Unit Name: Arctic Region Supercomputing Center
Report Date: 09.29.09

University of Alaska Fairbanks
2011 Annual Unit Plan

A. General Information

A1. Unit Name: Arctic Region Supercomputing Center (ARSC).

A2. Unit Mission Statement - ARSC supports high-performance computational research in science and engineering with an emphasis on high latitudes and the Arctic. The mission of the Arctic Region Supercomputing Center is to provide an ensemble of outstanding expertise, state-of-the-art technology and innovative research projects that will: Enable the creation and discovery of knowledge in science, engineering and art; enhance educational and research capabilities of the University of Alaska, the State of Alaska, the Department of Defense and the United States; advance knowledge of the polar regions; and contribute to a richer understanding of the world around us.

A3. Core Services - ARSC (www.arsc.edu) provides high-performance computing (HPC) systems and services, massive data storage systems, scientific data visualization, software, high bandwidth communications and secure network connections, technical scientific support staff and system administrators to sustain research identified as critical state and national priorities for the University of Alaska (www.alaska.edu), the University of Alaska Fairbanks (www.uaf.edu) and the DoD High Performance Computing Modernization Program (hpcmo.hpc.mil). The depth of experience in providing HPC support—installation, management, operations and maintenance—includes proprietary mainframes/clusters, commercial off-the-shelf (COTS)-based systems and support of add-on technologies, as well as information security support to meet prescribed academic and federal research requirements. ARSC has an established multi-petabyte data archive with multiple terabytes of disk as well as an established 10Gbit/s network connected to multiple academic and federal research networks.

ARSC actively partners with other institutions for grant seeking and publication, mentoring graduate and undergraduate students and providing internships. Research activities are focused in two key areas:

1.) high latitudes environmental modeling
2.) analysis of next-generation technologies for high-performance computing.

Scientific specialists and technical staff at ARSC provide HPC management services as well as training and assistance to current and prospective users of ARSC resources to allow them to successfully carry out computationally based research of DoD and academic investigations. ARSC has a proven record of success in teaching the HPC skills needed to develop a diverse and well-prepared 21st Century workforce by providing graduates with hands-on experience with the technical and scientific software that potential employers use. Additionally ARSC is accomplished at building and maintaining rapidly changing infrastructure needed to carry out large computational campaigns, and providing high availability use of HPC compute and data storage systems based on individualized needs.

B. Progress Report

B1. Major Accomplishments *Significant unit accomplishments for AY09-10 in the areas indicated below. Include the top three accomplishments in each area.*

Teaching, research and public service:

- ***Pacman* comes online as first supercomputer dedicated solely for academic scientific research at UAF**

An estimated $13 million is brought to the UAF research portfolio as a result of the direct access to ARSC high-performance computing (HPC) resources. Principle Investigators using ARSC's HPC resources cite the existence of the Center for providing a competitive position in successfully obtaining external, federal research dollars. The $6 million National Science Foundation grant to UAF and the University of Hawaii in the fall of 2009 to support the Pacific Area Climate Modeling and Analysis Network (PACMAN) provided the funds for ARSC to procure and install new supercomputing resources for use solely by the university community. The new supercomputer is named *Pacman* and will be used to investigate the effect of climate change on freshwater resources in Alaska and Hawaii. *Pacman*, and a new 2.5 petabyte scale data storage facility procured under the NSF grant, came online during the spring of 2010 in the first of three phases to provide uninterrupted support to the important, intensive computational science campaigns currently underway by 280 UAF researchers. As of October 2010 ARSC's machines purchased by the Center's major funding agency, the Department of Defense High Performance Computing Modernization Program (HPCMP), will be available only for unclassified DoD projects, marking a radical departure from historical practices of sharing high-performance computing (HPC) resources between DoD and non-DoD supercomputer users.

- **Computational Science Symposium**
  ARSC hosted a series of 11 topical sessions focusing on the current state of computational research activities at the University of Alaska Fairbanks Feb. 15 – 26, 2010. More than 50 principal investigators representing a wide range of scientific disciplines met with colleagues at UAF who use supercomputers as an essential tool in conducting research. The forum provided an opportunity for PIs to review and discuss the potential for future cross-disciplinary computational science research in the fields of climate, tsunami, physics and chemistry. ARSC supports more than 280 scientists at UAF by helping them find, write or improve the software they need to do their research and to conduct computationally intensive investigations in areas of high-priority to the state, including climate modeling, atmospheric science and ocean science. These scientists collectively bring $13 million additional grant dollars to UAF as a result of their computational science activities. During calendar year 2008, academic users of ARSC resources published a total of 64 peer-reviewed articles. During that same time of CY2008, ARSC delivered 12.5 million computing hours of capability to academic users and provided 427 terabytes of secure storage to highly confidential and often irreplaceable scientific data. Through its yearly participation in the International Conference for High Performance Computing (HPC), Networking, Storage and Analysis, as well as the annual publication of its science magazine Challenges, ARSC disseminates the findings of computational research activities at UAF to a broad audience.

- **Pan-Pacifc Climate and Weather Collaboration**
  ARSC hosted a meeting Sept. 8 – 10, 2009 at UAF for invited Chinese and UA scientists who use computational science and modeling to examine problems related to climate change and weather. Participants included academic and science partners at the University of Alaska Fairbanks (IARC, GI, CSEM) and the office of UA Statewide Vice President for Academic Affairs, as well as attendees from Nanjing University and the Chinese Academy of Sciences. The three-day meeting focused on enhancing support for computational research across a full spectrum of disciplines to leverage additional research opportunities, high-tech learning, collaborations, academic partnerships. Specifically, participants were able to lay the groundwork to:
  - identify a framework of common issues with respect to climate modeling and weather research
  - identify collaborative research projects as potential candidates for joint funding through U.S. and Chinese agencies
  - create partnerships with Nanjing University and science agencies in China to facilitate faculty, research and graduate student exchanges
  - establish the basis for a follow-on workshop to be held in China (ARSC's NSF grant proposal for this workshop has been funded and will take place October 2010)

Faculty, student and staff awards, competencies, regional/national/international recognition:

- **ARSC undergraduate research student recognition:**
  ARSC undergraduate interns Jose Antonio Figueroa and Vahid Ajimine are two of only four students selected from a national field of high-performance computing scholars recognized nationwide at a June 2010 conference sponsored by the Department of Defense High Performance Computing Modernization Program (HPCMP) in Illinois. Figueroa and Ajimine participated in ARSC's 2009 Summer Research Program under the HPCMP's Joint Educational Opportunities for Minorities (JEOM) program. The JEOM program places students from underrepresented groups at DoD research facilities throughout the country to work with researchers on computationally intensive problems.

  ARSC undergraduate student Research Projects Assistants (RPAs) successfully wrote a proposal and obtained a grant of $3,614 from the UAF Technology Advisory Board in the fall of 2009 to enhance and support the Remote Control Devices Project (RCDP). The fundamental aim of the RCDP is to expose students and teachers to challenges of completing tasks at remote locations by means of remote-controlled robots. Off-site students and teachers gain (near) real-time control over on-site ARSC robots through a custom-designed, web-based interface available at http://robots.arsc.edu Multiple users log in simultaneously, control separate robots in the same environment, and work together to complete tasks and scenarios. Participants gain exposure to a "work environment" which is becoming increasingly more important, such as in remote surgery, robotic repairs and inspections, and (in certain respects) oceanic and extra-terrestrial exploration.

