
Contract DG1330-12-CQ-0004,

In Accordance With (IAW) EXERCISED OPTION CLIN 1099

Statement of Objectives (SOO) – Task Order 0004

**Title: GROWTH OPTION, ADDITIONAL WCOSS
CAPABILITIES**

18 Nov 2014

**Weather and Climate Operational Supercomputing System
(WCOSS)**

**Augment Primary and Backup WCOSS Fully-Integrated into
Two (2) Contractor-Provided Facilities**

v1.21

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1. PURPOSE, SCOPE AND OBJECTIVES

1.1 PURPOSE

Weather and Climate Operational Supercomputer System (WCOSS) provides NOAA the Operational High Performance Computing (HPC) resources essential to support the processing of sophisticated numerical models used to predict and understand atmospheric and oceanic phenomena for weather and climate operational use. The WCOSS refers to the primary and backup supercomputers, related facilities, hardware, software and services. WCOSS refers to the total solution unless otherwise specified with the primary/backup modifier. The “augmented WCOSS” refers to the additional Task Orders 003 and 0004 compute and storage services PLUS Task Order 002 titled “WCOSS for the Task Order Base Period” services awarded on 15Feb2012.

1.2 SCOPE

This SOO describes the growth options requirements, IAW DG1330-12-CQ-0004 CLIN 1099, for the Contractor to design, develop, deliver, integrate, configure, test, validate, verify, monitor, document, support, enhance, refresh, upgrade, fit-up and sustain the augmentation to the WCOSS total solution as defined in the WCOSS ID/IQ Task Order 002 as the primary and backup supercomputers, related contractor provided facilities, and hardware, software and services.

1.3 OBJECTIVES

The overall objective is to acquire the maximum amount of compute resources that achieves NOAA’S HPC objectives that govern the intended use of WCOSS. The WCOSS supports the Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), National Weather Service (NWS) mission, “to provide weather, hydrologic, and climate forecasts and warnings for the United States, its territories, adjacent waters and ocean areas, for the protection of life and property and the enhancement of the national economy. NWS data and products form a national information database and infrastructure which can be used by other governmental agencies, the private sector, the public, and the global community ¹.”

2. BACKGROUND

2.1 INTRODUCTION

2.1.1 MISSION OVERVIEW

NOAA WCOSS serves the NOAA mission by providing significant computational capability, which is the basis for modeling and simulation infrastructure support for NOAA’s operational HPC applications. These applications assess and predict environmental changes to support protecting life and property; providing Government senior leadership and decision makers with reliable and verifiable scientific

¹ National Weather Service Mission Statement at URL: <http://www.nws.noaa.gov/mission.php>

information; managing the nation's living marine and coastal resources; and fostering global environmental stewardship.

2.1.2 GROWING DEMAND

NOAA is recognized as a world leader in understanding and predicting the Earth's environment through advanced modeling capabilities, climate research and real time weather products and services. The growing concern of environmental and global climate change, weather impacts upon homeland security and aviation, hurricanes, tornadoes and other severe weather have spurred growing demand for weather, climate, ocean, atmospheric, and space weather information with increased accuracy, shorter lead times and greater model resolution. NOAA's aggressive and proactive modeling plans are linked to the HPC technology curve which improves price-performance ratios over time providing increased computing resources critical to meet NOAA's modeling and strategic objectives.

2.1.3 RELIABLE MODEL EXECUTION AND PRODUCT DELIVERY

The WCOSS provides computing capabilities to ensure increasingly more complex environmental models are executed reliably on-time, all the time. The models must complete on time with growing amounts of input data including observational and satellite data synchronized to an external (outside of WCOSS) worldwide data collection cycle. The WCOSS must be highly dependable to run operational models many times a day within a prescribed time window to produce and reliably disseminate model guidance products on a fixed time schedule. WCOSS model run start and end times are available online at the following URL: <http://www.nco.ncep.noaa.gov/pmb/nwprod/prodstat/>.

2.1.4 DISASTER RECOVERY ACT

The majority of funding for this task order is provided by the Hurricane Sandy Disaster Recovery Act to support increasing the operational capacity of NOAA's operational high performance computing resources.

2.2 FUNCTIONAL OVERVIEW

2.2.1 NPS AND T2O

The WCOSS enables the NWS National Centers for Environmental Prediction (NCEP) Production Suite (NPS) and the Transition-to-Operations (T2O) capability. The NPS executes the operational production of the model runs from which the weather, climate, ocean, atmospheric, and space weather forecasts are made. The NPS, as of September 2014, currently generates more than 14.8 million operational model products, which are disseminated each day to Government agencies, commercial interests, and the public. The NPS, as of September 2014, is currently composed of approximately nine-hundred (900) applications, forty (40) of which are parallel utilizing Message Passing Interface (MPI) and/or threading (OpenMP). The T2O consists of the processes that support model enhancements and next generation forecast models destined for NPS operations. T2O serves as a critical link in the chain from research, to development, and finally, to operations. The WCOSS interchangeably hosts the NPS and T2O and provides the framework to fail over the NPS and T2O to the other HPC system.

2.2.2 NCEP PRODUCTION SUITE

Each forecast system in the NPS runs in a fixed time window. Model systems may not start early, nor may they finish late due to strict product delivery commitments and subsequent run dependencies. These circumstances produce a very high peak-to-average computational load ratio and drive platform performance accordingly.

2.2.3 TRANSITION TO OPERATIONS

The Backup WCOSS and a subset of the Primary WCOSS (not used or reserved by NPS) are fully utilized for T2O work by the NCEP Environmental Modeling Center (EMC), NCEP Service Centers, and other Government organizations. With the increasing complexity of the NPS, and the expectation of increasing skill for each of its forecast components, the need for T2O computing is significantly increasing. Adequate T2O computing is essential to provide testing for scientific and computational reliability, and the generation of new model product lines.

2.3 GOVERNMENT DATA/APPLICATIONS AND CONTRACTOR PROVIDED PRODUCTS AND SERVICES

2.3.1 GOVERNMENT DEVELOPED AT GOVERNMENT EXPENSE

2.3.1.1 The NPS and T2O consist of NOAA input data, HPC applications and output data. NOAA's input data includes satellite sources (e.g., geostationary and polar orbiters), non-satellite sources (e.g., surface reports, land, marine, upper-air profiles, land soundings, aircraft), and Doppler Radar. NCEP maintains and executes applications to include numerical models, libraries, post processing, and data flow. NCEP's output data includes model prediction products in various formats (e.g., GRIB1, GRIB2, BUFR, and Web content).

2.3.1.2 NOAA's operational HPC applications are coordinated, developed, and maintained by NCEP's Environmental Modeling Center (EMC). EMC coordinates HPC application development across numerous organizations including NOAA and NWS offices/centers; Department of Defense (DoD); international meteorological centers; and other organizations linked to environmental modeling. NOAA's operational HPC applications run on two (2) HPC systems (Primary WCOSS and Backup WCOSS) operated by NCEP Central Operations (NCO).

2.3.2 CONTRACTOR PROVIDED PRODUCTS AND SERVICES

The contractor provides products and services related to software, hardware and facilities necessary to deliver and sustain the WCOSS which hosts NPS and T2O. The contractor's software includes operating systems, compilers, libraries, scheduler, workflow, and GFP software (e.g., IDL, TotalView). The contractor's hardware includes the supercomputers, storage, interconnects, Internet Protocols, LAN switches, computer related peripherals, and ancillary systems. The contractor-provided facilities include physical space, mechanical, electrical, environmental, plumbing, all related power production, failover and backup requirements, and physical access controls.

2.4 WCOSS ID/IQ TASK ORDERS

Task Order 0001 provided the Project Management Plan (PMP) for the Phase 1 system which required the contractor to update, change and maintain the PMP through the end of the period of performance (i.e., 28Nov2011 through 30Sep2013). Task Order 002 provides requirements for the Phase 1 and Phase 2

systems for the base period (i.e., 15Feb2012 through 14Feb2017). Task Order 003 and Task Order 0004 build on Task Order 002's Performance Work Statement's solution (developed by the contractor). Ultimately, the contractor shall provide a comprehensive and integrated solution combining Task Order 002, Task Order 003, and Task Order 0004 products and services to provide a fully integrated, balanced and seamless end-to-end system for NPS and T2O workloads for the base period of the contract.

