

DEPARTMENT OF DEFENSE (DoD) Research and Education Program for
Historically Black Colleges and Universities and Minority-Serving Institutions
(HBCU/MI) Equipment/Instrumentation Fiscal Year 2013
Broad Agency Announcement W911NF-13-R-0008 CFDA# 12.630

Satellite Remote Sensing - Research and Education Instrumentation Program
(SRS-REIP)

Narrative

This Satellite Remote Sensing - Research and Education Instrumentation Program (SRS-REIP) proposal is a request for required lab upgrades to augment existing satellite remote sensing ground station capabilities at Elizabeth City State University (ECSU). New satellite ground stations have recently been installed at ECSU. These consist of a 3.6m X/L-Band ground station for the collection of Aqua, Terra, Suomi NPP, and FY-3 data, two 2.3m geostationary ground stations for the collection of GOES-East and GOES-West, a 3.7m C-Band system for the collection of Eumetcast data from the AB-3 satellite, and a 5.0m DOMSAT system. Necessary lab upgrades requested in this proposal include uninterruptible power supply (UPS), backup generators, network upgrades for dedicated bandwidth and required computer consoles plus software for the training center. SeaSpace has provided the satellite ground stations without cost to ECSU within an existing partnership however the requested equipment is required to support the educational use by ECSU.

Funding of the Satellite Remote Sensing Research and Education Instrumentation Program (SRS-REIP) under the DoD Research and Education Program for HBCU/MIs BAA W911NF-13-R-0008 would be used to further DoD's objective of attracting students to pursue studies leading to Science, Technology, Engineering and Mathematics (STEM) careers. Specifically SRS-REIP presents a compelling case for student participation in satellite remote sensing research and ground station operations. This proposal does not request funds for student support, in order to further DoD's objective of attracting students to pursue studies leading to STEM careers.

Elizabeth City State University

ECSU established the Center of Excellence in Remote Sensing Education and Research (CERSER) in 2001 through a partnership with SeaSpace and the Office of Naval Research Ocean, Atmosphere and Space Science and Technology Department. The goal of CERSER is to develop and implement innovative and relevant education and research collaborations focused on ice sheet, coastal, ocean, and marine science.

SRS-REIP will augment existing ground station receiving capabilities at ECSU. Our original satellite ground station was a 1.5m L-band unit installed in 2003, and past its useful life. This proposal will support required lab upgrades necessary for operation and maintenance of the new satellite ground systems consisting of a 3.6m X/L-Band ground station for the collection of Aqua, Terra, Suomi NPP, and FY-3 data, two 2.3m geostationary ground stations for the collection of GOES-East and GOES-West, a 3.7m C-Band system for the collection of Eumetcast data from the AB-3 satellite, and a 5.0m

DOMSAT system. Necessary lab upgrades requested in this response include UPS, backup generators, network upgrades for dedicated bandwidth and required computer consoles plus software for the training center.

With regards to education, ECSU now not only operates CERSER but also offers undergraduate and graduate courses in GIS/remote sensing. CERSER serves as an umbrella program for a number of exemplary education, training and outreach programs. In 2003 the National Science Foundation selected Dr. Hayden, CERSER Director, for the Presidential Award of Excellence in Science, Mathematics and Engineering Mentoring. SRS-REIP will enhance the ability of ECSU to have students pursue degrees in STEM fields, undergraduate and graduate training in ground station operation and satellite remote sensing.

- 1) Undergraduates can enroll in a minor in GIS/Remote Sensing while graduates can choose a MS in Mathematics with a concentration in Remote Sensing. Each of the classes associated with the degree programs will be enhanced with the acquisitions provided by this proposal;
- 2) The graduate program with a remote sensing concentration will use the acquired data to produce master's thesis projects;
- 3) Also impacted will be existing NSF, ONR and NASA programs which serve students and faculty from not only ECSU, but other MSIs many of which have limited research capabilities.