- **ARSC staff recognition:**
  ARSC HPC Mass Storage Specialist Gene McGill has been tapped to lead a national effort on behalf of the DoD High Performance Computing Modernization Program to address growing concerns of managing, archiving and quickly accessing an ever-growing amount of potentially confidentially and often irreplaceable data. McGill will oversee the Storage Initiative for all six DoD Supercomputing Resource Centers in the country.

  ARSC HPC Systems Analyst Liam Forbes (UAF '95, '98) was elected to the position of Board Secretary for the international Cray User Group at their meeting in Edinburgh, Scotland May 2010. ARSC will host the week-long CUG conference in May 2011, bringing more than 300 high-performance computing specialists and industry analysts to Fairbanks and the UAF campus.

  ARSC HPC Systems Analyst Melinda Shore was awarded U.S. Patent 7680104 on March 16, 2010 for technology allowing embedded IP addresses to be represented as tags. By using fixed tags rather than mutable (in the case where a protocol traverses a Network Address Translation device) IP addresses, complex, session-oriented protocols can be encrypted and/or integrity protected end-to-end, and it reduces the processing load on network devices which perform packet inspection.

- **ARSC major equipment acquisition**:
  ARSC obtained a new 11,648 core Cray XE6 under the DoD High Performance Computing Modernization Program (HPCMP) Technology Insertion Process for 2010. The supercomputer has been named *Chugach* (pronounced choo-gatch) after the mountain range in Southcentral Alaska. *Chugach* is a little over three times the size of *Pingo*, ARSC's 3,456-processor Cray XE5, but with a faster interconnect and new Cluster Compatibility Mode environment. *Chugach* will be part of a full complement of HPC hardware and software services that will be physically located at the DoD Supercomputing Resource Center (DSRC) in Mississippi and remotely operated by ARSC DSRC from Fairbanks as an open research system.

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B2. End Results and Strategies *Review end results, strategies, targets, etc, in the table below for the period July 1, 2009 to June 30, 2010 (State Fiscal Year-FY10) based on the FY09/CY2010 ARSC AUP.*

End Result:	Strategies to Achieve End Result:	Target(s):	Measure(s)/Assessment(s):	Status:	Budget Impact:
Maintain and enhance the Arctic Region Supercomputing Center's existing role in providing high-performance computational (HPC) science resources to UA/UAF faculty, staff and students to meet high-priority research areas significant to the university and to the State of Alaska.	– Collaborations with federal, state and university scientists and funding agencies to provide capable and diligent support of very large systems for computational science with a focus on phenomena related to the Arctic – Strengthen existing partnerships and create new ones to provide the computational basis for research, instruction and support of high-resolution modeling of Arctic systems – Strengthen existing partnerships and create new ones with federal, state and university scientists to develop innovative and accessible mechanisms for use of computational models by the public – Develop appropriate undergraduate and student programs that provide opportunities for experiential learning through visualization and use of high-performance computing systems – Collaborate with UA/UAF to secure additional space to accommodate new ARSC systems; obtain state funding to support UAF cyberinfrastructure needs for increased bandwidth connectivity, massive data storage, analysis and retrieval, and for disaster recovery	1.) Realignment of ARSC HPC resources into separate business models for DoD systems and academic systems by October 2010 2.) Commitment for ARSC funding in FY12 UAF operating and capital budget 3.) Chancellor's appointment of an advisory committee to guide academic HPC at UAF 4.) Procure and operate an NSF-funded supercomputer and storage system 5.) Sustain postdoctoral fellows program with increased focus on joint ventures with campus-based faculty engaged in computational science 6.) Target of eight undergraduate student employees/ research projects assistants in FY11	– Allocation of HPC resources to 71 principal investigators at UAF conducting computationally intensive scientific investigations – ARSC value to UAF research portfolio demonstrated by approximate $13 million in external grant dollars generated from UAF projects using (and dependent on) ARSC HPC resources – NSF grant to UAF to support Pacific Area Climate Monitoring and Assessment Network (PACMAN) – $1.5 million NSF grant to ARSC to enhance academic HPC at UAF and build UAF cyberinfrastructure – Incorporation of inundation models into UAF/ARSC Tsunami Computational Portal to better understand potential impacts on coastal communities and ecosystem – Provide consultation and support to NSF, NOAA, DoD and U.S. Minerals Management Service (MMS) for improved understanding of Beaufort Sea weather to enhance oil extraction planning, pollution mitigation, marine shipping and safety – Provide consultation and support to NOAA Fairbanks National Weather Service to use ARSC Arctic-specific WRF products as part of routine operational forecasting – Provide consultation and support to the North Pacific Research Board on Integration of ecosystem models in order to assess the impacts of changes in the ocean on fisheries production	– 1. Ongoing – 2. Ongoing – 3. Ongoing – 4. The NSF-funded supercomputer *Pacman* and new 2.5 petabyte-scale data storage facility came online during spring 2010 solely for academic use – 5.Four ARSC post-docs on staff w/joint appointments in IARC or SNRAS with strong focus on climate change modeling – 6. Six undergraduate Research Project Assistants (RPAs) employed as of September 2010 supporting computational science projects focusing on Arctic weather systems, space weather forecasting, ocean modeling, cybersecurity and developing and maintaining supercomputer software tests and tools	$4 million ARSC's FY11 UA operating budget request was unfunded

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End Result:	Strategies:	Target(s):	Measure(s)/Assessment(s):	Status:	Budget Impact:
Maintain and enhance ARSC as a DoD Supercomputing Resource Centers (DSRC) in the nation with support for the Center in service of DoD's requirements and UA's interests.	– Collaborate with UA/UAF to advocate the benefits of ARSC to DoD High Performance Computing Modernization Program (HPCMP) – Secure additional space and power to accommodate new high-performance computing systems purchased by DoD for ARSC/UAF – Strengthen partnership with UA/UAF to obtain state funding to support infrastructure needed to sustain successful acquisitions of new HPC machines (DoD and academic) – Demonstrate leadership in remotely operating and managing large HPC systems – Establish distinction in evaluation and assessment of leading edge computational science equipment, systems, tools and programming techniques	– 1. Acquisition of a new supercomputer and data storage system from the DoD High Performance Computing Modernization Technology Insertion Process for 2010 (HPCMP TI-10) – 2. Demonstrated ability in remote operation of ARSC DoD resources – 3. Segregation of ARSC HPC resources for DoD and non-DoD use – 4. Demonstrated ability and technical excellence of ARSC staff for analysis of next-generation computing technologies, and in running large, high-performance computing (HPC) systems, including massive data storage operations and high-speed networking	– Commitment from DoD for ARSC/UAF to manage and operate HPCMP resources through May 2011 with intensive educational campaign and lobbying for renewal of DoD contract with ARSC/UAF for continued management and operation of the Arctic Region Supercomputing Center in Fairbanks through 2016	– 1. ARSC acquired a new Cray XE6 supercomputer named *Chugach* and new massive data storage capabilities for HPC resources through the 2010 HPCMP Technology Insertion process – 2. ARSC broaden the scope of opportunities for physical presence of new DoD HPC resources by partnering with the National Petascale Computing Facility to place *Chugach* at the University of Illinois; DoD decided *Chugach* placement at HPCMP supercomputing facility in Mississippi, remotely operated by ARSC – 3. Ongoing – 4. ARSC staff have been tapped for leadership positions in implementing national, HPCMP program wide initiatives in data storage, security, networking and HPC user productivity, enhancement, technology transfer and training	The Center is funded by the Department of Defense High Performance Computing Modernization Program (HPCMP) through a contract handled by the General Services Administration (GSA). ARSC has had some type of contractual arrangement with the HPCMP since 1997. Our current contract runs from 8-4-2006 to 5-31-2011. FY09 experienced a significant shift down to $8 million in restricted spending with a resulting decline in indirect cost recovery. However, this enabled ARSC to save for future restricted funds equipment purchases and reduce the unrestricted carry forward as requested by UAF administration. Total FY09 revenue was $9 million with expenditures at $10.3 million (excluding indirect cost recovery). Roughly 90 percent of revenue is restricted revenue with a portion of indirect cost recovery providing ARSC's source of unrestricted funds.