2.5 WCOSS POINTS OF CONTACT

WCOSS points of contact include:

- 2.5.1 Mike Kane, WCOSS PM, Mike.Kane@noaa.gov, 301-683-3896
- 2.5.2 Adena Fritz, NCEP Asset Manager/NCEP DAR, Adena.Fritz@noaa.gov, 301-683-1313
- 2.5.3 Ben Kyger, WCOSS System Owner/Director, NCEP Central Operations, Ben.Kyger@noaa.gov, 301-683-3900
- 2.5.4 Rene Rodriguez, NCEP ISSO, Rene.Rodriguez@noaa.gov, 301-683-3959
- 2.5.5 Mike Kane, WCOSS COR, Mike.Kane@noaa.gov, 301-683-3896

2.6 GOVERNMENT COORDINATION

The Government shall coordinate applicable services as deemed necessary; such coordination may be accomplished during conference calls, email or other ad-hoc communications with the contractor.

3. Requirements

3.1 OVERALL REQUIREMENTS

3.1.1 The overall requirement of Task Order 0004 is for the contractor to deliver all products and services to accomplish the objectives and performance measurements identified in this SOO.

3.1.2 In accordance with ID/IQ Section B.5 and other terms and conditions, the contractor shall develop and deliver a Performance Work Statement (PWS) subject for review and approval by the Government.

3.1.3 The contractor shall provide in its Performance Work Statement (PWS), details of products and services to be accomplished in response to these requirements.

3.1.4 Applicable WCOSS products and services shall be fully integrated, efficient, economical, compatible, technically compliant, and otherwise as deemed acceptable to the Government. These objectives include the following:

a. This augmentation to the WCOSS compute, storage, software, and support services should economically build on the ID/IQ Task Orders 002 and 003 solutions and to leverage the facilities, products, and services provided by Task Order 002, and Task Order 003 to maximize efficiencies;

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b. The contractor shall provide the best value and balanced solution for additional compute and storage to augment WCOSS.

c. The Government is expecting the delivery under this Task Order 0004 to be a significant increase in capability and capacity of the Phase II WCOSS.

i. At a minimum the Government is expecting the delivery under this Task Order 004 to be at least One Hundred Percent (100%) of the Task Order 0002 Phase 2 system (IvyBridge) benchmark capability and One Hundred Fifteen (115%) of the Task Order 0002 Phase 2 system (IvyBridge) benchmark capacity.

ii. The combined WCOSS (Task Orders 002, 003, and 004) should exceed 2.16 PF (peak) per system.

d. The storage and filesystems delivered must be integrated with the technically compliant storage and filesystems as delivered under Task Order 002 (Phases 1 and 2) and Task Order 003.

e. The data from the additional Task Order 004 storage resources shall be visible or made available to the TO2 and TO3 nodes.

f. The data from the TO2 and TO3 storage resources shall be visible to the TO 004 compute nodes.

3.1.5 The augmented WCOSS shall be balanced (compute and storage), fully integrated and seamless from an end-user perspective (e.g., NPS and T2O workloads).

3.1.6 The additional Task Order 0004 compute, storage, software, network components, products, and related services shall be administratively managed and accounted for separately from other contract task orders (i.e. separately from Task Order 002 and Task Order 003) from a contractual task order perspective (e.g., acceptance testing and invoicing).

3.1.7 The contractor shall provide non-disruptive reliable 7x24x365 calendar days performance by the augmented WCOSS to meet time line schedules and sensitive production cycles and reliable dissemination of model products;

3.1.8 The contractor shall provide the highest levels of systems maintainability, technical reliability by the augmented WCOSS to achieve NOAA's Operational HPC mission;

3.1.9 The contractor shall provide options for scalability up to a factor of 4X for overall computing/performance by the augmented WCOSS to meet NOAA's future demands through non-disruptive expansions and refreshes, technology upgrades and fit-ups;

3.1.10 The contractor shall provide facilities to house the augmented Primary and Backup WCOSS;

3.1.11 The contractor shall provide facilities related products and services for the augmented WCOSS;

3.1.12 The contractor shall provide HPC related products and services for the augmented WCOSS;

3.1.13 The contractor shall provide a balanced HPC lifecycle systems technology to accommodate expansions and refreshes with required facilities for the augmented WCOSS;

3.1.14 Submittals for the augmented WCOSS (including submittals history) shall be made available via a protected Web portal (secure HTTP and password protected). Submittals include all reports, forecast schedules, costs and expenditures, project management plans and other WCOSS related documentation.

3.2 RESILIENCY, RELIABILITY, AVAILABILITY, AND SERVICEABILITY (RRAS)

3.2.1 WCOSS AND FACILITIES

The requirement is to meet RRAS performance measures for the augmented WCOSS and the facilities that house the augmented WCOSS.

3.2.1.1 The requirement includes consistently and continually meeting RRAS objectives with any future change or enhancement made to the augmented WCOSS and facilities.

3.2.2 OPERATIONAL USE TIME (OUT)

The requirement is to sustain 99.9% Operational Use Time (see Appendix A) or better.

3.2.2.1 Operational Use Time shall never exceed one-hundred percent (100%) availability in daily and monthly statistics.

3.2.2.2 Operational Use Time consideration per ID/IQ's Section F paragraph F.1.3 shall include the augmented portion of the WCOSS solution through the base period and will commence immediately at the time the augmented system is accepted by the Contracting Officer (CO) for the Primary and Backup WCOSS. If a phased delivery is provided then OUT will commence immediately at the time each phase of the augmented system is accepted by the CO for the Primary and Backup WCOSS.

3.2.3 SYSTEM AVAILABILITY

The requirement is to sustain ninety-nine percent (99%) System Availability (see Appendix A) or better.

3.2.3.1 System availability shall never exceed one-hundred percent (100%) availability in daily and in monthly statistics.

3.2.3.2 The contractor shall authorize its System Administrators to bypass the normal service and support escalation path when creating a Problem Management Record (PMR) and engage directly with the OEM's Level 2 and Level 3 support in order to facilitate the problem resolution process. OEM's Level 2 & 3 support provides direct access to subject matter experts and, if necessary, product development staff.

3.2.4 DEVELOPMENT USE TIME (DUT)

The requirement is to sustain 99% Development Use Time (see Appendix A) or better.

3.2.4.1 Development Use Time shall never exceed 100% availability in daily and monthly statistics.

3.2.4.2 Development Use Time consideration per ID/IQ's Section F paragraph F.1.3 shall include the augmented portion of the WCOSS solution through the base period and will commence immediately at the time the augmented system is accepted by the Contracting Officer for the Primary and Backup

WCOSS. If a phased delivery is provided then DUT will commence immediately at the time each phase of the augmented system is accepted by the Contracting Officer.

3.2.5 NUMERICAL REPRODUCIBILITY / ACCURACY

The requirement is to provide the augmented WCOSS that exhibits reliably consistent bit-for-bit numerical reproducibility of benchmark results and exhibit bit-for-bit reproducibility on all operational codes. This includes bit-for-bit reproducibility for subsequent runs of the same code, same input data and same software levels with re-compilation using the same compiler and compiler flags or without re-compilation. Numerical results shall reproduce "known truth" (operational run for the same case) out to five (5) decimal places.

3.2.6 RUN TIME VARIABILITY

The requirement is to deliver the augmented WCOSS that exhibit, within five percent (5.0%) of average, reliably consistent runtimes on successive runs of benchmark and operational codes within a consistent environment (compute, storage, I/O), same input data and same software levels with re-compilation using the same compiler and compiler flags or without re-compilation when run on either system.

3.2.7 NPS ON-TIME PRODUCT GENERATION

3.2.7.1 The requirement is to sustain NPS on-time product generation, for each product, within 15 minutes of target completion times at a rate of ninety-nine percent (99%) or better.

3.2.7.2 If the vendor provides a heterogeneous solution, the entire system (including TO2 and TO3) must be capable of running all portions of the NPS.

3.2.8 PRODUCT DELIVERY DURING FAILOVER

The requirement is to ensure no degradation in NPS product delivery occurs during planned and routine failover testing between Primary and Backup WCOSS.