****Indicate the academic departments that will use the equipment/instrumentation, including any collaboration with other institutions.***

Primary usage of the equipment will be by the students and faculty of the ECSU School of Mathematics, Science and Technology. Secondary usage will be by students and faculty from other minority serving institutions that participate, in large numbers, in the summer and academic year training events conducted by CERSER. This includes the summer research experience for undergraduates jointly funded by NSF and ONR, and the NASA Innovations in Climate Change Education project. Several of these projects are described in more detail below. Highlights from these events can be found at http://nia.ecsu.edu/past_events.html.

<i>COLLABORATIONS</i>	<i>DETAILS</i>
North Carolina Chapter #03191 professional chapter of IEEE-GRSS http://nia.ecsu.edu/ieee/ GRSS Student Branch #66221 http://nia.ecsu.edu/ieee/student/index.html	The first meeting of the Eastern North Carolina Chapter of the IEEE-GRSS was held on November 13, 2003 in the CERSER Lab. IEEE-GRSS chapter conducts 2-3 distinguished lecturers and meetings each year. The Spring 2003 Lecture Series featured Dr. Sonia Gallegos, Principal Investigator with the Naval Research Laboratory at Stennis Space Center in Mississippi.
Center for Remote Sensing of Ice Sheets (CReSIS) https://www.cresis.ku.edu/about/university-partners	ECSU is an original partner in CReSIS. Other CReSIS partners include, Indiana University, Univ. of Kansas (lead), Penn State Univ., and the Univ. of Washington. CReSIS has been funded since 2005 by NSF to predict the future mass balance of the polar ice sheets under a range of possible climate conditions. ECSU contributes expertise in analyzing satellite data and expertise in generating high-level data products. All CReSIS outreach and education efforts are led by ECSU.

<p>IEEE Geoscience and Remote Sensing Society (GRSS) - Minority Travel Program (MTP) http://nia.ecsu.edu/past_events_by_event.html?EVENT=IGARSS</p>	<p>GRSS brings together world-class scientists, engineers and educators engaged in the fields of geoscience and remote sensing. ECSU has managed the GRSS-MTP program for the past 8 years. GRSS-MTP provides funds for underrepresented students to make oral and poster presentations of their remote sensing research at the annual conference. To date 75 students have been supported. 90% of these students have gone on to enter or complete graduate STEM degrees. An example of a student supported by the MTP program is Dr. Terrance West, engineer with the U. S. Army Aviation and Missile Research Development and Engineering Center (AMRDEC). http://nia.ecsu.edu/ur/1011/110329dls/bio.html</p>
<p>Engaging Minority University STEM Education Professors in the Science of Climate Change http://nia.ecsu.edu/nice/</p>	<p>Elizabeth City State University has joined with the University of New Hampshire under the NASA Innovations in Climate Education (NICE) to empower faculty of education programs at Minority Serving Institutions to better engage their pre-service teachers in teaching and learning about global climate change through the use of NASA Earth observation sets. This project is designed to first impact teaching on college campuses within science education classes. Second, as pre-service teachers transition into in-service teachers, the impact will extend to elementary and secondary schools. Over the past two years, 34 MSI STEM education faculty have participated in this project working with an ecological model in STELLA that utilizes satellite imagery data from the MODIS and SeaWiFS sensors. The training also addressed the challenges and approaches to integrating the lessons into their courses.</p>
<p>SeaSpace Corp. http://nia.ecsu.edu/ur/1213/121021seaspace/ http://www.seaspace.com/training.php</p>	<p>SeaSpace is a global leader in remote sensing solutions and is the world's leading provider of satellite ground stations and processing software for remote sensing applications. SeaSpace entered into partnership with ECSU to host their east coast training facility.</p> <p>SeaSpace Corporation WorldMet® service is comprised of two U.S. nodes. One in Poway California at SeaSpace headquarters, hereby referred to as WorldMet® West, and the other at Elizabeth City State University WorldMet® East. International nodes are currently located in Sevilla, Spain, and Daejon, Korea. Future nodes will be located in Japan and India. The purpose of WorldMet® is to collect and distribute satellite data.</p>
<p>The National Science Foundation & The Office of Naval Research Undergraduate Research Experience (REU) http://nia.ecsu.edu/past_events_by_event.html?EVENT=Ocean%20Marine</p>	<p>NSF Office of Polar Programs and ONR jointly fund the current REU program at ECSU. This program operated under the name CReSIS-REU for 3 years and now operates under the name Arctic and Antarctic REU (AaA-REU).</p> <p>The REU program objective is to promote the professional development of minority undergraduate students through their participation in ocean, marine and polar science research. The program consists of undergraduates, each student assigned to a specific research team, where they will work closely with the faculty. In addition, seminars, lunch meetings, and social functions are organized to facilitate undergraduate interaction.</p> <p>The project will be conducted for eight weeks during summer 2013, with on-line mentoring and follow-up during academic year</p>