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End Result:	Strategies:	Target(s):	Measure(s)/Assessment(s)	Status:	Budget Impact:
Diversification of funding base to generate revenue from sources other than U.S. Department of Defense	– Strengthen partnership and collaboration with UA/UAF to advocate for and secure external funding to support high-performance computing research at UAF, including massive data storage, analysis retrieval and disaster recovery – Increase partnerships and collaborations with UA faculty and researchers to enhance grant funding opportunities from other federal agencies – Increase communication and PR strategies focusing on ARSC's distinction in the evaluation and assessment of leading edge computational science equipment, systems, tools and programming techniques; and high-tech innovations and problem-solving expertise in high-performance computing, massive data storage systems, software, security and high bandwidth communications – Enlistment, and occasional recruitment, of research faculty in computational science areas	– 1. Additional resources available from external funding agencies to support UAF cyberinfrastructure – 2. Grant and project proposals funded in targeted areas of climate change modeling, Arctic weather research and forecasting, and the study of new and next-generation technologies aimed at boosting computer processing speed and productivity	– Allocation of HPC resources to 71 principal investigators at UAF conducting computationally intensive scientific investigations – ARSC value to UAF research portfolio demonstrated by approximate $13 million in external grant dollars generated from UAF projects using (and dependent on) ARSC HPC resources – $6 million NSF grant to UAF to support Pacific Area Climate Monitoring and Assessment Network (PACMAN) – $1.5 million NSF grant to ARSC to enhance academic HPC at UAF and build UAF cyberinfrastructure – Incorporation of inundation models into UAF/ARSC Tsunami Computational Portal to better understand potential impacts on coastal communities and ecosystem – Provide consultation and support to NSF, NOAA, DoD and U.S. Minerals Management Service (MMS) for improved understanding of Beaufort Sea weather to enhance oil extraction planning, pollution mitigation, marine shipping and safety – Provide consultation and support to NOAA Fairbanks National Weather Service to use ARSC Arctic-specific WRF products as part of routine operational forecasting – Provide consultation and support to the North Pacific Research Board on Integration of ecosystem models in order to assess the impacts of changes in the ocean on fisheries production	– 1. $1.4 million NSF Major Research Instrumentation grant funded August 2010; Phase I of three-year $6 million EPSCoR (Experimental Program to Stimulate Competitive Research) grant to UAF/University of Hawaii funded in fall 2009 to support PACMAN (Pacific Area Climate Monitoring and Analysis) – 2) Other funding, such as through MMS and NSF, has been received for 2010-11, with additional funding being sought from various sources	$2.5 million

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End Result:	**Strategies:**	**Target(s):**	**Measure(s)/Assessment(s):**	**Status:**	**Budget Impact:**
Establish ARSC as a center of excellence for computational scientists in collaborations and exchanges between UA/UAF and Chinese researchers for modeling North Pacific environmental phenomena and climate change	– Strengthen current partnerships and develop new collaborations between UA/UAF/ARSC and Chinese academics /agency representatives to establish formal ties and to develop a framework of common issues with respect to climate change modeling, weather modeling and the study of next-generation computing technologies – Increase communication, outreach and PR strategies focusing on ARSC's increased depth of engagement in China in the areas of climate change modeling, weather modeling and the study of next-generation computing technologies – Investigate and pursue activities resulting in one new computational science discipline to provide additional and increased focus on existing UA/UAF program priorities in climate change, atmospheric science and computational oceanography	– 1.) Coordinate and conduct international conference of Chinese and U.S. computational scientists to examine problems related to climate – 2.) Successful submission of grant proposal (NSF and Chinese NSF) for support of collaborations	– External funding for workshops or similar meetings in China and Alaska – Pursuit of joint funding – Joint publications or presentations	– 1.) ARSC hosted the Pan-Pacific Climate and Weather Collaboration Meeting at UAF Sept 8-10, 2009 to identify a framework of common issues with respect to climate modeling and weather research, to identify collaborative research projects for joint funding through U.S. and Chinese agencies, to create partnerships with Nanjing University and science agencies in China for faculty, research and graduate student exchanges, and to establish the basis for a follow-on workshop to be held in China – 2.) NSF funding has been provided for a workshop to be held October 2010 in Beijing on the topics of next-generation supercomputing, HPC application acceleration technologies and climate/weather modeling	$100,000 in FY11

B3. Analysis of Performance Metrics and Supporting Data

Data Review

ARSC's initial target numbers for FY11 have been adjusted downward to reflect a very high level of uncertainty associated with renewal of the Center's contract with the Department of Defense High Performance Computing Modernization Program (HPCMP). There is a strong possibility that the Center's contract will be terminated in May 2011. Several options for limited follow-on or transition funding with the HPCMP have been proposed and are under negotiation. Successful achievement of these options is reflected in the low FY12 target numbers. Until a more certain funding source is identified, estimates beyond FY12 are not warranted.

Strategies

To respond to and prepare for this significant change in the role of the Center within the HPCMP and associated drop in funding, ARSC is following several approaches:
a) Enhancing support of non-DoD high performance computing at UA: ARSC has always been actively engaged with University of Alaska research, leveraging the HPCMP support appropriate to serve multiple communities and provide bridges between them. Independent of the changes in HPCMP funding, ARSC participated actively in obtaining the National Science Foundation EPSCoR grant for PACMAN (Pacific Area Climate Monitoring and Analysis Network), of which $3M came to the University of Alaska Fairbanks. ARSC obtained a separate $1.4 million MRI (Major Research Instrumentation) grant. ARSC has made it possible to use the equipment portions of these grants more effectively by combination with respect to operational support and infrastructure. These grants provide salary for research, start-up funds for supplies, equipment, and research staff, shared use laboratory facilities and opportunities for expanding additional research programs.
b) Proposed options for leveraging specific areas of staff expertise that can contribute to both the University of Alaska and other organizations:

- contribute to the operations of the "consolidated" HPCMP using remote work strategies that allow staff to continue to contribute to both the university and the HPCMP. These areas of include general HPC expertise, investigation of next-generation technologies (like graphics processing units) for accelerated high-performance computing (HPC) applications, data storage, security and value of the ARSC Alaska location for diversity, redundancy and disaster recovery for storage and HPC capability
- support existing university projects in areas of storage and security
- explore similar options with state agencies or industry partners

c) Look for ways to leverage the weather and climate modeling expertise of research staff to bring in related funding.

