductions across program elements.			
Computational Systems and Software Environment	**151,121**	**135,593**	**-15,528**
The decrease reflects the effect of a rate adjustment at LLNL between FY 2013 and FY 2014, year-to-year computing assessments, and a reduction to reflect anticipated management efficiency and workforce restructuring reductions across program elements.			
Facility Operations and User Support	**173,013**	**155,506**	**-17,507**
The decrease reflects the effect of a rate adjustment at LLNL between FY 2013 and FY 2014, and a reduction to reflect anticipated management efficiency and workforce restructuring reductions across program elements.			
Total Funding Change, Advanced and Simulation and Computing Campaign	**595,000**	**564,329**	**-30,671**

Integrated Codes
Overview

Integrated codes, in concert with input decks created by the design user community, contain the mathematical descriptions of the physical processes relating to nuclear weapon systems and describe what the nation knows about nuclear weapons function. This subprogram funds the critical skills needed to develop, maintain and advance the capabilities of the large-scale integrated simulation codes that are needed for the following Stockpile Stewardship Program (SSP) and Directed Stockpile Work (DSW) activities: annual assessment; Life Extension Program (LEP) design, qualification, and certification; Significant Finding Investigation (SFI) resolution; and safety assessments to support transportation and dismantlement. In addition, these capabilities are necessary for a host of related requirements such as nuclear counter-terrorism efforts (e.g. nuclear forensics, foreign assessments and device disablement techniques).

Sequence (Ongoing for ASC)



Benefits

- The ASC codes and computing infrastructure support DSW work such as design, analysis, qualification, baselining, and SFI resolution. Stockpile work, science, and simulation are bound together through the Predictive Capability Framework (PCF) and the Component Maturation Framework (CMF).
- Historically, simulation capabilities were carefully calibrated to the underground test results. As long as the calculated configurations were close to the as-tested regime, one could be confident in the results. Refurbishment options and aging push the simulations outside of tested regimes and, therefore, require more predictive capabilities.
- Within the Integrated Code subprogram, ASC invests in modeling and integrated code development related to warhead re-use capabilities.