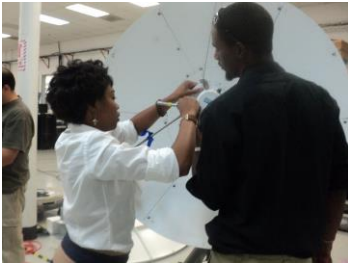





	<p>2013-14. The AaA REU program serves over 25 undergraduate students each summer. The students participating are selected from ECSU and from other MSIs. The program also includes a Research Experience for Teachers (RET) component, which involves 5 pre-service STEM education majors.</p> <p>Dr. Hayden serves on the advisory board for the NSF Office of Polar Programs.</p>
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****Indicate if faculty members will require training for optimal use of the requested equipment/instrumentation. If so, the associated costs and effort of the faculty may be included in the budget.***

During the SRS-REIP period of performance of this award, ECSU faculty, graduate students and undergraduates will engage in three training events: 1) TeraScan[®] System Training, 2) TeraScan[®] Operator Training, 3) Satellite Measurements of the Atmosphere, Oceans and Land, an Introduction. SeaSpace and CERSER staff members will conduct training, in the CERSER lab. Cost associated with the training is included in the budget. This includes reference material and training manuals. We anticipate training 10 participants at each workshop.

****Describe how faculty and students are expected to use the equipment/instrumentation, including as applicable: Will it be used for instruction only or in research? If used in research, how will students and faculty members use the equipment/instrumentation? Will there be any opportunity for local high school teachers or students to become familiar with use of the equipment/instrumentation? If so, will it be part of a broader outreach effort to interest students in pursuing STEM disciplines as undergraduates?***

Faculty and student researchers will use the requested equipment to support their research

		
<p>ECSU students are shown working with SeaSpace representatives to prepare satellite ground stations for installation.</p>		
		
<p>The Remote Sensing laboratory, the Viking boat and Ground Penetrating Radar are shown. All of these are used extensively in undergraduate research and K-12 outreach at ECSU.</p>		

and used in classroom instruction. Both academic year and summer research programs are conducted through CERSER [3]. These programs engage both ECSU and students from other MSIs in remote sensing and ground station operation related research-training activities. Past summer REU highlights 2001-2013 can be viewed at http://nia.ecsu.edu/past_events_by_event.html?EVENT=Ocean%20Marine. Summer research training programs take place for 8 weeks under the NSF/ONR REU project. Past academic year research training highlights can be viewed at <http://nia.ecsu.edu/ur.html>. Academic year research training takes place on Tuesday and Thursday evenings 5–7pm from August through mid-April of each year. Both summer and academic year programs provide professional development opportunities and hands-on research opportunities to the participants.

Precollege students will also be engaged with the new instrumentation. ECSU annually conducts the Celebration of Women in Mathematics, Outreach Day of Research Week and several 2-week summer workshops for middle and high school students. As such, SRS-REIP will be part of a CERSER boarder engagement effort.