Resources and Reallocation

ARSC reduced spending for the summer undergraduate research program and reduced software licensing spending and infrastructure costs as part of FY11 UAF $5.5 million pullback
ARSC discontinued maintenance and operational support of the Discovery Lab in the Rasmuson Library and redirected funds to support the new academic supercomputer *Pacman*, a new 2.5 petabyte scale data storage facility, and to support UAF faculty and student research on the new academic systems. Until May 2010, the Discovery Lab served as ARSC's primary venue for high-profile community engagement activities. During the period of January through November 2009, the Discovery Lab hosted a total of 975 guests at 70 separate events, including public outreach tours and collaborative performances. ARSC discontinued maintenance and operation of the lab in order to redirect staff resources to support the installation of a new supercomputer and a new data storage system at UAF, and to support UAF faculty and student research on the new academic systems.

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Fairbanks Academic Unit-Level Historical Performance and Targets These metrics do not apply to this unit

Line No. ▼	*Performance Metrics and Supporting Data* Reporting Period: FY10 (July 1, 2009 to June 30, 2010)	*Historical Performance* FY06	FY07	FY08	FY09	FY10	*FY11 Target* Current	New	*FY12 Target*
1	Student Credit Hours Generated (ex. 500-level)								
2	Grant-Funded Research Expenditures								
3	High Demand Job Academic Awards								
4	Undergraduate Student Retention								
5	Undergraduate Enrollment								
6	UA Scholar Enrollment								
7	Graduate Enrollment								
8	Unit Enrollment Management Plan								
9	Student Learning Outcomes Assessment								

Community Campus Academic Unit-Level Historical Performance and Targets These metrics do not apply to this unit

Line No. ▼	*Performance Metrics and Supporting Data* Reporting Period: FY10 (July 1, 2009 to June 30, 2010)	*Historical Performance* FY06	FY07	FY08	FY09	FY10	*FY11 Target* Current	New	*FY12 Target*
1	Student Credit Hours Generated (ex. 500-level)								
2	High Demand Job Academic Awards								
3	Undergraduate Student Persistence								
4	Undergraduate Enrollment								
5	UA Scholar Enrollment								
6	Unit Enrollment Management Plan								
7	Student Learning Outcomes Assessment								
8	Non-credit Instructional Productivity Units (NCU) Delivered								

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Research Unit-Level Historical Performance and Targets

ARSC data subject to RADICAL change as new information becomes available

Line No.	*Performance Metrics and Supporting Data* Reporting Period: FY10 (July 1, 2009 to June 30, 2010)	*Historical Performance* FY06	FY07	FY08	FY09	FY10	*FY11 Target* Current	New	*FY12 Target*
1	Grant-Funded Research Expenditures	14,491	14,064	14,358	9,888	12,156	16,000	10,000	2,400
2	Indirect-Cost Recovery	2,607	2,433	2,026	1,865	2,213	3,000	1,000	600
3	Non-General Fund (NGF) Revenue	13,486	12,690	13,579	10,214	11,497	14,300	12,700	3,700
4	Ratio of NGF Revenue to GF Revenue	~	~	~	~	~	~	~	~
5	TA/RA Positions	10	10	5	9	8	10	4	4

Additional Unit-Specific Metrics (ARSC AUP 2010)

Reporting period:	FY06	FY07	FY08	FY09	FY10	FY11 Current	FY11 Target	FY12 Target
Filled post doc positions	1	8	8	8	6	5	6	4
Filled Undergrad Positions	3	4	8	8	8	5	6	6

B4. Publications in refereed journals/periodicals

Please use EndNote to report publications for CY2008.,Include the information as an attachment when you submit the AUP.

(file attached: 2008AUP_ARSC_PeerReviewedJournals.enl)

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B5. Occurrences of applied research benefiting Alaska

Unit	Project Title	Project Status (complete, active, awarded, proposed)	Description of contribution to the state of Alaska	Native Knowledge *(collaborative w/ AK Native or rural groups and/or involves traditional knowledge?)**
ARSC	Regional Weather Forecasting Research and Modeling for Alaska	Complete	Risk Management; Public Safety in terms of air quality and aviation; volcanic plume dispersion and wildfire smoke transport. More accurate prediction of regional weather with higher resolution operational forecasts to include inversion layers; Predicts air quality for behavior recommendation.	
ARSC	Virtual Tsunami Center	Active	Provide world-class models for inundation, propagation and run-up of tsunamis on coastal and littoral regions. Tsunami warning center and analysis. Better understanding of temperature inversions, which play an important role in air quality in cold regions. Integration of ground-based observations with	
ARSC	Modeling permafrost change	Complete	Study effects of regional climate change; mitigate damage to Alaska infrastructure due to melting permafrost; forecasting of safe areas to build.	
ARSC	Collaborative Research: Downscaling global climate projections to the ecosystem of the Bering Sea with nested biophysical models.	Active	Creation of ocean circulation and ecosystem models that predict change in the Alaska marine environment. For example, the amount of fresh water influx or size of sea ice coverage in the Gulf of Alaska, the Bering Strait and Beaufort sea are vital pieces of information to the international fishing and shipping industries, and provide needed input for modeling North Pacific weather phenomena.	
ARSC	Modeling of Circulation in the North Aleutian basin	Complete	Creation of ocean circulation and ecosystem models that predict change in the Alaska marine environment. For example, the amount of fresh water influx or size of sea ice coverage in the Gulf of Alaska, the Bering Strait and Beaufort sea are vital pieces of information to the international fishing and shipping industries, and provide needed input for modeling North Pacific weather phenomena.	
ARSC	A study of WRF capabilities in resolving temperature inversions in Alaska and Montana	Complete	Applicable to studies of air quality and transportation safety	
ARSC	Polar sea-ice information needs: Interdisciplinary training, outreach and IPY legacy products through a sea-ice system services approach	Complete	Improved models forecasting the change of polar ice packs and melting sea ice; impacts of an ice-free summer Arctic Ocean.	
ARSC	Modeling processes controlling the on-shelf transport of oceanic mesozooplankton populations in the Gulf of Alaska and SE Bering Sea.	Active	Understanding of how physical ocean properties such as salinity, temperature and currents impact primary food production elements. These efforts will aid in understanding fishery production and changes to fish populations in different future climate scenarios.	
ARSC	Social Vulnerability to Climate Change in the Alaskan Coastal Zone	Complete	Potential impacts of coastal erosion, changing storm patterns, tsunami, and other impacts of climate change on coastal societies.	
ARSC	Beaufort Sea Mesoscale Meteorology Model Study Phase II	Active	Understanding of the weather patterns, particularly winds, storms, and sea ice, in the seas north of the Alaska North Slope. Impacts on oil extraction and safety. Determining optimal input data and model configuration for weather model accuracy.	