3.2.8.1 For unplanned failovers due to hardware, software, facilities and services provided by the contractor, the contractor shall be responsible for these failures and report these unplanned failovers in the OUT and DUT monthly measurements.

3.2.9 MAXIMIZE UTILIZATION

The requirement is to leverage the full suite of tools and services (Provided under Task Orders 002 and 003), including documentation and training, to maximize the overall utilization of the augmented WCOSS.

3.2.10 RESILIENCE

The requirement is to provide the augmented WCOSS and facilities to be resilient and include features whereby failures are predicted, detected and mitigated. These features include:

3.2.10.1 Sustaining NPS and T2O as faults are detected;

3.2.10.2 Mechanisms to detect and defend against hardware, software and facilities faults;

3.2.10.3 Government interaction with these capabilities to include alerts and error logging.

3.2.10.4 The contractor shall track all NPS jobs that exit with non zero return codes.

3.2.11 WORKLOAD RESILIENCY

The requirement is to provide the augmented WCOSS that supports workload resiliency for NPS and T20 to include serial, MPI and OpenMP applications. These features should include actions such as:

3.2.11.1 Restarts of applications from a system fault and other administrator and software actions.

3.2.12 SERVICEABILITY

The requirement is to provide services and upgrade the augmented WCOSS and facilities with no disruption or impact to NPS and T20 to include hardware, software and facilities.

3.2.12.1 Maintenance performed by the contractor on a regular basis and emergency maintenance performed as required shall follow the NCO Configuration Management procedures.

3.2.12.2 Maintenance shall be performed while maintaining OUT and DUT performance objectives in accordance with terms and conditions of the WCOSS Contract.

3.2.12.3 Upon completion of routine and emergency maintenance, in addition to any tests required to confirm the success of the maintenance, the Government may, at its discretion, require the contractor to demonstrate numerical reproducibility and runtime variability by either or both of (a) running a suite of forecast models that were operational at the time of the system maintenance; and, (b) running a mutually agreed upon set of contractor-provided applications that include validating disk and I/O subsystems performance.

3.2.12.4 The contractor shall assist the Government in the performance of these tests.

3.2.12.5 The time required to perform NCO required validation tests will be considered NULL time and not charged against OUT, DUT, or System Availability.

3.2.12.6 Whenever a system is taken out of service for any upgrade or service maintenance activity, the contractor shall plan to minimize the time that the backup system will be out of service. The contractor shall coordinate the plan with NOAA prior to any planned outages and both parties must agree that the planned approach is optimal.

3.2.12.7 At any point during a planned outage the contractor shall ensure that the backup system can be brought back into operations within 24 hrs upon notification by the Government.

3.2.13 TOOLS AND SERVICES FOR RRAS

The requirement is to leverage the full suite of tools, visual displays, and services provided under Task Orders 002 and 003, including documentation and training, to achieve RRAS objectives. Documentation to include error detection, correction, prevention, and reporting attributes.

3.2.13.1 The Systems Administration (SA) team shall be responsible for analyzing and monitoring data from systems including the xCAT Event Analyzer (EA) or equivalent tools, products, and services.

3.2.13.2 The SA team shall support and modify the monitors and create new monitors to take advantage of new features of the system.

3.2.13.3 If a heterogeneous solution is proposed the tools and visual displays must be integrated with those provided in TO2 and TO3 to provide a single unified set of tools and displays.

3.2.14 MONITORING AND DIAGNOSTICS

The monitoring and diagnostic tools and services should be integrated with those provided under Task Order 002 and Task Order 003, to the greatest extent practical. The Contractor shall describe and provide performance monitoring diagnostics tools and services to include the comprehensive set of HPC and facilities attributes (e.g. software stack, compute, memory, interconnects, storage, I/O, LAN, power consumption, cooling, and other environmental controls).

3.2.15 ACCOUNTING

The contractor shall provide accounting information provided by the operating system as well as the workload management system. The accounting information should at a minimum describe system utilization by individual accounts and IT resources categories including compute, memory, storage, and I/O. 3.2.15.1 - The accounting information should be integrated with those provided under Task Order 002 and Task Order 003, to the greatest extent practical.

3.2.16 REPORTS

The requirement is to provide monthly RRAS reports.

3.2.16.1 Additional reports may be required at the Government's request.

3.2.16.2 The RRAS reports shall include at minimum the trend in OUT, DUT, System Availability, incident and root cause analysis, resource usage and bottlenecks for all major system components (e.g., software stack, compute, memory, interconnects, storage, I/O, LAN, power production, cooling, other environmental controls).

3.2.16.3 IBM shall meet with NCO management monthly to discuss and report on the WCOSS previous month's requirements to include OUT, DUT and System Availability, Documented System Issues, and ongoing project status.

3.3 ARCHITECTURE

3.3.1 WCOSS AND FACILITIES INTEGRATION

The requirement is to fully-integrate the Primary and Backup augmented WCOSS into the two (2) contractor-provided facilities.

3.3.2 SYMMETRY

The requirement is to provide the Primary and Backup augmented WCOSS that are architecturally identical and symmetrical to each other.

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3.3.2.1 While homogeneity can simplify system operation and maintenance, the architecture for each HPC system shall provide the best possible technically compliant solution to execute NPS and T2O workloads.

3.3.2.2 The contractor may use a heterogeneous configuration for each augmented WCOSS; however, each augmented WCOSS must be architecturally identical and symmetrical to each other.

3.3.2.3 The Backup augmented WCOSS, which will be utilized for contingency operations and host T2O, shall duplicate all aspects of the requirements of the Primary augmented WCOSS to include node configuration, interconnects, switch bandwidth, I/O rates and system uptime.

3.3.3 SCALABILITY

The requirement is to accommodate expanding computational products and services needed for NPS and T2O.

3.3.3.1 This requirement includes the capability to scale the augmented WCOSS and associated facilities to meet NOAA's increasing computing and storage needs.

3.3.3.2 Scaling of HPC components shall be integrated, balanced, and meet performance objectives.

3.3.3.3 Scaling HPC and facilities components shall be comprehensive and integrated end-to-end. HPC components include hardware, software, maintenance and services. Facility components include power production, cooling, physical floor space, maintenance and services.

3.3.4 PERFORMANCE

The requirement is to ensure the augmented WCOSS is capable of maintaining NCEP's operational product delivery schedule and increasingly complex meteorological applications to run within the same fixed wall-clock time window. These workloads are comprised of a range of computational tasks (capability, capacity and I/O demands), complicated models, data assimilation, data analysis, and product generation, with accompanying high-volume and low-latency data storage and retrieval.

3.3.5 COMPONENTS

The requirement is to provide the augmented WCOSS composed, integrated and configured end-to-end with the operating system, processors, memory, interconnect fabric, storage, computer related peripherals, and other elements required to meet requirements.

3.3.6 PROCESSORS

The requirement is to provide the augmented WCOSS with processors that support both 32-bit and 64-bit fixed and floating-point numerical representations.

3.3.7 PROCESSORS AND MEMORY

The requirement is to provide and configure systems (computational, interactive, memory, I/O, and storage) to deliver optimal and balanced performance for the NPS and T2O.

3.3.8 MEMORY

The requirement is to provide two (2) GB or greater per core for all the compute nodes.

3.3.8.1 Memory errors must be detected, corrected, and reported.

3.3.9 OPERATING SYSTEM

The requirement is to provide the augmented WCOSS with a UNIX or Linux-based operating system including documentation.

3.3.9.1 All components of the Operating System shall be operationally supported 7x24x365 by IBM, inclusive of upgrades, maintenance and support.

3.3.9.2 The Operating system shall contain and integrate all system software components to include filesystem support for the storage systems and interconnects.

3.3.10 STORAGE

The requirement is to provide the augmented WCOSS an appropriate amount (i.e. capacity and I/O) of disk storage to fulfill NPS and T2O processing objectives in accordance with paragraph 3.5.5.

3.3.10.1 The response shall contain a rationale for the amount (i.e. capacity and I/O) of disk storage that is proposed.

3.3.11 I/O

The requirement is to provide the augmented WCOSS with components connected via a framework providing I/O rates to support NOAA's workload, including reporting and recovery from outages and interfacing to the NCEP Wide Area Network (WAN).