The annual Celebration of Women in Mathematics brings 400 middle and high school girls and their teachers to ECSU for a day of hands-on STEM workshops, competitions and seminars.



The outreach day of Research Week 2013 brought 900 middle and high school students to campus for a day of STEM activities and seminars. This is an annual event. Shown left-to-right is Willie Brown (former ONR student researcher) exposing students to the ECSU flight simulator lab; students in the CERSER research lab; and students with the Tuskegee Airmen who were our speakers for the day.

Listed below are former and current grants from ONR, which support development of Satellite Remote Sensing capabilities at ECSU and integration of research into education:

ONR Award Title (Dr. Hayden, PI)	Award Number	Approx. duration	Award Amount
ONR Nurturing ECSU Research Talent	NOOO14-99-1-0990	8/1/95 - 7/31/03	1,817,658.00
ONR-URE IN O/M SCIENCE	N00014-01-1-0529	3/15/01 - 12/31/12	284,500.00
ONR AVHRR-SST	NOOO14-01-1-1070	9/17/01 - 11/29/05	1,295,000.00
ONR AVHRR-SST continuation	NOOO14-01-1-1070	9/17/04 - 02/28/06	150,000.00
ONR URE- OCEAN & MARINE SCI	N000140110529	3/15/04 - 2/28/08	536,001.00
ONR URE- OCEAN & MARINE SCI	N00014-08-0832	3/15/08 - 2/28/11	629,371.00
NSF/ONR REU	PLR-1263061	2/1/10- 1/31/14	625,000.00
NSF/ONR Arctic and Antarctic REU	ANT-0944255	7/1/13 – 6/31/16	984,151.00

As a result of those investments, ECSU now not only operates CERSER but also offers undergraduate and graduate courses in GIS/remote sensing. Undergraduates can enroll in a minor in GIS/Remote Sensing while graduates can choose a MS in Mathematics with a concentration in Remote Sensing. Each of these classes and associated degree programs will be enhanced with the acquisitions provided by this proposal. In addition the graduate program with a remote sensing concentration will use the acquired data to produce master's thesis projects.

GEOG 221: Cartographic Principles 3 hrs

Planning and construction of thematic maps for use in communicating the spatial relations of geographic and geologic information. The course includes topographic, geographic, and thematic maps, and various grid location systems, computer printouts of data collections, and aerial photos. Elements of map design and introduction to computer mapping (GIS) are also covered. Lecture, two hours; laboratory, two hours. .

GEOG 332: Geomorphology 3 hrs

The course reviews the fundamental geomorphic principles that govern the development and modification of landforms. Lecture and lab, three hours.

GEOG 360: Principles of Geographic Information System 4 hrs

The course includes learning the basic GIS operations, design, preliminary exposure to geographic data structures, and hands-on experiences with several GIS programs through exercises. Lecture and laboratory, four hours. .

GEOG 365: Introduction to Remote Sensing and Digital Image Processing 4 hrs

Basic principles of remote sensing and image analysis using a computer system with the end result of producing a map. Discussed are the introduction and basic principles, electro-optical sensors and imagery obtained, data acquisition and image processing, georeferencing, and terrain corrections. Lecture and laboratory, four hours.

GEOG 461: Advanced Geographic Information System 4 hrs

An advanced GIS course with emphasis on students' individual projects. Laboratory complements lecture, and will be a hands-on study of the discussion above, but the course concentrates mainly on individual projects. Lecture and laboratory, four hours.

RS 501 Geophysical Remote Sensing: 3 hrs

Physical geography, cultural geology, and technical and space policy; aerospace remote sensing systems, fundamental electromagnetic field theory and RF circuit design; fundamental active and passive microwave remote sensing; basic conception of signal processing. Fundamentals of remote sensing applications.