ARSC	EPSCoR Track 2	Active	In cooperation with researchers at the University of Hawaii, gain understanding of pan-Pacific climate and weather. Includes such phenomena as changes to weather patterns, transport of pollutants, and the impacts of different rainfall and winds on agriculture.	YES
ARSC	MRI-R2: Acquisition of a Configurable Supercomputer for Arctic Research	Active	Computational science research in 13 major areas, covering dozens of campus researchers. Includes climate change, native languages research, oceanography, and materials science. This grant will support basic and applied research, student work, and external grant seeking.	YES
ARSC	Collaborative Proposal: Multi-Scale Modeling: Assessing the role of eastern boundary upwelling regions and their ecosystems on climate variability using a fully coupled multi-scale model	Active	Increased understanding of the integrated systems for ocean, atmosphere and ice. Emphasis on improving verisimilitude of computational models, through multiple observation methods and modeling techniques. Emphasis on Arctic climate systems.	
ARSC	Workshop on High Performance Computing Application Acceleration (CHINA WORKSHOP)	Active	A meeting scheduled for October 2010 to bring together experts in HPC application acceleration from the US and China. Major themes are molecular dynamics and earth systems. This workshop will identify relevant areas for collaboration in which China and US interests overlap, with special attention to Arctic systems for climate and weather. External grantseeking opportunities will be identified.	
ARSC	Workshop on Cross-Pacific Teleconnections in Weather and Climate	Pending	A meeting to bring together experts in weather, climate, oceanography, ice, fisheries, ecologies, land surface and anthropomorphic factors, especially those which span from the US Arctic to East Asia. This workshop will identify relevant areas for collaboration in which China and US interests overlap, with special attention to Arctic systems for climate and weather. External grantseeking opportunities will be identified.	
ARSC	Petascale Computing Resource Allocations to Push the Limits of WRF on a Pan-Pacific Domain	Pending	Access to leading-edge supercomputing resources to better understand high resolution computational weather forecasting, with a focus on the high latitudes. This will augment existing computational weather forecasting for Alaska.	
ARSC	CMG Collaborative Research: Uncertainty characterization of volcanic plumes advected by wind fields	Pending	Understanding the flow of volcanic ash and chemicals such as sulfur dioxide, as they are ejected from active volcanoes. Particular focus on Alaska volcanoes, including their potential for impacting quality of life and Arctic aviation.	
ARSC	Robust Model-driven inversion of interferometric SAR Time Series for Monitoring Geodynamic Processes	Active	Better understanding of temperature inversions, which play an important role in air quality in cold regions. Integration of ground-based observations with remote sensing observations, to produce more accurate computational model output for use by Alaska planners and the general public.	
ARSC	Exploring temporal and spatial variability in Gulf of Alaska groundfish dynamics with integrated biophysical models.	Active	Coupling of physical ocean models (density, salinity, temperature, currents) with fish ecosystems model. Achieving better understanding of fisheries production, changing patterns of fishery production, and the relationship between changing ocean systems and ecosystems.	
ARSC	Parallelization and Porting of the Alaska Tsunami Forecast Model to ARSC	Active	Application analysis and performance acceleration for a computational tsunami prediction model. Integration of a new computational tsunami model into the ARSC tsunami portal, used by researchers to test and analyze different tsunami scenarios. This will provide better understanding of tsunami risk, and an ability to parameterize tsunami energy, propagation, and run-up.	

ARSC	Radar Observations and Computer Simulations of the Auroral and Polar Cap Ionosphere	Pending	Integrating radar experiments using HAARP with computational modeling, to better understand ionosphere behaviors. Impacts will include better understanding of the Aurora, improved predictability of radio wave propagation for communications, and enhanced understanding of the Sun's behavior on the ionosphere – all with a high latitudes emphasis.	
ARSC	Modeling of artificial airglow and plasma density enhancements in the F-region ionosphere resulting from powerful HF transmissions	Pending	Integrating radar experiments using HAARP with computational modeling, to better understand ionosphere behaviors. Impacts will include better understanding of the Aurora, improved predictability of radio wave propagation for communications, and enhanced understanding of the Sun's behavior on the ionosphere – all with a high latitudes emphasis.	
ARSC	Alaskan and High Latitude Climate Research, Alaska Climate Research Center, Geophysical Institute, University of Alaska	Pending	Integrating existing and ongoing data collected in support of Arctic climate research. Data include ground-based observations, remote observations, climate models, land surface measurements, and anthropomorphic measures. Creating better integration of these data resources for use in applied Arctic research.	
ARSC	EAGER: Scheduling and Resource Management with Large Per-Node Core Counts for High Performance Computational Clusters	Pending	More efficient utilization of high performance computing resources at UAF for Arctic-focused research. Includes small- and large-scale computational science, as well as data analysis, transformation, analysis, visualization, and access.	
ARSC	Adaptation of an Arctic Circulation Model	Pending	Increased understanding of the integrated systems for ocean, atmosphere and ice. Emphasis on Arctic climate systems.	
ARSC	Proposal to assess small scale nuclear battery options	Pending	Identification of methods for bringing less expensive power options to Alaska, for use off the grid, as battery backup, and as primary electrical producers.	

***This information is being collected as an *Indicator* for UAF's NWCCU accreditation reporting.**

B6. Comparative scores of students who take professional exams

These metrics do not apply to this unit

List examination scores:

School, College or Institute	Examination Type	Test Date	# of UAF Students Tested	UAF Pass Rate	National Pass Rate

Unit Name: Arctic Region Supercomputing Center
Report Date: 09.29.10

C. End Results and Strategies – FY 2011

Complete the table below for the period July 1, 2010 to June 30, 2011. For each end result, identify the applicable core theme**: 1.) Educate:** Undergraduate and Graduate students **2.) Discover:** Through Research, Scholarship, and Creative Activity, including an Emphasis on the North and its Peoples **3.) Prepare:** Alaska's Career, Technical, and Professional Workforce **4.) Connect:** Alaska Native, Rural, and Urban Communities through Contemporary and Traditional Knowledge **5.) Engage:** Alaskans via Lifelong Learning, Outreach, and Community and Economic Development

End Result:	Theme	Strategies to Achieve End Result:	Target(s):	Measure(s):	Status:	Budget Impact:
Maintain and enhance ARSC's existing role in support of scientific discovery through computation within the University and State of Alaska.	Educate Discover Prepare	– ARSC provides a fundamental foundation upon which UAF can fulfill its promise as America's Arctic research university – ARSC supports more than 280 scientists by helping them find, write or improve the software they need to further their research and conduct computationally intensive investigations in areas of high-priority including climate modeling, atmospheric science and ocean science – ARSC will strengthen existing collaborations and form new ones with federal, state and university scientists and funding agencies to provide capable and diligent support of very large systems for computational science with a focus on phenomena related to the Arctic – Strengthen existing partnerships and create new ones to provide the computational basis for research, instruction and support of high-resolution modeling of Arctic systems – Develop appropriate undergraduate and student programs that provide opportunities for experiential learning through visualization and use of high-performance computing systems – Collaborate with UA/UAF to secure additional space to accommodate new ARSC systems; obtain state funding to support UAF cyberinfrastructure needs for increased bandwidth connectivity, massive data storage, analysis and retrieval, and for disaster recovery	– Commitment for ARSC funding in FY12 UAF operating and capital budgets – Expand capabilities of NSF-funded supercomputer and data storage system – Chancellor's appointment of an advisory committee to guide academic HPC at UAF – Sustain postdoctoral fellows program with increased focus on joint ventures with campus-based faculty engaged in computational – Sustain undergraduate student employees/ research projects assistants and fully fund national, undergraduate summer computational science research program	– State-provided core funding to support academic, scientific high-performance computing at UAF – UAF development of a basic, three-part funding model used by central shared resources such as the library – Realignment of ARSC HPC resources into separate business models for DoD systems and academic systems by October 2011	ongoing	$2.5 million