Funding and Activity Schedule

Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2012	Ongoing user support • Training. • Direct code usage support. • Bug fixes. Capability development • Delivered initial capability for effects from a low-yield urban nuclear event. • Completed improvements in primary performance assessment code in support of Level 1 milestone for early time initial conditions for boost. This is a key step in enabling re-use. • Began improvements in primary performance assessment code in support of Level 1 milestone for late time initial conditions for boost. Capability extension • Delivered parallel scalability enhancements in support of engineering LEP activities. • Demonstrated scalability of nuclear performance codes to 100,000 processors. • Completed re-factorization of transport code to take advantage of General Purpose Graphics Processing Units. Skills accession	**160,945**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	• Maintained an ongoing mentoring program for early career staff. • Participated in conclusion of Predictive Science Academic Alliance Program (PSAAP). Strategic research • Further refined the study of details of the thermonuclear burn process as it is relevant to simulation of weapon performance. • Investigated improvements in hydrodynamic algorithms and multi-material treatments.	
FY 2013	Ongoing user support and maintenance • Code builds and ports. • User training and assistance. • Regression testing and bug fixes. Capability development • Deliver improvements in primary performance assessment code in support of an FY 2014 Predictive Capability Framework (PCF) planned pegposts for late time initial conditions for boost. • Deliver improvements in nuclear performance assessment codes in support of out-year PCF planned pegposts for boost and secondary performance. • Deliver improvements in safety codes to address multi-point safety issues in support of out-year PCF planned pegposts. • Deliver improvements in engineering assessment codes in support of an FY 2015 PCF planned pegposts for hostile environments and out-year PCF planned pegposts for normal and abnormal environments. Capability extension • Complete initial optimization of threading for homogeneous architectures. • Deliver deterministic pre-conditioners to improve the performance of probabilistic calculations of particle transport. • Deliver improvements to support general domain-decomposed/replication hybrid parallelism. • Deliver the ability to set up analyses (including mesh generation) for machines with more than 1 million processors. • Enhance visualization and data analysis capabilities to model new experimental diagnostics. Strategic research • Investigate the use of higher-order finite element methods for various applications. • Begin to evaluate options for treating physics time evolution. • Release an initial suite of proxy applications used for co-design under a common build system with documentation.	**145,702**
FY 2014	Ongoing user support and maintenance • Code builds and ports. • User training and assistance. • Regression testing and bug fixes. Capability development • Deliver capability in primary performance assessment code in support of a PCF	**157,507**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	planned pegposts for late time initial conditions for boost. • Deliver improvements in nuclear performance assessment codes in support of out-year PCF planned pegposts for boost and secondary performance. • Deliver improvements in safety codes to address multi-point safety issues in support of out-year PCF planned pegposts. • Deliver improvements in engineering assessment codes in support of an FY 2015 PCF planned pegposts for hostile environments and out-year PCF planned pegposts for normal and abnormal environments. Skills accession • Participate in PSAAP II selection process and program start. • Collaborate with PSAAP II centers on technical topics and staff recruitment.	
FY 2015 **FY 2016** **FY 2017** **FY 2018**	Ongoing user support and maintenance • Code builds and ports. • User training and assistance. • Regression testing and bug fixes. Capability development • Deliver improvements in nuclear performance assessment codes in support of out-year PCF planned pegposts for boost and secondary performance. • Deliver improvements in safety codes to address multi-point safety issues in support of out-year PCF planned pegposts. • Deliver capability in engineering assessment codes in support of a PCF planned pegposts for hostile environments. • Deliver improvements in engineering assessment codes in support of out-year PCF planned pegposts for normal and abnormal environments. Skills accession • Maintain an ongoing mentoring program for early career staff. • Collaborate with PSAAP II centers on technical topics and staff recruitment.	**167,766** **173,338** **176,918** **180,507**

Physics and Engineering Models
Overview

The Physics and Engineering Models (PEM) subprogram within ASC provides the models and databases used in simulations supporting the U.S. stockpile. These models and databases describe a great variety of physical and engineering processes occurring during the operation of a nuclear weapon. The capability to accurately simulate these processes is required for annual assessment; design, qualification and certification of warheads undergoing Life Extension Programs; resolution (and in some cases generation) of Significant Finding Investigations; and the development of future stockpile technologies. The PEM subprogram is closely linked to the Science Campaign, which provides the experimental data that informs development of new models used in simulation codes.

Sequence (Ongoing for ASC)

Benefits

- Provides high fidelity models used in simulations of nuclear weapon performance to enable maintenance of the U.S. stockpile without nuclear testing.

Funding and Activity Schedule

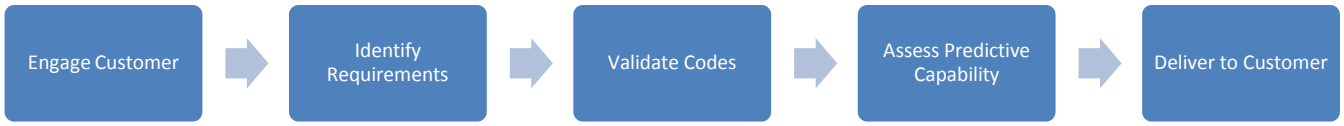
Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2012	DSW Support • Finished Level 1 Milestone advancing capabilities for annual assessment and resolution of significant finding investigations associated with early phase primary implosion. • Provided advanced high explosives models supporting certification for future LEPs and stockpile modifications. Material Properties • Delivered materials models required for maturation and certification of advanced safety technologies. • Delivered and assessed the impact of new plutonium properties models to be used in annual assessment. Strategic Development • Provided capabilities required for assessing the impact of extreme radiation environments on weapon circuits without the use of the recently decommissioned Sandia Pulsed Reactor.	**69,890**
FY 2013	• Provide multi-phase models for material strength. • Develop and implement improved descriptions of the Plutonium equation of state based on recent experimental data. • Provide physics-based models of transistor response to neutron irradiation in support of the W88 ALT. • Provide fluid/structural response models for B61 delivery environments.	**68,932**

Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2014	• Develop and demonstrate predictive capabilities for calculating the onset of primary boosting and the influence of stockpile changes on this onset (joint with Science Campaign). • Develop predictive models of microscopic thermonuclear processes in plasmas, such as ion stopping, and multiple ion interactions during stopping.	**62,995**
FY 2015 **FY 2016** **FY 2017** **FY 2018**	• Provide reactive flow models for HE detonation and burn that capture grain scale material heterogeneity and are computationally efficient. • Provide models for complex hydrodynamic processes that are sufficiently predictive to enable design and assessment of re-use options. • Provide models needed for certification on new safety options.	**67,098** **69,326** **70,759** **72,194**

Verification and Validation
Overview

Verification and Validation (V&V) provides assurance that the models in the codes produce mathematically correct answers which reflect physical reality. The V&V subprogram funds the critical skills needed to apply systematic measurement, documentation, and demonstration of the ability of the models and codes to predict physical behavior. The V&V subprogram is developing and implementing Uncertainty Quantification (UQ) methodologies as part of the foundation for the Quantification of Margins and Uncertainties (QMU) process of weapons assessment and certification. The V&V subprogram also drives software engineering practices to improve the quality, robustness, reliability, and maintainability of the codes that evaluate and address the unique complexities of the stockpile. As nuclear test data is becoming less relevant with an aging stockpile, and as weapons designers with test experience leave the nuclear security enterprise, it becomes increasingly important that the codes are verified and validated so future generations of designers are comfortable relying on these foundational tools.

Sequence (Ongoing for ASC)



Benefits

- Provides methods and measures necessary to assess the credibility of the ASC codes and models, quantify uncertainties in ASC calculation results, measure the progress in the ASC predictive capabilities, and provide confidence when applying simulations for stockpile deliverables.
- Within the V&V subprogram, ASC invests in capabilities related to and used to conduct B61 LEP and W78/88-1 study support.