RS 502 Geographic Information Systems and Geophysical Signal Processing: 3 hrs

Mapping concept, data structure, data management techniques, data acquisition, global positioning system interface, data manipulation and analysis; Fourier series and periodic waveforms, Fourier transform and its properties. Auto-and cross-correlations, power spectrum. Delta function, unit step function. Time domain windows. Z-transform and properties, inverse Z-transform. Principles of digital filters, moving average and recursive filters. Introduction to cepstrum and its application in seismic data processing. Pole-zero technique for designing ARIMA filters. Shaping and spiking filters using Wiener's principle of least square estimation. Deconvolution of seismic traces: feed forward and feed backward methods, spectral factorization. Applications of two-dimensional symmetric filters for processing gravity and magnetic fields.

RS 503: Digital Image Processing and Analysis: 3 hrs

Topics covered include principles of electro-optical imaging, image data processing including image visualization and statistics extraction, radiometric and geometric correction, image enhancement, image classification, artificial intelligence-based information extraction, multi-spectral image analysis, change detection, and thematic map accuracy assessment. Application specific image processing methods will be introduced. State-of-the-art commercial image processing software will be used for applications development.

RS 504 General Analytic Methods of Remote Sensing: 3 hrs

Advanced remote sensing data processing and analysis techniques will be covered with applications to observations of the earth's hydrosphere, cryo-sphere, atmosphere, subsurface and surface lithosphere environments.

RS 505 Geophysical Modeling: 3 hrs

Course will introduce students to various analytic models used to understand and visualize observed and theorized geophysical processes including phenomena occurring in the Earth's hydrosphere, cryo-sphere, atmosphere, subsurface and surface lithosphere environments.

RS 506 The Principles of Microwave Remote Sensing: 3 hrs

Spaceborne remote sensing of the earth's atmosphere, land, and oceans; The primary methods and applications of microwave remote sensing are considered with both active (radar) and passive (radiometry) techniques covered; satellite and optical sensors; image analysis

****Describe the requested equipment/instrumentation and explain how it will enhance the institution's research capabilities and the quality of the applicant institution's STEM programs.***

With regards to the quality of ECSU/CERSER STEM programs, past ONR Nurturing ECSU Research Talent (NERT) alumni have terminal degrees. Many more are in the process of completing terminal degrees and hundreds have received their master's degree in STEM areas of interest to ONR. The proposed SRS-REIP project will facilitate the ability of ECSU to continue to offer quality research based education in the area of satellite remote sensing.

Working with cyberinfrastructure in remote locations has offered Dr. Linda Hayden the opportunity to support a wide range of students to develop research interest in Polar

Regions [4]. In particular, ONR academic year and summer research training programs has contributed impressively to the STEM workforce.

Below are profiles of several NERT alumni who are making outstanding contributions. Their achievements speak volumes to the quality of ECSU's past and current ONR research training programs.



Napoleon Paxton, Ph.D.
Naval Research Lab Washington DC
Network Security Community
Research Scientist

Exert from his 2006 Professional statement [1]..... I am interested in studying information technology at the graduate level for two main reasons. First, earning a Doctor of Philosophy degree in Information Technology will enable me to acquire the theoretical and technical skills that will prepare me to become a high level executive in this field. Secondly, I am excited about the chance to participate in significant applied research in the area of information security, which is my proposed concentration area. The University of North Carolina at Charlotte will offer me the opportunity to obtain the best education in this area of expertise. I had the opportunity to be in the Office of Naval Research undergraduate research training group at Elizabeth City State University. This program gave me hands on experience in research and made me realize that I would not be satisfied with just a baccalaureate level of education and expertise. I am currently on the network research team, and our research is focusing on the security of user accounts.

I gained experience while working as an assistant network administrator at the Center of Excellence in Remote Sensing and Education Research (CERSER). This position introduced me to Macintosh, UNIX and Microsoft Window servers. Some of my duties include creating user accounts, joining computers to the network, and to create personal security assessments of the CERSER lab.