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End Result:	Theme:	Strategies to Achieve End Result:	Target(s):	Measure(s):	Status:	Budget Impact:
Maintain and enhance ARSC as a national DoD Supercomputing Resource Center (DSRC) in service of DoD's requirements and UA's interests.	Educate Discover Prepare	- Contribute to the operations of a "consolidated" High Performance Computing Modernization Program (HPCMP) using remote work strategies that allow ARSC staff to continue to contribute to both the university and the HPCMP - Propose options for leveraging specific areas of staff expertise tapping 15-year plus experience in providing and managing large HPC systems on behalf of the Department of Defense and the University of Alaska, including massive data storage and rapid access to data over secure networks	– Successful installation and remote operation of the new Cray XE6 supercomputer named *Chugach* and new massive data storage capabilities at the U.S. Army Engineer Research and Development Center (ERDC) in Vicksburg, Mississippi – Continued leadership by ARSC on behalf of the DoD HPCMP to address growing concerns of managing, archiving and quickly accessing an ever-growing amount of potentially confidentially and often irreplaceable data through national Storage Initiative	– *Chugach* and related HPC systems online for DoD High Performance Computing Modernization Program (HPCMP) use in January 2011	ongoing	$12.7 million

Unit Name: Arctic Region Supercomputing Center
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End Result:	Theme:	Strategies to Achieve End Result:	Target(s):	Measure(s):	Status:	Budget Impact:
Diversification of funding base to generate revenue from sources other than U.S. Department of Defense to provide UA/UAF faculty, staff and students access to ARSC computational science resources to meet high-priority research areas significant to the State of Alaska.	Discover	– Look for ways to leverage the weather and climate modeling expertise of research staff to bring in related funding – Explore options for leveraging specific areas of staff expertise tapping 15-year plus experience in providing and managing large HPC systems on behalf of the Department of Defense and the University of Alaska, including massive data storage and rapid access to data over secure networks – Strengthen partnership and collaboration with UA/UAF to advocate for and secure external funding to support high-performance computing research at UAF, including massive data storage, analysis retrieval and disaster recovery – Increase partnerships and collaborations with UA faculty and researchers to enhance grant funding opportunities from other federal agencies – Increase communication and PR strategies focusing on ARSC's distinction in the evaluation and assessment of leading edge computational science equipment, systems, tools and programming techniques; and high-tech innovations and problem-solving expertise in high-performance computing, massive data storage systems, software, security and high bandwidth communications – Enlistment, and occasional recruitment, of research faculty in computational science areas	– Commitment for ARSC funding in FY12 UAF operating and capital budgets – Expand capabilities of NSF-funded supercomputer and data storage system – Chancellor's appointment of an advisory committee to guide academic HPC at UAF – Sustain postdoctoral fellows program with increased focus on joint ventures with campus-based faculty engaged in computational – Sustain undergraduate student employees/ research projects assistants and fully fund national, undergraduate summer computational science research program	– New or continued funding from NSF, NOAA, DoD and U.S. Minerals Management Service – New or continued partnerships with private and public entities using HPC to provide reliable management and operation of cyberinfrastructure investments, including the HPC computing systems, data sources and data storage systems, scientific data visualization, secure high-speed network connections, technical support staff and system administrators	–ongoing	$2.5 million

Unit Name: Arctic Region Supercomputing Center
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End Result:	Theme:	Strategies to Achieve End Result:	Target(s):	Measure(s):	Status:	Budget Impact:
Establish ARSC as a center of excellence for computational scientists in collaborations and exchanges between UA/UAF and Chinese researchers for modeling North Pacific environmental phenomena and climate change.	Educate Discover Prepare	– Host on-site meetings and workshops in Fairbanks for UA/UAF and Chinese academics /agency representatives from China to establish formal ties and to develop a framework of common issues with respect to climate modeling. – Initiate activity resulting in one, new computational science discipline to provide additional and increased focus on existing UA/UAF program priorities in climate change, atmospheric science and computational oceanography	– Successful submission of grant proposal (NSF and Chinese NSF) for support of collaborations – Increased depth of engagement with particular Chinese scholars and their institutions	– Successful workshops or similar meetings in China and Alaska – Pursuit of joint funding – Joint publications or presentations	– NSF-funded workshop in Beijing October 2010 workshop will identify relevant areas for collaboration in which China and US interests overlap, with special attention to Arctic systems for climate and weather. – External grant-seeking opportunities being identified for the study of new and next-generation technologies aimed at boosting computer processing speed and productivity; ARSC staff have demonstrated national leadership in the study and testing of these new technologies for high-performance computing	$100,000 in FY12

Unit Name: Arctic Region Supercomputing Center
Report Date: 09.29.10

D. Long Range End Results and Strategies – FY 2012 and Beyond

D1. Long Range End Results Table

Complete the table below. **For End Results with an anticipated start date of 2012, the results should be in line with budget requests for FY2012.** Add rows as needed. For each end result, identify the applicable core theme(s) listed below.

A. Educate: Undergraduate and Graduate students
B. Discover: Through Research, Scholarship, and Creative Activity, including an Emphasis on the North and its Peoples
C. Prepare: Alaska's Career, Technical, and Professional Workforce
D. Connect: Alaska Native, Rural, and Urban Communities through Contemporary and Traditional Knowledge
E. Engage: Alaskans via Lifelong Learning, Outreach, and Community and Economic Development

End Result:	Theme:	Strategies to Achieve End Result:	Target(s):	Measure(s)/Assessment(s):	Budget Impact:	Anticipated start date:
Maintain and enhance ARSC's existing role in support of scientific discovery through computation within the University and State of Alaska	Educate Discover Prepare	**Shift funding from DoD to UAF**	**$3 million per year**	**Amount of State funding**	**$3 million**	**July 2011**
Maintain and enhance ARSC as a DoD Supercomputing Resource Centers (DSRC) in the nation with support for the Center in service of DoD's requirements and UA's interests	Educate Discover Prepare	**Robust participation in all HPCMP initiatives**	**$12.7 million per year**	**Renewal of contract**	**$12.7 million**	**May 2011**
Diversification of funding base to generate revenue from sources other than U.S. Department of Defense to provide UA/UAF faculty, staff and students access to ARSC computational science resources to meet high-priority research areas significant to the State of Alaska.	Discover	**Hire more faculty and write more joint proposals**	**$1 million per year**	**Number of funded proposals and amount**	**$1 million**	**July 2011**
Establish ARSC as a center of excellence for computational scientists in collaborations and exchanges between UA/UAF and Chinese researchers for modeling North Pacific environmental phenomena and climate change	Educate Discover Prepare	**Hold planning meetings and write joint proposals**	**$100,000**	**Amount of external funding**	**$100,000**	**July 2011**

D2. Top three challenges for FY2012

Identify the top three challenges confronting the unit for the period July 1, 2011 to June 30, 2012. **These challenges must be directly related to the unit's FY2012 budget request.**

Challenge 1: State/UA/UAF commitment to fund computational research and high-performance computing in areas of high priority to the University and to the State of Alaska: climate change, atmospheric sciences, and fisheries and ocean sciences

Challenge 2: Secure external funding to support and acquire high-performance computing resources and cyberinfrastructure needed to sustain UAF's computational science and research activities

Challenge 3: Facilitate continued growth of a faculty and student body able to more effectively use and employ computational science tools to advance research and discovery at UAF in areas of high priority to the University and to the State of Alaska

D3. Use of unanticipated funds

Specify what the unit would do with additional funds, should they be made available later in FY2012. Activities must be in line and support the FY2012 budget request.