Funding and Activity Schedule

Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2012	On-going user support • Provided training on the use of UQ tools. • Continued implementation of Quality Assurance (QA) controls on codes and models development process. • Ensured material and nuclear databases were correctly updated and maintained. Verification and Validation • Completed verification and validation assessment of improvements in primary performance code in support of Level 1 milestone (initial conditions I for boost). • Began outlining strategy to verify and validate improvements to primary performance code in support of Level I initial conditions for Boost II. • Validated material and Plutonium models required to support certification of safety design options for refurbished weapons. • Provided technical support in validating models used to certify weapon systems under hostile environments in the absence of the Sandia Pulsed reactor. Predictive Capability Assessment • Completed common modeling in support of the boost initiative. • Conducted initial assessment of calibrated predictive capability against system specific baseline models. • Completed validating primary common model against relevant datasets. • Completed validating secondary common model against relevant datasets.	**46,087**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	• Conducted sensitivity and safety studies in support of LEP work. UQ methods • Completed participation with conclusion of PSAAP I activities. • Began providing support to improve UQ methodology for use to support annual stockpile assessment activities.	
FY 2013	On-going user support and training • Provide training on the use of UQ tools. • Implement QA controls on codes and models development process. • Ensure material and nuclear databases are correctly updated and maintained in support of on-going weapon assessment and life extension activities. Verification and Validation • Begin activities required to verify and validate improvements to primary performance code in support of Level I Initial Conditions for Boost II. • Begin verification and validation of improvements to assessment codes used in support of Level I Energy Balance II. • Provide the support needed to verify and validate improvements made to physics models and codes used in modeling circuit responses to hostile environments. Predictive Capability Assessment • Conduct assessment of un-calibrated science-based models against system specific models. • Improve the primary common model and validate the model against additional underground datasets. • Improve the secondary common model and validate the model against additional underground datasets. • Validate high explosive common model in support of design/development activities associated with life extension programs. UQ Research • Improve UQ aggregation tool for use in assessing weapon performance. • Work to improve UQ method to address model form uncertainty.	**56,232**
FY 2014	On-going user support and training • Provide training on the use of UQ tools. • Implement QA controls on codes and models development process. • Ensure material and nuclear databases are correctly updated and maintained to support weapon assessment activities. Verification and Validation • Complete verification and validation assessment activities in support of Level I initial conditions for Boost II. • Conduct and complete verification and validation assessment of radiation transport code in support of Level I Energy Balance II. Predictive Capability Assessment • Establish initial benchmarking of science-based models against system specific models and identify recommendations for future investments to model improvements.	**52,728**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	• Improve the primary common model until the model has been validated against all relevant underground data sets. UQ Research • Collaborate with PSAAP II centers on technical topics related to UQ methods and improvements. • Improve UQ aggregation tool for use in assessing weapon performance. • Continue to improve UQ aggregation to include model form uncertainty. • Work to improve UQ method for assessing stockpile and life extension programs.	
FY 2015 **FY2016** **FY 2017** **FY 2018**	On-going user support and training • Provide training on the use of UQ tools. • Implement QA controls to ensure material and nuclear databases are correctly updated and maintained. Verification and Validation • Verify improvements in nuclear performance codes in support of out-year PCF pegposts. • Verify improvement in safety codes to address multi-point safety issues. • Validate improvements to physics and material models to support out-year PCF pegposts. • Verify improvements in engineering codes in support of out-year PCF pegposts for normal/abnormal/hostile environments. Predictive Capability Assessment • Continue to assess predictive capability as improvements to codes and models are made available, including new nuclear material data. • Improve the primary and secondary common models against remaining relevant underground datasets.	**56,162** **58,028** **59,226** **60,427**

Computational Systems and Software Environment (CSSE)
Overview

Computation Systems and Software Environment (CSSE) builds the computing systems needed for weapons simulations. Since the scale of the requirements of the ASC codes drives the programs need to achieve its predictive capability goals, the ASC Campaign must continue to invest in and consequently influence the evolution of computational environments. Along with the powerful Commodity and Advanced Technology systems that the campaign fields, the supporting software infrastructure that is deployed on these platforms includes many critical components, from system software to Input/Output (I/O), storage and networking, and post-processing visualization and data analysis tools.

Sequence (Ongoing for ASC)

Benefits

This Computational Systems and Software Environment sub-program delivers the following to the nuclear weapons complex:

- production and advanced/problem-optimized systems;
- the system software infrastructure including the support of an operating system environment;
- integrated tools to enable the development, optimization, and efficient execution of application codes;
- I/O (or data transfer), networking technologies, and storage infra-structure, and
- integrated environments to support end-user post-processing visualization, data analysis, and data management.

This sub-program develops the plans and coordinates the execution of next-generation computing technology research and development. This R&D prepares the ASC applications and computing environment for the paradigm shift in computing technology to extreme, heterogeneous, multi-core on-node parallelism.