3.3.12 INTEGRATED ARCHITECTURAL DESIGN

The requirement is to provide and deploy an integrated architectural design with interconnecting systems and subsystems at various levels to balance performance, meet objectives and minimize risk.

3.3.13 SINGLE POINT ADMINISTRATION

The requirement is to provide the Primary and Backup augmented WCOSS with the capability of being administered via a single, stand-alone workstation, on-site and remotely, which is capable of administering either the entire system simultaneously or on a node-by-node-basis.

3.3.14 TEST SYSTEM

The requirement is to provide a test system that is approximately at least one percent (1%) of the capacity and computing resources of the Primary augmented WCOSS.

3.3.14.1 The test system shall be architecturally similar to augmented WCOSS and capable of testing and validating hardware and software in a manner that is representative and consistent to the augmented WCOSS.

3.3.15 ARCHIVE SYSTEM ACCESSIBILITY

The requirement is to ensure the augmented WCOSS is capable of transferring high volumes of data to a Government provided archive system located outside of the WCOSS IBM-provided facilities.

3.3.15.1 The Government will be responsible for the WAN connectivity between augmented WCOSS and the archive system and for the availability of the archive system itself.

3.3.15.2 The augmented WCOSS I/O performance shall sustain the archive data flow. Data volumes remain relatively steady throughout the day. Data volumes increase at a rate equivalent to that of system performance.

3.3.15.3 The augmented WCOSS I/O performance shall be designed to scale with the NCEP WAN. Currently, NCEP provides a 10Gbps WAN backbone between the Primary and Backup WCOSS and to the NCEP Washington D.C. metropolitan network. Over the life of the contract the Government expects to increase its current WAN capacity beyond 10 Gbps.

3.3.15.4 The augmented WCOSS shall accommodate peak periods to include transitions to future Government provided archive systems or recovery from outages. Peak periods remain consistent with ID/IQ Task Order 002 for writes which are estimated for NPS at 16TB per day and for T2O 6TB per day; and for reads estimated for NPS at 10 TB per day and for T2O 6TB per day.

3.3.16 NON-SCALABLE WORKLOADS

The requirement is to include in the augmented WCOSS architecture a capability to execute non-scalable programs (programs that do not use MPI) which will use NPS and T2O data.

3.3.16.1 These capabilities cannot adversely impact performance or create security risks to computing and I/O performance required to support NPS and T2O.

3.3.16.2 The non-scalable workloads include but are not limited to the following applications:

- a. Data Flow - Systems executing data transport applications (e.g., DBNet, LDM) that receive and transfer data to external partners. For example, a large quantity of model data is transferred from the WCOSS to partners for dissemination to customers' world-wide.
- b. Scientific Applications - Systems executing scientific applications that use the WCOSS model output to create graphical files and include applications such as National Center for Atmospheric Research (NCAR) Graphics, GRADS, IDL, Advanced Weather Interactive Processing System (AWIPS) II and National Centers AWIPS (N-AWIPS). For example, large quantities of graphic files are created to verify model performance and include transfers to Websites for external access.

3.4 WCOSS NPS AND T2O

3.4.1 EXECUTING NPS OR T2O INTERCHANGEABLY

The requirement is to provide the augmented WCOSS capable of executing NPS and T2O workloads interchangeably and meeting the performance requirements described in Section 3.11.3. NPS executes on either the Primary or Backup augmented WCOSS. T2O executes on the Primary and Backup augmented WCOSS. The Government will determine the allocation of HPC computing resources to NPS and T2O functions.

3.4.2 SWITCHING OF NPS AND T2O

The requirement is to provide the framework for supporting the NPS and T2O failover process. This includes making the appropriate data available on the augmented WCOSS in an efficient, robust and secure manner. The Government will control the failover processes including data mirroring functions.

3.4.3 SWITCHING OF NPS

The requirement is to provide the augmented WCOSS that supports controlled switching of the NPS workload from one system to the other.

3.4.3.1 The NPS failover will be completed within fifteen (15) minutes of initiating the failover process while meeting requirements. The Government controls the failover process.

3.4.4 SWITCHING OF T2O

The requirement is to provide the augmented WCOSS that supports controlled switching of the T2O workloads from one system to the other.

3.4.4.1 The T2O workloads will be completed within ninety (90) minutes of initiating the failover process while meeting requirements. The Government controls the failover process.

3.5 PERFORMANCE IMPROVEMENTS

3.5.1 EXPANSIONS / REFRESHES / UPGRADES / FIT-UPS

The requirement is for the augmented WCOSS to provide balanced HPC lifecycle technology expansions, refreshes, and technically compliant integrated with associated facilities upgrades and fit-ups using project management principles and executed with minimum disruption to NPS and T2O.

3.5.1.1 The contractor shall provide these technically compliant upgrades through either additional hardware very similar to the existing systems, wholly new systems, or a combination thereof.

3.5.1.2 The contractor shall submit a detailed implementation schedule (in Microsoft Project format) within Fifteen (15) calendar days of task order award (see section 3.17) for Government approval prior to proceeding.

3.5.1.3 The Government reserves the right to delay an upgrade based upon the availability of new technologies to maximize price-performance ratios.

3.5.1.4 All upgrades shall meet all requirements and requirements throughout the base period. The need for a balanced system (processing, I/O, storage, bandwidth, facilities) is mandatory to support these requirements.

3.5.1.5 The Government may opt, at any time, to accept, defer, or reject each upgrade. The Government understands that it may incur some risk should it reject or defer a recommended upgrade.

3.5.2 PERFORMANCE UPGRADES ACCEPTANCE

The requirement is to adhere to the acceptance criteria in the ID/IQ Section E for periodic performance upgrades.

3.5.3 PERIODIC UPGRADE PROCESS

The requirement is to provide periodic upgrades using a risk reduction process to include firmware and software updates.

3.5.3.1 The cycle of periodic upgrades starts with the new configurations being demonstrated with a test machine (see paragraph 3.3.14) and implemented in the augmented WCOSS environments using a schedule submitted by IBM for Government approval.

3.5.3.2 All failover procedures will be submitted by the contractor for Government review and approval.

3.5.3.3 Prior to a rolling upgrade, the contractor shall coordinate with the NCO production staff to determine the resources required to support production.

3.5.3.4 The contractor shall test the roll back process and verify that the contractor can return to the previous level and document how long that process will take.

3.5.3.5 In the event that NCEP needs to failover to a system that is being upgraded, it is assumed that the primary production system is no longer viable. At the point of a required failover, the contractor shall determine if enough resources exist to support production in either state, upgraded or not upgraded.

3.5.3.6 Based on NCO's review and approval, the contractor shall either roll forward or roll back the upgrade on sufficient nodes to support production. The contractor shall then fence these nodes as production only. In any event, these actions will be coordinated by the contractor with NCO and submitted to NCO for approval; the WCOSS Project Manager and COR shall be included in all coordination efforts initiated by the contractor.

3.5.3.7 The contractor shall make available and facilitate, in a timely manner, the Government access to key personnel involved in benchmark run preparation, if necessary, for a period of at least thirty (30) days after system upgrades.

3.5.4 BENCHMARK PERFORMANCE

The contractor shall meet the Benchmark Requirements described in Section J, attachment 6, of the ID/IQ contract.

3.5.4.1 The requirement is to exceed the benchmark performance described in the ID/IQ's Section J Attachment 9, IBM Benchmark Performance for NCEP WCOSS and the requirement 3.1.4.c.

3.5.4.2 Benchmark performance shall be measured using Task Order 002, "IBM Section J, Attachment 9, IBM Benchmark Performance for NCEP WCOSS", Appendix E, Tables 2A, 2B and 2C as required for the T0002 Phase 2 performance commitment and demonstration.

3.5.5 STORAGE CAPACITY AND BANDWIDTH

The requirement is to provide additional balanced and fully integrated storage capacity and storage bandwidth performance augmenting the ID/IQ Task Order 002 and Task Order 003 solutions.

3.5.5.1 The Contractor shall provide Task Order 0004 storage capacity and bandwidth performance using the format shown in Table 3.5.5-1.