PRIORITIES:

1.) Fund academic, scientific high-performance computing at UAF in support of research computationally intensive investigations in areas of high-priority to Alaska and the people of the Far North, including climate modeling, atmospheric science and ocean science. As stated in the February 2010 report titled "The future of the University of Alaska Fairbanks, and the Mission of the Arctic Region Supercomputing Center" prepared by a visiting team of external reviewers (Dr. Amy Apon, Director, Arkansas High Performance Computing Center; Dr. Julio Facelli, Director, Center for High Performance Computing, University of Utah; Dr. Craig Stewart, Director, Research and Academic Computing, Indiana University)

'Fieldwork has traditionally been at the core of UAF's efforts to understand the ecosystems of Alaska and the Polar Regions in general. UAF is highly regarded for the quality of its fieldwork-oriented research. But fieldwork alone has become insufficient for reaching 21st-century research goals. Advance computational tools and simulation, based on data collected by UAF and other researchers, are essential to the predictions necessary for understanding our complex world and creating the inventions we need to improve human lives.'

An estimated $13 million is brought to the UAF research portfolio as a direct result of access to ARSC high-performance computing (HPC) resources. Principle Investigators using ARSC's high performance computing resources cite the existence of the Center for providing a competitive position in successfully obtaining external, federal research dollars. Supercomputers are an indispensible tool when it comes to understanding and solving some of today's most pressing problems. Through collaboration and computation, ARSC provides scientists with the crucial, high performance computing resources they need for finding solutions to big problems.

Institutions with academic supercomputing centers provide a competitive edge when it comes to recruiting top-notch faculty and students. According to the National Science Foundation's report "Cyberinfrastructure Vision for 21st Century Discovery," increasing access to supercomputers is crucial to keeping U.S. research competitive.

2.) Reinstate full funding to support summer undergraduate research program in computational science

3.) Chinese Scholars Program in ARSC/UAF/UA disciplines of interest

E. Additional Information

E1. Unit Unmet Needs

Identify unmet unit needs that could be supported through private, non-governmental funding, such as donors, foundations, etc.

Many attractive opportunities exist for joint ventures and/or private sector support in areas that ARSC has extensive knowledge and expertise: 1.) Data-driven Science and Engineering 2.) Data-intensive Storage Solutions and 3.)HPC Management Solutions.

I. DATA DRIVEN SCIENCE AND ENGINEERING

Every discipline of science and engineering is being revolutionized by the widespread and comprehensive use of high-performance computing (HPC). From new diagnostic tools in healthcare or designing space vehicles able to withstand the pressure of reentry to Earth's atmosphere to predictive models that track the path of potentially deadly tsunamis, the need for reliable, safe and secure HPC cyberinfrastructure is essential for problem solving on a huge scale and in a timely manner. These include the HPC computing systems, data sources and data storage systems, visualization environments and highly skilled technical support staff, all linked by high-speed networks.

The Arctic Region Supercomputing Center has a 15-year record of supporting the needs of scientists and engineers doing large-scale computational campaigns. ARSC brings together highly skilled HPC staff and the best research minds at America's Arctic University to achieve success and provide competitive advantage for researchers in academic and federal realms.

ARSC is engaged in targeted Arctic research areas that cross several disciplines, including the mathematical and social sciences, climate and weather research, engineering and biology.

Significant supercomputing power is required for data-intensive climate and weather modeling. Alaska is characterized by extreme, rugged topography that harbors numerous, small pockets of microclimates – in the Interior Alaska community of Fairbanks within a span of 30 miles, it's not unusual to see temperatures vary from -10F to +40F and winds that fluctuate from 0mph to 50mph within a 24-hour period.

Computational scientists at ARSC have fine-tuned an Arctic-specific, high-resolution configuration of the Weather Research and Forecasting (WRF) model, with multiple daily WRF forecasts for the Alaska region made available to the National Weather Service.
Life goes on in Alaska during all weather events, and accurate prediction is vital for the protection of lives and property.

Scientific specialists and technical staff at ARSC provide in-depth assistance and training to successfully carry out computationally based investigations. Current projects include modeling the magnitude and path of tsunamis, predicting the impact of volcanic ash and smoke from wildfires; forecasting space weather's impact on global communications and radar systems; and modeling the physical aspects of ocean systems to forecast impacts on fisheries and ecosystems.

A common theme in science and engineering research activities is the strong need for computational capacity, including highly technical requirements for processing large-scale parallel applications, and the need for high-speed networking to access giant storehouses of data.

ARSC has the expertise to support computational science, data storage-intensive projects, and a wide range of collaborations focused broadly on arctic research. The hardware, software and human assets at ARSC also focus on engineering concerns, ranging from analysis of next-generation supercomputers to radio wave propagation, as well as supercomputing research on system design and performance and mathematical modeling of complex systems.

The depth of experience in providing HPC support includes proprietary mainframes/clusters, commercial off-the-shelf (COTS)-based systems and supporting add-on technologies, as well as providing information security support following prescribed academic and federal research requirements. ARSC has an established multi-petabyte data archive with terabytes of disk space as well as an established 10Gbit/s network connected to multiple academic and federal research networks.

ARSC provides application performance analysis and benchmarking (measurement of the relative performance of software under different conditions) for the study of new and next generation computing technologies. Since 2009, ARSC has been actively engaged in evaluation of graphics processing units (GPUs) for application acceleration. Investigations have included a variety of GPU devices from ATI and nVidia, operated in single- and dual-GPU configurations, across multiple computational systems. To date, findings indicate the promise of 5-100 percent speedups in complete applications, but far greater acceleration within computational kernels and synthetic benchmarks.

Ensuring that graduates have experience working with the technical and scientific software that potential employers use, and to ensure that current HPC professionals can adapt to rapidly changing technologies, ARSC provides in-depth training, workshops and for-credit courses. ARSC has a proven record of success in teaching HPC skills needed to develop the diverse and well-prepared 21st Century workforce needed to accelerate scientific discovery for national competiveness, global security and economic success.

II. DATA INTENSIVE STORAGE SOLUTIONS

Managing an ever-increasing mountain of highly sensitive and often irreplaceable data is critical to the success of universities, government agencies and private businesses. It is essential that these entities have trusted sources for processing, accessing and storing substantial amounts of information of the most private nature.

Private and public organizations — from natural resource extraction companies and medical service providers, to federal and state agencies holding the vital statistics of its citizens—must be able to safely, swiftly and securely access huge storehouses of proprietary data.

The Arctic Region Supercomputing Center has a 15-year proven record of success in running large, high-performance computing (HPC) systems, including massive data storage operations and high-speed networking, on behalf of the U.S. Department of Defense High Performance Computing Modernization Program and the University of Alaska.

ARSC brings together the hardware, software and human assets to collect, store, manage, integrate and analyze data at the multi-petabyte scale with confidence.