Jeaime Powell, Ph.D. student
CERSER GRID manager
2013 BEYA Award for Graduate Student Leadership

Receiving his Bachelor's Degree in Computer Science from ECSU with a minor in Aviation Science, Je'aime Powell has always been enthusiastic about technology specifically computer science and its applications. He took it a step further when he obtained his Master's Degree in Applied Mathematics with a concentration in remote sensing and he's currently pursuing his Ph.D. in Computer Information Systems. As an undergraduate, Je'aime received scholarships through the ONR Nurturing ECSU Research Talent program. He also completed a summer internship with ONR. By nature Mr. Powell is a computer scientist but yet he always had a passion for environmental issues and how the two can be integrated; and one way he contributes this passion in CERSER is his role as ECSU Grid Manager.



Jerome Mitchell, Ph.D. student
Indiana University
Infomatics and Computing Department

Exert from his 2007 Professional statement [2].....As an undergraduate student researcher for the Center for Excellence in Remote Sensing Education and Research (CERSER), I participated in a number of projects related to remote sensing and intelligent systems. I participated in the United States Antarctic Program (USAP) sponsored by NSF through the ECSU CReSIS involvement. At the West Antarctic Ice Sheet (WAIS) Divide, I worked with distinguished scientists on issues concerning mass balance of ice sheets to better understand global climate. The most important near-future goal I have set is obtaining a Ph.D in computer science, specializing in intelligent systems with environmental remote sensing applications.



Torreon Creekmore, Ph.D.
Jefferson National Laboratory

Exert from his 2003 Professional statement: This program helps me to mature professionally as well as personally and provides invaluable and unforgettable work experiences. My goal is to develop in the academic area of physics. I would like to continue my education and enhance my knowledge by participation in the program. I have had the chance to engage in meaningful dialogue, learning experiences, and interactions with both professional and higher education officials.



Quality of Research: A group of students under the direction of Dr. Malcolm LeCompte at Elizabeth City State University (ECSU) conducted a research project to quantify ice margin changes in the Amundsen Sea region using LIMA as a benchmark. They discovered a small ice shelf that had gradually shrunk from 1972 to 2003 and has failed to reform.

The feature is a former ice shelf occupying an embayment along the southern side of Canisteo Peninsula 12.5 miles north of Suchland Islands and approximately 20 miles north northwest of Cranton Bay. The feature was named by US-Advisory Committee on Antarctic Names (ACAN) Board of Geographic Names (BGN) for Elizabeth State University in Elizabeth City, North Carolina.

The ACAN recommended Elizabeth City State University Bay for approval at its meeting on January 5, 2012 to the U.S. Board on Geographic Names The name Elizabeth City State University Bay has been approved for use on maps and other products of the

Federal government. The name was approved officially at the meeting of the U.S. Board on Geographic Names on April 17, 2012 and was entered into the Geographic Names Information System (GNIS), the nation's official geographic names repository on April 19, 2012. [4] [5]

The following chart presents the anticipated use of the CERSER lab, in days per year, by undergraduates, graduate students, faculty, K-12 students/teachers and faculty from ECSU and other MSIs.

Program/use in days per year	Software training in lab	Hardware training at antenna	Tours of facility	Use of satellite data
Undergraduate	60	30	10	60
Graduate	60	30		100
K-12 Precollege	5		10	5
Other MSI	15	15		20
ECSU/MSI faculty	60	30	10	100
TOTAL DAYS PER YEAR	200	105	30	285

Use by Non- educational Institutions

ECSU will serve as the SeaSpace east coast TeraScan® software training center, where existing and future TeraScan® DoD customers can attend training courses closer to their home base. Currently the only other option is to travel to Poway, California for training at the SeaSpace headquarters training facility, or for SeaSpace personnel to travel to the customer’s site to provide training. Once trained, ECSU personnel and/or students will serve as trainers to the DoD customers on an agreed upon schedule as necessary.