Table 3.5.5-1: Task Order 0004 Storage Capacity and Bandwidth requirements

Per site	Per site
Capacity	Bandwidth
X.XX PB (Raw) X.XXX PB (Useable)	XX GB/s

3.5.5.2 The requirement is to balance the WCOSS storage requirements for capacity and Input Output Operations Per Second.

3.5.5.3 The requirement is to provide at a minimum 40 GB/sec of aggregate I/O bandwidth (See Appendix B for recommended I/O bandwidth data).

3.5.5.4 The requirement is to provide a storage solution that will accommodate future growth in compliance with the concurrent execution of NPS and T2O applications (3.11.3).

3.5.6 EQUIPMENT REMOVAL

The requirement is to uninstall and remove all unused WCOSS equipment and related facilities equipment, components, cables, related computer peripherals, and other related items at no additional cost to the Government.

3.5.6.1 NCEP's property and configuration management processes shall be followed as part of the contractor's uninstall and removal plans.

3.5.6.2 The contractor shall scrub the disks and provide documented/certified confirmation to the Government prior to removing the disks that all applicable information recorded has been removed and is not retrievable.

3.6 WORKLOAD MIGRATION

3.6.1 PORTING NCEP CODES TO THE NEW WCOSS

The contractor is not required to port the NCEP codes from the current WCOSS to the new augmented WCOSS. The Government will be responsible for porting the NCEP models and applications, with the contractor's assistance, to the new augmented WCOSS and to future WCOSS upgrades and refreshes.

3.6.2 TRAINING

The requirement is to provide training to the Government and support contractors sufficient to meet the Government's schedule of completing the code migration to the new augmented WCOSS and future WCOSS upgrades and refreshes.

3.6.3 BENCHMARK PERSONNEL

The requirement is to provide and facilitate, in a timely manner, the Government access to key personnel involved in benchmark run preparation for a period of at least Ninety (90) days after acceptance of the augmented systems.

3.6.3.1 The contractor shall provide and facilitate such access via e-mail, teleconference, phone, or in person meetings.

3.6.3.2 These requirements apply for future WCOSS upgrades, technical collaborations, exchanges, and refreshes.

3.7 HIGH PERFORMANCE STORAGE (HPS)

3.7.1 WCOSS HPS

3.7.1.1 The requirement is to provide additional capacity to the HPS system for both the Primary WCOSS and Backup WCOSS.

3.7.1.2 The Contractor shall provide a balanced HPS that optimizes both capacity and I/O bandwidth.

3.7.2 PARALLEL FILESYSTEM

The requirement is to provide parallel file systems.

3.7.2.1 If the solution proposed is a heterogeneous solution then the filesystem(s) must support the requirements 3.1.4.e and 3.1.4.f.

3.7.2.2 The augmented HPS design may be a single filesystem of uniform design, or may be multiple filesystems individually optimized for differing I/O and storage requirements.

3.7.3 QUOTAS

The requirement is for each augmented HPS system to support user and group quotas for a number of files and space and include configuration, enforcement and reports.

3.7.3.1 All requirements apply while quotas are enabled.

3.7.4 BANDWIDTH

The requirement is for each augmented HPS to provide I/O transfer rates sufficient to meet performance requirements to include acceptance testing, run-time variability testing and on-time product generation from the NPS.

3.7.4.1 The filesystem I/O bandwidth shall be maintained throughout the life of the filesystem regardless of issues such as fragmentation or nearing full capacity.

3.7.4.2 The contractor is responsible for anticipating changes in computational performance requirements and maintaining system balance, including filesystem I/O rate, as NPS and T2O application suite changes over the augmented WCOSS lifecycle.

3.7.5 DIFFERING I/O AND STORAGE REQUIREMENTS

Acquisition Sensitive

The requirement is for each augmented HPS system to support differing I/O and storage performance driven by the NPS and T2O workloads to include:

3.7.5.1 Production jobs, for which the most important I/O activity is bursts of large-block writes, and for which the I/O objectives is to minimize the time idle CPUs are waiting on I/O;

- a. Post-production jobs, which reorder the production output or compute new values based on it, and which tend to have heavy I/O, but are shorter and more random;
- b. Data transfer jobs, which move data to and from the WCOSS, employ large or very large block reads and writes, and have a relatively low thread count; and,
- c. On-line (i.e., non-archive) data retention needs for various categories of HPC input and output data.

3.7.5.2 The requirement is to provide a filesystem(s) that support the NPS and T2O workstreams while optimizing the compute and storage (i.e. capacity and I/O) resources as well as meeting the concurrent execution of NPS and T2O applications requirement (3.11.3)

3.7.6 DEGRADED MODE

The requirement is for each augmented HPS system performance to minimize impacts to NPS and T2O when running in a degraded mode to include the contractor quantifying degraded mode prior and during a degraded mode event.

3.7.6.1 The requirement includes the balances of the augmented solution against meeting other requirements in minimizing impacts to T2O and NPS during degraded mode.

3.7.7 FILE SIZING

The requirement is for each augmented HPS system to support a minimum of one billion files and individual files that are at least 10 TB in size.

3.7.8 METADATA

3.7.8.1 Metadata I/O – In other NOAA HPC systems the approximate aggregate performance from mdtest is: 8000 file creates/s, 33000 file stats/s, 8000 file removals/s, and 86000 directory stats/s. The government desires a solution that provides a factor of 10 or better improvement of these values

3.7.8.2 Metadata Management – The storage architecture shall provide dedicated resources that separate the metadata from the other data.

3.7.8.3 Metadata Backup and Recovery - The requirement is for each augmented HPS system to provide a method for the metadata to be backed up and the ability to search the metadata offline to identify what files have been lost in the event of a filesystem failure.

3.7.9 SHARED STORAGE SYSTEM (SSS)

3.7.9.1 The Contractor shall provide a scalable and highly-reliable SSS at both WCOSS sites, integrated with each HPC system and other server computers.

3.7.9.2 The SSS and HPS shall be independent such that the performance of the HPS is not affected by the usage of the SSS.

3.7.9.3 All technical specifications of the HPS apply to the SSS, except where specifically noted below.

3.7.9.4 The current SSS functions as a mirrored storage system, between the Primary and Backup WCOSS, used by T2O. It is reasonable for bandwidth and transaction capability to scale with size of the SSS and therefore both of these metrics can be ~10% of the aggregate maximum of the HPS.

3.7.9.5 SIZE - Over the life of the contract the ratio of the SSS and HPS capacities will remain approximately the same, and the ratio of SSS I/O bandwidth to the SSS capacity will remain approximately the same and the ratio of HPS I/O bandwidth to the HPS capacity will remain approximately the same.

3.7.9.6 BANDWIDTH - The SSS shall support I/O transfer rates and storage capacity commensurate with NOAA's increasing computational demands.

3.7.9.6.1 The I/O bandwidth capability of the SSS shall not have a negative impact on the T2O workflow.

3.7.9.7 ACCESSIBILITY

3.7.9.7.1 The SSS shall be accessible by the Primary and Backup WCOSS. All information residing on the SSS will be accessible from both the Primary and Backup WCOSS.

3.7.9.7.2 The availability of the data on either WCOSS system shall be independent of system availability such that data is accessible to one WCOSS system even in the event the other WCOSS system has suffered an interruption in service.

3.7.10 STANDARDS

The requirement is for each augmented HPS system to be technically POSIX compliant.

3.7.10.1 Any deviations from POSIX standards will be provided by the contractor for Government approval prior to implementation.

3.7.11 REBUILD

The requirement is for each augmented HPS to provide robust performance during a rebuild of sections of the filesystem.

3.7.11.1 During a rebuild of sections of the augmented HPS, unaffected sections shall be available to all WCOSS nodes.

3.7.12 SCALING

The requirement is for each augmented HPS system to scale using the storage/bandwidth performance defined in paragraph 3.5.5.

3.7.12.1 T2O disk storage objective is for T2O storage to grow at a rate larger than NPS to support the development of models that will become operational on the next model upgrade cycle.

3.7.13 DRIVE FAILURE PROCEDURES

The procedures described under Task Order 002 section 3.8.1.1 shall be followed for the augmented storage provided under this task order.