ARSC's petabyte-scale (a quadrillion bytes) of storage and its high-speed network connections are essential to the data-intensive activities of the Alaska Native Language Center (ANLC), UAF's Rasmuson Library Alaska Polar Regions and the Geographic Information Network of Alaska (GINA).

GINA uses ARSC's storage infrastructure to archive and preserve geospatial data captured by MODIS and AVHRR satellites. ARSC has implemented custom solutions to provide external access to data uploads of GINA's large collections of satellite imagery to storage servers for safekeeping and rapid access. GINA ties its Web server to ARSC's storage system over a private network. External GINA users have transparent and swift access to information from a trusted source, and both the short- and long-term integrity of the data is ensured.

University and agency researchers use this archive to manage resources, monitor the landcover and permafrost, track sea ice, study the oceans and atmosphere, and to perform climate change research. The large, long-term archive safely housed and managed at ARSC is of particular use for current and future climate change research or projects using ARSC HPC services and disaster recovery copy storage.

ARSC has demonstrated expertise, software and hardware capability, and the capacity for data management, especially in storing massive amounts of data, database design, development and support, and in processing data for scientific, engineering, medical or integrated human systems analyses.

Meeting existing regulations and best practices for protecting data against loss or being accessed by unintended entities is a hallmark of ARSC's Information Assurance services, confirmed by more than 15 years of outstanding, capable and diligent support of very large HPC systems.

ARSC provides secure network configuration and operational optimization, high-speed networking analysis and design for organizations that use national or international communications networks.

III. HPC Systems Management Solutions

The use of high-performance computing (HPC) applications and systems is a major driver in new scientific discovery and innovation for national competitiveness, global security and economic achievement.

Private and public entities using HPC demand assurance that these considerable cyberinfrastructure investments, including the HPC computing systems, data sources and data storage systems, visualization environments, secure high-speed network connections, technical support staff and system administrators, are managed for maximum productivity.

The Arctic Region Supercomputing Center has a 15-year proven record of success in managing large HPC systems, including massive data storage and rapid access to the data over secure networks, on behalf of the U.S. Department of Defense High Performance Computing Modernization Program and the University of Alaska.

ARSC has the expertise, software and hardware for High Performance Computing (HPC). The depth of experience in providing HPC support—installation, management, operations and maintenance—includes proprietary mainframes/clusters, commercial off-the-shelf (COTS)-based systems and support of add-on technologies, as well as information security support meeting prescribed academic and federal research requirements. ARSC has an established multi-petabyte data archive with multiple terabytes of disk as well as an established 10Gbit/s network connected to multiple academic and federal research networks.

Additionally ARSC is accomplished at building and maintaining rapidly changing infrastructure needed to carry out computational campaigns, and providing high availability use of HPC compute and data storage systems based on individualized needs.

ARSC brings together hardware, software and human assets to achieve success and provide the competitive advantage:

Computational Support Services—code porting, optimization, benchmarking (measurement of the relative performance of software under different conditions), modeling and *ad hoc* code development, frontline support for call-centers and documentation.

Information Assurance Services—meeting regulations and best practices for protecting data against loss or unauthorized access by unintended entities; security auditing while meeting unique needs of scientific projects for availability.

Data Center Operations—processing data for scientific, engineering, biomedical or integrated human systems analyses and providing training for the efficient/effective operations of data centers.

Secure Network configuration and operational optimization— including high-speed networking analysis and design for organizations that use national or international communications networks.

Training in HPC practices—including computational methods, applications programming, applications use, analysis of results and visualization; advanced HPC instruction in high-end computational methods to build technology literacy and prepare a 21st Century workforce.

Research in Computational Sciences–including, but not limited to climate, oceanography, space physics, weather and tsunami, as well as providing support research within the framework of existing models and/or developing components of new community models.

Research in Acceleration Technologies and next-generation systems applicable to HPC – including the hardware and the software required to use it; independent testing of new software and hardware products for industry and academia.

Since ARSC's first compute cycles were realized in 1993, the Center has established national recognition for outstanding service in all aspects of high-performance computing and network support.

The Center's achievements are directly attributable to a culture created by a staff of 40-plus technical computing and scientific professionals in High Performance Computing disciples, who effectively provide unique connections among academic and defense computing communities with the computers, data storage systems, secure high-speed networks and next-generation experimental systems needed by HPC users to solve big problems.

E2. Major Capital Investment Priorities and Space Needs

In order to better connect academic and research priorities with capital investment planning, identify the unit's highest priority facility needs, if any, for consideration in the six-year capital plan. Units should also describe any other significant space management issues in this section. Be sure to show the linkages between facilities needs and unit End Results.

Academic & Research High Performance Computing Capital Budget Request FY12
FY12 (GF: $1,500.0, Total: $1,500.0)
FY13-FY17 (GF: $1,500.0, Total: $1,500.0)
Alaska and UAF are on the front lines of global climate change unprecedented in recorded human history, and Alaska is on the front lines of the impact of that change. It falls to Alaska, Alaskans and UAF to lead in the research necessary to understand this global phenomenon. Fieldwork has traditionally been at the core of UAF's research efforts to understand the ecosystems of Alaska and the Polar regions. Fieldwork alone has become insufficient for reaching 21st-century research goals. Advanced computational tools and simulations, based on data collected by UAF and other researchers, are essential to the predictions necessary for understanding our complex world.

SW OIT Butrovich Computer Facility Backup Power
FY12 (GF: $3,700.0, Total: $3,700.0)
The University of Alaska's Butrovich Data Center has experienced 13 power outages in the last 15 years. As increasing power loads cause greater dependence on the power grid inter-tie with GVEA, the number of future outages would not be expected to decrease. These outages have an impact on core services for the entire University of Alaska system. In the event of a utility power outage, an existing UPS battery backup provides a total of 720kW of uninterrupted power to computer and communications systems for a period of 30 minutes. However, during such a power outage, the cooling system is not supported by backup power and stops functioning. Without cooling, computer systems will overheat in less than 8 minutes. It is not possible to operate the cooling system on the existing battery UPS.
An upgrade of the UPS system from 720kW to 990kW would provide sufficient capacity to power both computing and cooling systems for the duration of a brief power outage (up to 15 minutes). In the event of a longer outage, an auto-started backup generator would be necessary to provide power and cooling beyond the capacity of the UPS to prevent disruption to the University's business, research, and other computing functions.

UAF Academic High Performance Computing Phase I Operating Budget Request FY12
(GF: $500.0, NGF: $100.0, Total: $600.0)
This request is to make a first step toward sustained funding of High Performance Computing, in order to provide systems, services and support to the UAF community. Over the years since high performance computers were installed at UAF in 1993, they have grown in importance for UAF’s research, teaching and operations. Service to UAF has included many millions of CPU hours and large-scale storage, visualization, analysis, and other activities. Since the loss of Senator Stevens, however, the external funding that enabled these high-performance computing services to UAF has become unavailable. Currently, there are over 230 faculty, staff, postdoc and student users of high-performance computing, with scores of unique research projects. These are from all research units at UAF, as well as the College of Engineering and Mines, the College of Natural Science and Mathematics, and the College of Liberal Arts. This initial funding will provide personnel including systems administrators and end-user support sufficient to maintain a basic level of services to major users, particularly those who have large externally-funded research projects that otherwise might not be fully completed.