Requested Items

A generator is needed for both Dixon Hall where CERSER center houses the satellite ground stations and also for E.V. Wilkins building where the GRID data storage facility is housed. Wilkins already has an uninterruptible power supply (UPS) but Dixon Hall does not. A fiber optics cable connects Wilkins building and Dixon Hall. Ricky’s Welding will provide structural frame requirements for installation of the requested equipment.

Generator

The SRS-REIP proposal request two 60 KW Generators with transfer switch and 24 hour fuel tank. Fuel for initial fill up included in the quote. A Concrete Pad will be installed for the generators. Nema 1 three phase panel feed from transfer switch

100A three phase feeder from 200A panel to existing 100A panel

4 lights feed from generator: 2 will be located in the rack room, 1 located in panel room, and 1 located in room adjacent to rack room.

Network upgrades for dedicated bandwidth

Data received from that location will be made available to WorldMet@West, depending on the volume and frequency it can require a constant flow of dedicated bandwidth. NPP, Tera and Aqua will require the most when it's available, port 1480 is what we use to send and receive data along with FTP and SSH. Once fully operational, the existing ground station assets at ECSU will have the following bandwidth requirements:

GOES-15	3.7 Mbit/sec	
GOES-13	3.7 Mbit/sec	
Terra	12.5 Mbit/sec	1.2 GB
Aqua	15 Mbit/sec	1.4 GB
NPP	15-30 Mbit/sec (currently 15)	1.4 GB (up to 2.8 GB)

GOES data will be acquired on a constant basis, whereas the polar orbiting satellites will be acquired only when the satellite traverses over the region. Therefore the total bandwidth at any given time will be 7.4 Mbit/sec as a minimum with only GOES, to 50 Mbit/sec as a maximum for the transfer of all satellite data. Without 50 Mbit/sec of bandwidth, the data transfer would be slowed to a speed that would no longer qualify the data as real-time. For operational users, the value of data decreases as the time to receive it increases.

The successful operation of the requested equipment requires dedicated bandwidth. The requested network upgrades to accomplish this includes a Catalyst 3750X 24 Port Data IP Base; Cisco GE SFP, LC connector LX/LH transceiver ; Cisco Four GbE port network module; and a Cisco 715W AC power supply

The Catalyst 3750X is an Industry-leader in security protecting against malicious behavior with Flexible NetFlow. It ensures data confidentiality with MACSec layer-2 encryption. Importantly, it supports non-stop communications with redundant power supplies and cooling fans. It minimizes downtime with hot-swappable power supplies, cooling fans and network modules. The Catalyst will allow us to prioritize CERSER-critical network traffic with Strict Priority Queuing.

Ancillary Ground Station Hardware

ECSU requires the following hardware and software for the training lab:

- 1) Fifteen (15) TeraScan® Visualization Systems, comprised of a desktop computer, a 30” monitors plus keyboard/mouse, and a copy of TeraScan® software.
- 2) One (1) TeraScan® Trainer System, comprised of a desktop computer, a 42” monitor (wall mounted) plus keyboard/mouse, and a copy of TeraScan® software, for use by the trainer during instruction.

ECSU requires the following hardware and software for operation of the existing equipment.

- 1) One (1) TeraScan® Monitoring System, comprised of a desktop computer, a 42” monitor (wall mounted) plus keyboard/mouse, and a copy of TeraScan® software, for the use of monitoring the satellite overpasses and data collection.

- 2) One (1) 60TB TeraVault data storage, for short-term (30 day) archiving of data
- 3) One (1) T-REX™ processing system, for near real-time processing of medium to high-resolution data (such as Suomi NPP). Necessary to process the data in near real-time.
- 4) Toshiba G9000 UPS and backup generators to maintain reliability during power outages.