3.8 BACKUP/RECOVERY SYSTEM (BRS)

If a heterogeneous solution is offered it must be capable of leveraging the BRS resource provided under TO2 to provide data critical in re-establishing the NPS should there be an interruption of service.

3.9 NETWORK

3.9.1 LOCAL AREA NETWORK (LAN)

The requirement is to leverage the LAN from the ID/IQ Task Order 002 solution and augment the LAN as needed for the additional WCOSS capabilities through the base period and continue to meet Task Order 002 LAN requirements to include connectivity to the NCEP WAN router at each WCOSS location. NCEP will provide WAN services including the WAN router at each of the WCOSS facilities.

3.9.2 COMPONENTS

The requirement is to provide all LAN hardware and software, including cables, fiber runs, conduits, interconnects, and L2/3 switches with the augmented WCOSS.

3.9.3 BANDWIDTH

The requirement is for the LAN to be capable of initially supporting connectivity to NCEP's WAN at speeds up to 20Gb/s with the augmented WCOSS.

3.9.3.1 The bandwidth shall scale to performance levels commensurate to future NCEP WAN performance capabilities.

3.9.4 TUNING

The requirement is for the WCOSS Transmission Control Protocol (TCP) to be tuned to maximize performance with high latency, high capacity WAN with the augmented WCOSS.

3.9.4.1 The throughput shall be capable of fully utilizing the WAN capacity between WCOSS and other NOAA locations connections.

3.9.5 LATENCY

The requirement is to maximize WCOSS throughput to NCEP's Washington, DC, metro WAN, and between the Primary and Backup augmented WCOSS.

3.9.6 SUPPORT

The requirement is for the LAN to be operationally supported by the contractor 7x24x365 calendar days for all LAN components and services with the augmented WCOSS.

3.9.7 HIGHLY AVAILABLE

The requirement is for the LAN to be highly available to include fully redundant network interfaces to the WAN router with the augmented WCOSS.

3.9.8 MONITORING AND REPORTING

The requirement is for the LAN is to include the ability for the Government to monitor the LAN including availability and utilization with the augmented WCOSS.

3.9.8.1 Weekly reports for LAN activity shall be provided to include availability and utilization.

3.9.9 QUALITY OF SERVICE (QOS)

The requirement is for the LAN to integrate with the Government's implemented network quality of service and class of service with the augmented WCOSS.

3.9.10 DOCUMENTATION

The requirement is to provide and maintain up-to-date documentation for LAN architecture with the augmented WCOSS.

3.9.11 INTERNET PROTOCOL (IP) ADDRESS MANAGEMENT

The requirement is to utilize the Government's IP management scheme with the augmented WCOSS.

3.9.11.1 The Government will provide private and public IP addressing which will consist of two public class Cs and one private class B.

3.9.11.2 The contractor shall determine the most appropriate use of IP addressing for additional WCOSS capabilities.

3.9.11.3 The contractor shall maintain documentation of the augmented WCOSS IP addressing and routing.

3.10 SOFTWARE

3.10.1 LIFE CYCLE SUPPORT

3.10.1.1 The Contractor shall provide lifecycle support for all installed software on the WCOSS and ancillary systems used by the Contractor to support the WCOSS and facilities.

3.10.1.2 The lifecycle support shall include, but not limited to, errata and security patches, and upgrades / replacement software to ensure all software is not end-of-life and not obsolete.

3.10.1.3 The lifecycle support shall follow NCO's configuration management process.

3.10.2 SOFTWARE LICENSES

The Contractor shall provide, manage, support, and own all software licenses required by the WCOSS and ancillary systems used by the Contractor to support the WCOSS and facilities.

3.10.3 SOFTWARE INVENTORY

3.10.3.1 As part of the initial system acceptance the Contractor will provide a complete software inventory.

3.10.3.2 The Contractor shall provide an up-to-date software inventory to the Government when the software inventory changes and when requested by the Government.

3.10.3.3 The software inventory shall include software name, version number, description, where and when the software is installed, and license information, e.g., license management (i.e. hardware lock, enterprise), license expiration date.

3.10.4 DEVELOPMENT SOFTWARE

3.10.4.1 The Contractor shall provide, configure and support application development software for the WCOSS.

3.10.4.2 The Contractor shall provide the following software or its equivalent:

- FORTRAN 90/95/2003, C, C++ programming environments, including:
- ANSI standard FORTRAN 90/95/2003, C, and C++ compilers
- macro preprocessors
- source-level debuggers
- performance profilers
- support for 32-bit, 64-bit, and 128 bit IEEE reals and integers
- support for reading and writing 32-and 64-bit IEEE floating-point formats in I/O operations
- MPI-1.1, MPI-2 I/O, MPI-2 one-sided communications (for Subsystems supporting parallel environments only)
- OpenMP+MPI hybrid

3.10.5 PROGRAMMING ENVIRONMENTS

3.10.5.1 The Contractor shall provide, configure and support the programming environment for the WCOSS.

3.10.5.2 The Contractor shall provide the following software or its equivalent:

- Parallelized, optimized numerical libraries
- Optimized I/O libraries.

3.10.6 COMMERCIAL OFF THE SHELF (COTS) SOFTWARE

3.10.6.1 The Contractor shall provide, configure and support COTS software for the WCOSS.

3.10.6.2 The Contractor shall provide the following software:

(4) user licenses (up to a combined total of 256 processors) for The Etnus TotalView parallel debugger (www.totalviewtech.com) or equivalent

3.10.7 COMMUNITY SUPPORTED SOFTWARE

3.10.7.1 The Contractor shall install and configure community supported software for the WCOSS.

3.10.7.2 The Offeror shall install and configure the latest versions the software listed in Appendix L, unless otherwise specified:

3.11 WORKLOAD MANAGEMENT

3.11.1 PREEMPTIVE AND PRIORITY SCHEDULING

The requirement is to provide the augmented WCOSS with the capability for efficient preemptive and priority scheduling.

3.11.2 DYNAMIC AND FLEXIBLE

The requirement is to provide the augmented WCOSS with the same workload management software as provided in Task Order 002 that functions dynamically and is flexible to meet NPS requirements including numerous scheduling changes to accommodate unanticipated disaster or operational test scenarios.

3.11.2.1 The requirement is to provide a workload management capability that is able to run both serial and parallel jobs on a single node.

3.11.3 CONCURRENT EXECUTION OF NPS AND T2O APPLICATIONS

The requirement is to provide the augmented WCOSS capable, through software and hardware configuration, of executing both NPS and T2O applications concurrently on the Primary or the Backup system.

3.11.3.1 The NPS applications shall be protected from T2O in order to meet requirements including operational use time, system availability, runtime variability, minimize IO contention, and maintain the product delivery schedule.

3.11.3.2 The system shall be flexible to maximize T2O utilization of available system resources without impact on the NPS.

3.11.3.3 The impact of T2O on the NPS will be quantifiable and monitored in real-time.

3.11.4 MINIMIZE NPS IMPACT ON T2O

The requirement is to provide, through software and hardware configuration, the capability of performing NPS required system technically compliant upgrades and maintenance support with minimal impact to T2O with the augmented WCOSS.

3.11.4.1 This includes, but is not limited to, OS upgrades, NPS application testing and upgrades, switching between Primary and Backup augmented WCOSS, and facility maintenance.

3.11.5 WORKFLOW SCHEDULER

The requirement is for the contractor to integrate the Task Order 0004 technically compliant solution with the workflow scheduler (ecFlow) provided under Task Order 003.

3.11.5.1 Operational Supported Scheduler

The requirement is for the contractor to operationally support the contractor-provided scheduler 7x24x365 calendar days through the base period.

3.12 SYSTEM DELIVERY

3.12.1 SYSTEM DELIVERY AND ACCEPTANCE

The requirement is to deliver and achieve acceptance of the complete Primary and Backup augmented WCOSS for Government access at both IBM-provided facilities using the schedule and timeline provided as part of the response to this SOO.

3.12.2 The Government will consider an earlier delivery or a time phased delivery schedule, and adjust the acceptance dates accordingly, if the Government determines it is in its best interest.