Funding and Activity Schedule

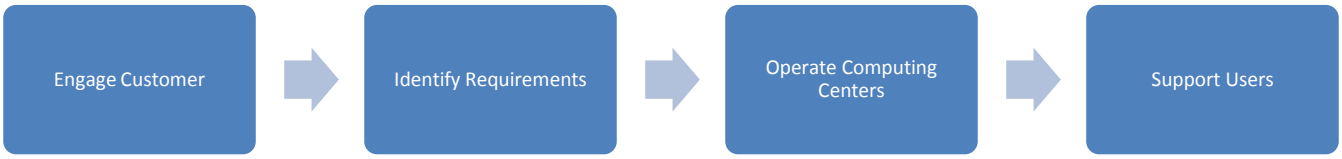
Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2012	Platform Operations • Continued deployment of Sequoia at LLNL. • Continued operation of Cielo and Roadrunner. • Deployed Tri-Lab Linux Capacity Cluster (TLCC2) systems. • Retired BlueGene/L, Unclassified BlueGene uBGL, and TLCC1 systems. Planning • Developed the mission need statement for ASC's next-generation advanced system as a replacement for Roadrunner. Capability Development • Advanced reliable, available, and secure environment for distance computing. • Furthered development of computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis. • Initiated the Hybrid Memory Cube (HMC) technology partnership to explore the optimization of HMC's performance and energy capabilities. • Explored alternative computer technologies on scalability, reliability, packaging, and cost.	**181,178**

Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2013	Platform Operations • Operate Sequoia in General Availability (GA) mode. • Continue operation of Cielo in GA mode. • Decommission of Roadrunner. • Operate TLCC2 systems. Planning • Complete CD-1/2/3 phases for ASC Trinity System to be procured by the ACES (SNL/LANL) team and deployed at LANL. • Initiate CD-0 phase for ASC 2017 Advanced Technology System. Capability Development • Provide readiness support to ASC code teams in porting and scaling applications onto Sequoia and Cielo. • Further development of tri-lab computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis. • Continue oversight of the jointly funded NNSA and DOE Advanced Scientific Computing Research (ASCR) FastForward projects. • Initiate additional industrial partnerships to address critical Exascale R&D technology barriers via the Design Forward program.	**151,121**
FY 2014	Platform Operations • Operate Sequoia. • Operate Cielo. • Operate ASC Trinity system. • Operate TLCC2 systems. Capability Development • Continue providing readiness support to ASC code teams in porting and scaling applications on to Sequoia and Cielo. • Further development of tri-lab computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis. • Continue oversight of the jointly funded NNSA and DOE ASCR FastForward projects.	**135,593**
FY 2015 **FY 2016** **FY 2017** **FY 2018**	Platform Operations • Operate Sequoia. • Decommission Cielo. • Operate TLCC2 systems. • Initiate deployment of CTS1 clusters. Planning • Complete CD-3 phase for ASC 2017 Advanced Technology System. Capability Development • Continue providing readiness support to ASC code teams in porting and scaling applications on to Sequoia. • Further development of tri-lab computing environment consisting of user tools, networks, file system, archival storage, and visualization and data analysis.	**144,424** **149,221** **152,304** **155,393**

Facility Operations and User Support
Overview

The Facility Operations and User Support subprogram provides the facilities and services required to run nuclear weapons simulations. Facility Operations includes physical space, power, and other utility infrastructure, and Local Area /Wide Area Networking for local and remote access, as well as system administration, cyber-security, and operations services for ongoing support. User Support includes computer center hotline and help-desk services, account management, web-based system documentation, system status information tools, user training, trouble-ticketing systems, common computing environment, and application analyst support.

Sequence (Ongoing for ASC)



Benefits

- The Facility Operations and User Support subprogram deploys the necessary physical facility for computing centers at the national laboratories.
- ASC provides the operational support for reliable production computing and storage environments, as well as a suite of services enabling effective use of ASC Tri-Laboratory computing resources.