SeaSpace Corporation

SeaSpace Corporation WorldMet® service is comprised of two U.S. nodes. One in Poway California at SeaSpace headquarters, hereby referred to as WorldMet® West, and the other at Elizabeth City State University (ECSU), hereby referred to as WorldMet® East. International nodes are currently located in Sevilla, Spain, and Daejeon, Korea. Future nodes will be located in Japan and India. The purpose of WorldMet® is to collect and distribute real-time satellite data to customers.

SeaSpace provides COMS imager data from Korea to the Naval Oceanographic Office at Stennis Space Center in Mississippi in near real time. Upon launch of INSAT-3D satellite from India in 2013 and MTSAT-3 satellite from Japan in 2014, WorldMet® plans to provide this data to the Naval Oceanographic Office, and possibly additional Navy offices. WorldMet® West and East each will be assigned responsibility to deliver data to customers in their respective regions of the U.S. Each will serve as a back-up site for the other.

****Describe how the requested equipment/instrumentation will interface with existing resources or upgrade facilities and equipment/instrumentation currently available.***

Presently ECSU houses a 1.5m L-band, two 2.4m X/L band, one 3.6m X/L-band and one 3.7 C band ground stations along with accompanying receiving/processing equipment. The dishes are stationed on the roof of the Dixon-Patterson Technology building. The ground stations communicate with both geostationary as well as polar orbiting telemetries. GEOS, Landsat, NPP, NOAA, MetOP, Terra, and Aqua are just a few of the data streams that are captured for the eastern coast of North America. The passes include both multispectral and hyperspectral data streams with some spatial resolutions at or below one meter. Temporal resolutions are at a minimum of one pass per 30-minute interval.

To handle the large data stream requirements, a dedicated gigabit network switch with a fiber connection provided directly from the service provider is required. The addition of the switch and service will provide guaranteed data throughput speeds of ~50Mbps. A sample of the current network throughput breakdown is GOES-15 3.7Mbps, GOES-13 3.7Mbps, Terra 12.5Mbps, Aqua 15Mbps, and NPP 15-30Mbps. ECSU network staff will install the new switch and integrate it into the existing Cisco network.

****Describe any special circumstances regarding the acquisition or installation of the equipment, e.g., plumbing or electrical upgrades (these costs may be included in the proposed budget if necessary to make the equipment or instrumentation fully***

operational).

SRS-REIP equipment will allow ECSU to maintain a > 95% uptime. The location of ECSU is on the northeastern corner of North Carolina where both winter storms and hurricanes frequent. The data, which is invaluable to both ECSU faculty and students, may only be received directly from satellites while in the area. This means that during a severe weather event, a backup form of power outside of the traditional power lines is necessary to insure data streams and imagery are received. To accomplish this a 60-kilowatt generator and UPS is requested.

To handle the increased data stream requirements, a dedicated gigabit network switch with a fiber connection directly to the service provider is required. The addition of the switch and service will provide guaranteed data throughput speeds. The addition of the equipment will also make ECSU the premier location for ground station training on the east coast of the United States. The training will benefit academic, governmental, and military agencies.

****Indicate the estimated useful life of the equipment/instrumentation and describe how the institution plans to service and maintain it after the 12-month period of the award. This item should address the source(s) of funding for continued operation and maintenance.***

The typical life of the Seaspace ground station equipment is five to ten years with minimal ongoing upkeep. The life span of the electrical panel upgrades correlate to the life of the building. The generator's expected life span is 25 years. The network switch mean time between failure(s) is ~200,000 hours.

The computers come with a 3-year warranty. SeaSpace will warranty the software and support for no extra charge, since we are partners. As for the lifetime, the normal life expectancy would be considered 6 years before a typical computer would need replacement.

Funds resulting from the training of non-university participants will be used to maintain and service the equipment. Training costs \$1600 a day at SeaSpace, however CERSER may institute a different pricing system for non-university participants. SeaSpace will manage the marketing and billing for non-university participants. ECSU will keep 70% and SeaSpace will get 30% for overhead.