3.12.3 A detailed description shall be provided that explains how this system will be integrated with the existing systems (TO2 P1 & P2 and TO3). The description will contain the amount of expected downtime that may be incurred.

3.12.4 The augmented system shall be delivered and accepted with the minimum size and performance as defined in paragraphs 3.5.4 and 3.5.5.

3.12.5 Throughout the augmented lifecycle, the WCOSS shall be technically compliant and meet all requirements and ensure that each system/facility component and end-to-end system does not adversely impact system performance / dependability to include model run times, numerical reproducibility, and I/O requirements.

3.13 SUPPORT

The Government requires that the contractor shall provide the appropriate level of support with deep technical knowledge of the architecture offered to maintain the program while understanding that the Government expects the contractor to maximize the amount of compute resources delivered by this investment.

3.13.1 SYSTEM ADMINISTRATION

3.13.1.1 System Administration team shall administer the augmented WCOSS and its peripheral devices and to work with NCEP staff members who support NPS and T2O.

3.13.1.2 The requirement is for the contractor to identify, provide and maintain System Administration staffing levels necessary to meet requirements with the augmented WCOSS leveraging the services provided by ID/IQ Task Orders 002 and 003.

3.13.1.3 System administration support shall be available 7X24X365 calendar days.

Acquisition Sensitive

3.13.1.4 The contractor shall be responsible for organizing system administration support to be technically compliant and meet all requirements and for ensuring competent staffing at all hours.

3.13.1.5 On-call system administrators are required to provide expert assistance to Government personnel engaged in supporting on-time product generation, dissemination, and development.

3.13.1.6 System Administration team shall work normal business hours and provide on-call emergency staffing as deemed acceptable by the Government.

3.13.1.7 Password Resets

3.13.1.7.1 Government system administrators are responsible for resetting user passwords during normal business hours.

3.13.1.7.2 The contractor shall be responsible for resetting user passwords outside of normal business hours and responding within one (1) hour upon receipt of the request.

3.13.2 APPLICATION SUPPORT

The requirement is for the contractor to identify, provide and maintain Application Support staffing levels necessary to meet requirements with the augmented WCOSS leveraging the services provided by ID/IQ Task Order 002.

3.13.2.1 The Application Support team shall assist the Government with code optimization, data migration, training, and code conversion.

3.13.2.2 The Application Support staff shall support the NCEP transition to the augmented system in accordance with the agreed upon project schedule.

3.13.2.3 The application support team is required to possess deep technical knowledge of the architecture that is offered.

3.13.3 WCOSS HELPDESK

The requirement is for the contractor to identify, provide and maintain Helpdesk Support staffing levels necessary to meet requirements with the augmented WCOSS leveraging the services provided by ID/IQ Task Order 002.

3.13.3.1 The contractor shall respond to help desk tickets within twenty-four (24) hours of the ticket being submitted.²

3.13.3.2 A point of contact shall be provided by the contractor as part of the response along with the necessary contact information.

3.13.3.3 A helpdesk tickets report shall be provided at the weekly reporting meeting and the contractor shall discuss ticket status with focus on issues and unresolved tickets.

3.13.3.4 This task order will leverage help desk support services provided by ID/IQ Task Order 002.

² Note: This language was agreed to by the contractor on August 15,2013

3.13.4 EMERGENCY RESPONSE

The requirement is for the contractor to identify, provide and maintain Emergency Response Support staffing levels necessary to meet requirements with the augmented WCOSS leveraging the services provided by ID/IQ Task Order 002.

3.13.4.1 Incidents that negatively impact NCEP's ability to run production jobs or perform development work are usually reported to the contractor support staff via telephone. The contractor shall respond within thirty (30) minutes upon notification.³

3.13.4.2 For both business hours and non-business hours the contractor shall provide accurate contact information and a schedule of availability for support personnel.

3.13.4.3 All reported incidents shall be properly and clearly documented as to the status and final disposition and action(s) taken within twenty-four (24) hours of closure.

3.14 TRAINING

The requirement is to provide a comprehensive training program for WCOSS administrators, WCOSS users and NCEP support staff with the augmented WCOSS leveraging the services provided by ID/IQ Task Order 002.

3.14.1 The contractor's training program shall provide and include periodic refresher training courses for new releases.

3.14.2 Courses for end-users shall be on-site at NCEP and other NOAA facilities in the D.C. metropolitan area, for scientific staff and include training familiarization classes on, but not limited to, system basics, compiler features, and performance tuning and optimization features.

3.14.3 Application Support staff shall identify systematic user issues and structure on-site training classes to address them. Meteorological and Oceanographic applications and associated libraries shall be highlighted, if applicable.

3.14.4 Training for System Administrators shall be a combination of standard classes taught at the contractor's facilities and on-site classes. Topics to include, but not limited to, advanced system administration, file systems, resource management, performance tuning, system troubleshooting, and failure analysis.

3.15 DOCUMENTATION

The requirement is to provide and maintain up-to-date documentation via a Web portal and documentation shall be accessible to all WCOSS authorized users prior to system availability with the augmented WCOSS leveraging the documentation services from Task Order 002.

3.16 SECURITY

³ Note: The contractor and NCEP agreed to change the requirement from "Immediately" to "30 mins" on August 5, 2013

3.16.1 WCOSS SECURITY

The augmented WCOSS shall comply with all applicable Federal, Department of Commerce and NOAA IT security policies, procedures, and standards. WCOSS security level is classified as a High Impact System in accordance with FIPS PUB 199 leveraging the products and services from the ID/IQ Task Order 002.

3.16.1.1 The requirement includes an operating system and related system software for the WCOSS that is secure, robust and can be updated (no less than on a quarterly basis) with the latest technically compliant security patches, upgrades, and fixes.

3.16.1.2 The contractor shall be responsible for ensuring all Assessment and Authorization processes (formally called Certification & Accreditation (C&A)) and documentation required for system acceptance is followed and complete.

3.16.1.3 The contractor shall maintain a consistent and NCEP approved security posture and assist NCEP with WCOSS security activities to include IT security continuous monitoring.

3.16.1.4 WCOSS shall be maintained in accordance with Federal Information Processing Standards (FIPS) 200 and NIST Special Publication (SP) 800-37.

3.16.1.5 All IT equipment delivered as part of this Task Order shall be considered a Government computing resource from a Government IT security perspective, regardless of its location or actual owner.

3.16.1.6 The WCOSS System Owner (SO) will be the Director of NCEP Central Operations. The WCOSS Information System Security Officer (ISSO) will be the NCEP Information Security Officer (ITSO).

3.16.2 SCANNING

The requirement is to comply with NCEP's scanning practices with the augmented WCOSS leveraging the services from the ID/IQ Task Order 002.

3.16.2.1 Scanning shall occur at a minimum on a monthly basis.

3.16.2.2 All equipment on the WCOSS LAN shall be scanned for vulnerabilities by the ISSO each time there is a new connection.

3.16.3 IT SECURITY POLICIES AND REGULATIONS

The requirement is to comply with NOAA IT security policies and regulations with the augmented WCOSS leveraging the products and services from the ID/IQ Task Order 002.

3.16.3.1 The contractor shall comply with the Federal Information Security Management Act (FISMA), OMB policy and NIST guidelines to include and not limited to NOAA Information Technology Security Policy; and, NWS Management, Operational, and Technical Controls Policy.

3.16.3.2 The contractor shall be responsible for monitoring the work performed and ensuring that all required NOAA IT security procedures are followed by all contract support personnel to which the contractor grants temporary short-term system access.

3.16.4 TWO FACTOR AUTHENTICATION SUPPORT

The contractor shall point all interactive authentications to the government maintained two factor authentication server(s). The system is currently a RSA two factor solution. Operational accounts will be exempt from two factor authentication.

3.17 PROJECT MANAGEMENT

3.17.1 PROJECT MANAGEMENT (PM) SERVICES

The requirement is to provide PM services and leverage the ID/IQ Task 002 project management plan.

3.17.2 DETAILED PM PLAN

The requirement is to leverage the ID/IQ Task Order 002, and 003 project management plan to provide a detailed PMP within fifteen (15) days of Task Order awards. The contractor shall update the detailed PMP to include Task Order 0004.