Funding and Activity Schedule

Fiscal Year	Activity	Funding (Dollars in Thousands)
FY 2012	User Support • Integrated Tri-Lab Linux Capacity Cluster (TLCC2) systems. • Provided analysis and software environment development. • Provided help desk support to ASC computer users. • Coordinated user training across user support sub-teams. • Executed a strategy for a more persistent common computing environment for users to transition seamlessly between current production systems to future architectures. • Supported applications for large runs on Cielo, Dawn, and other ASC platforms. • Utilized Y12 and remote ASC cluster resources for production manufacturing problems. Capability Deployment • Completed Phase 2 planning for contingency response findings identified by the GAO. • Enhanced redundancy and reliability of electrical distribution systems to support future petascale and exascale system. • Continued analysis of future modifications and/or expansion of facilities that will be needed by future ASC systems.	**159,859**
FY 2013	User Support • Provide Web documentation, user manuals, technical bulletins, training, hotline and help desk support for ASC users of Cielo, Sequoia, and TLCC2 systems. • Ensure a more persistent common computing environment for users to transition seamlessly among current production systems. • Develop and initiate action plan to increase overall availability of computer cycles	**173,013**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	to end users. • Provide operational support for reliable and secure production computing environment: system administration and operations, software and hardware maintenance, licenses and contracts, archival storage, computing environment security and infrastructure, production computing services, and tri-lab system integration and support. Capability Deployment • Complete planning and exercise contingency response plans. • Support the utilization of ASC codes and computing resources at the Kansas City Plant to solve production manufacturing problems through modeling and simulation. • Decommission Roadrunner and TLCC1 systems.	
FY 2014	User Support • Provide Web documentation, user manuals, technical bulletins, training, hotline and help desk support for ASC users of Cielo, Sequoia, and TLCC2 systems. • Ensure a more persistent common computing environment for users to transition seamlessly among current production systems. • Develop and initiate action plan to increase overall availability of computer cycles to end users. • Provide operational support for reliable and secure production computing environment: system administration and operations, software and hardware maintenance, licenses and contracts, archival storage, computing environment security and infrastructure, production computing services, and tri-lab system integration and support. Capability Deployment • Complete planning and exercise contingency response plans. • Support the utilization of ASC codes and computing resources at the Kansas City Plant to solve production manufacturing problems through modeling and simulation. • Decommission the remaining TLCC1 systems.	**155,506**
FY 2015 **FY 2016** **FY 2017** **FY 2018**	User Support • Provide Web documentation, user manuals, technical bulletins, training, hotline and help desk support for ASC users of Sequoia and TLCC2 systems. • Ensure a more persistent common computing environment for users to transition seamlessly among current production systems. • Develop and initiate action plan to increase overall availability of computer cycles to end users. • Provide operational support for reliable and secure production computing environment: system administration and operations, software and hardware maintenance, licenses and contracts, archival storage, computing environment security and infrastructure, production computing services, and tri-lab system integration and support. Capability Deployment • Complete planning and exercise contingency response plans. • Deploy newer file system and archival storage technologies to replace aging technologies. • Support the utilization of ASC codes and computing resources at the Kansas City	**165,635** **171,135** **174,671** **178,213**

Fiscal Year	Activity	Funding (Dollars in Thousands)
	Plant to solve production manufacturing problems through modeling and simulation.	

Supporting Information

Capital Operating Expenses [a]

Capital Operating Expenses Summary

(Dollars in Thousands)

	FY 2012 Current	FY 2013 Annualized CR	FY 2014 Request
Capital Operating Expenses			
General Plant Projects	2,485	2,540	2,596
Capital Equipment	9,091	9,291	9,495
Total, Capital Operating Expenses	**11,576**	**11,831**	**12,091**

Outyear Capital Operating Expenses Summary

(Dollars in Thousands)

	FY 2014 Request	FY 2015 Request	FY 2016 Request	FY 2017 Request	FY 2018 Request
Capital Operating Expenses					
General Plant Projects	2,596	2,653	2,711	2,771	2,832
Capital Equipment	9,495	9,704	9,917	10,135	10,358
Total, Capital Operating Expenses	**12,091**	**12,357**	**12,628**	**12,906**	**13,190**

[a] Funds are appropriated for Operations and Maintenance, which includes operating expenses, capital equipment and general plant projects. The program no longer budgets separately for capital equipment and general plant projects.