3.17.2.1 The contractor shall update the integrated schedule, risk register and issue log weekly via the Web portal and the overall PMP shall be updated quarterly.

3.17.2.2 The following shall be included in the detailed PMP with the augmented WCOSS leveraging the services from the ID/IQ Task Order 002:

- a. The contractor's approach for managing project tasks and deliverables on schedule, on time, and within budget;
- b. Work Breakdown Schedule (WBS) that depicts the contractor's division of work for all tasks and identify and specify human resources assigned to work on each WBS element;
- c. Risk management plan that describes the contractor's approach to manage and minimize risks and issues to include a risk register/issue log to document identified risks/issues and associated responses and mitigation strategies;
- d. Integrated Schedule (in MS Project format) used by the contractor to manage the schedule for the required tasks, deliverables and associated due dates; updated on a weekly basis and,
- e. Integrated schedule will incorporate the contractor's tasks, updates provided by the Government WCOSS PM.

3.18 FACILITIES

3.18.1 GEOGRAPHIC LOCATION

The requirement is to leverage the products and services from the ID/IQ Task Orders 002 and 003 which provide two (2) geographically separate facilities to house the Primary and Backup WCOSS.

3.18.1.1 This requirement shall utilize the contractor provided DataSite facility (Orlando, FL) facility and CoreSite facility (Reston, VA) facility throughout the life of this Task Order.

3.18.2 AVAILABLE POWER PRODUCTION, COOLING, AND PHYSICAL SPACE

The requirement is to leverage the products and services from the ID/IQ Task Orders 002 and 003 which provide available and reliable power production, cooling, and physical space to meet WCOSS requirements including operational use time, system availability, and no degradation to WCOSS product delivery during planned, routine failovers between the Primary and Backup system.

3.18.3 ACCESS CONTROLLED SPACE

The requirement is to leverage the products and services from the ID/IQ Task Orders 002 and 003 which provides controlled WCOSS space accessible 7x24x365 to WCOSS contractor and Government staff.

3.18.3.1 The contractor shall submit the access list for Government approval.

3.18.4 SCALABLE POWER, COOLING, AND PHYSICAL SPACE

The requirement is to leverage the products and services from the ID/IQ Task Orders 002 and 003 which provide power production, cooling and physical space for the augmented WCOSS.

3.18.4.1 The power production, cooling and space shall be scalable to support fit-ups and other modifications to support the augmented WCOSS lifecycle technology expansion or refresh, or technically compliant upgrades including parallel operation for existing and new system (swing space).

3.18.4.2 The power production, cooling and physical space shall be scalable to support optional WCOSS growth options, as exercised at the discretion of the Government.

3.18.5 FACILITIES MANAGEMENT

The requirement is to leverage the products and services from the ID/IQ Task Orders 002 and 003 which provide 7x24x365 calendar days facilities management integrated with NCO's operational monitoring and response processes.

3.18.6 FACILITIES MONITORING

The requirement is to leverage the Web portal provided under Task Orders 002 and 003 for access for facilities monitoring to include air temperature, humidity, power production, water temperature / flow-rate and network cameras to monitor physical access to the Primary and Backup augmented WCOSS.

3.19 OTHER REQUIREMENTS

3.19.1 In accordance with the ID/IQ's terms and conditions, submittals are required for items such as the following:

- a. Section E.6 – Task order Acceptance Test Plan (Submittal)
- b. Section G.7 – Progress Reports (Submittal)
- c. Section H.9 – Security Process Requirements (Submittal)
- d. Section H.11 – Key Personnel (if changes apply)
- e. Section H.13 – Electronic and Information Technology (Submittal)
- f. Section H.14 – Security Requirements for Information Technology Resources (Submittal)
- g. Any other clause which requires submittal or documentation.

4. GOVERNMENT FURNISHED PROPERTY (GFP) AND CONTRACTOR ACQUIRED PROPERTY (CAP)

4.1 GFP is defined in Task Order 002.

4.2 If CAP is proposed, the items shall be listed in the proposal.

5. OTHER INFORMATION

5.1 Once Task Order 0004 is awarded, only the assigned Contracting Officer can authorize changes revisions, or updates to this task order.

5.2 Within the contractor's cost summary/price proposal, CLINs and PWS paragraphs shall be identified. Please note that it is the contractor's responsibility to provide a proposal that represents: (a) a cost effective approach/solution to NOAA's program objectives, (b) all cost elements are justified and clearly stated in the NOTE section of the price/cost summary proposal, and (c) if cost/price related assumptions are made, there should be a sound basis/justification for all assumptions clearly stated and the rationale to support those assumptions in the NOTE section of the price/cost summary proposal.

5.3 The contractor's proposal should be reviewed internally prior to submission to ensure that the proposal's sections are consistent with all other proposed sections; example: Task Order 0004's Price/Cost summary Proposal (section) and the Performance Work Statement (section). Failure to accomplish this action prior to submission to NOAA will result in delays and may otherwise be cause for rejection of the proposal.

5.4 Any questions regarding the technical requirements contained in this SOO shall be submitted to Mike Kane (WCOSS Program Manager) and Franklin Miles (Contracts Specialist). General questions may be submitted to Michael Blumenfeld who is NOAA's Contracting Officer assigned to DG1330-12-CQ-0004 including all task orders.

5.5 Appendix A provides a glossary.

6. PERIOD OF PERFORMANCE AND IBM POINTS OF CONTACT

6.1 - The anticipated period of performance is estimated to be from the date of task award through 12Feb2017.

6.2 The contractor shall identify its Technical Point of Contact(s), or Key Personnel.

7. DELIVERABLE/SUBMITTALS (ALSO SEE DG1330-12-CQ-0004, APPLICABLE SECTION)

- 7.1 The contractor shall identify all proposed deliverables/submittals applicable to Task Order 0004 including CLIN and/or PWS paragraph.
- 7.2 The contractor's proposal shall at a minimum contain the following tables:
 - 7.2.1 Core Information by node type including core counts, memory, GHz, make, model, and type
 - 7.2.2 Nodes provided (see Task Order 003 PWS Table 3.4.1-1 and 3.4.1-2)
 - 7.2.3 Storage Information (see Task Order 003 PWS Table 3.6.5-1).
 - 7.2.4 Interconnect Information
- 7.3 Schedule (see Task Order 003 PWS Figure 3.14-1).
- 7.4 System Diagram (see Task Order 003 PWS figure 3.4-2)
- 7.5 Requirements compliance matrix – table mapping the SOO requirements to the section in the PWS that are proposed to meet each requirement.
- 7.6 If the contractor proposes a heterogeneous solution describe:
 - a. How the contractor will provide the personnel with the necessary technical expertise to install, configure, integrate, and support this solution with the existing WCOSS.
 - b. How the contractor plans to mitigate the integration issues given the difficulties the contractor has run into with the integration of the TO2 Phase II system with the TO2 Phase I system.

8. PERFORMANCE REQUIREMENTS SUMMARY (PRS)

The contractor shall identify all PRS information including Desired Outcomes, Required Services including applicable PWS paragraph, Performance Standard including applicable PWS paragraph or Appendix, Monitoring Method, and incentive/disincentives.

9. AUTHORIZED TRAVEL SCHEDULE

The contractor shall identify all proposed travel applicable to Task Order 0004 including Task Order PWS paragraph. Travel proposed must include POC, Locations, To & from Dates & Timeframe, a Purpose/Summary/Trip Report, and Number of Personnel that traveled. Travel reimbursements are subject to the requirements/restrictions of the Federal Travel Regulation (FTR).

Appendix A Glossary

7x24x365 is a term to describe high-availability and defined as seven days a week, twenty four (24) hours a day, each and every day of the calendar year.

Capability: Ability to execute a fixed number of copies of a benchmark application across multiple nodes in as short a period of wall-clock time as possible.

Capacity: Ability to simultaneously execute as many copies of a benchmark application utilizing the entire system within a specified wall-clock limit.

Development Use Time (DUT) is defined as the percentage of time development jobs can run on the WCOSS. DUT is determined by considering all WCOSS resources minus the resources necessary to execute the entire NCEP Production Suite (NPS). The Transition to Operations (T2O) executes within the DUT and the T2O will execute on the Primary and Backup WCOSS.

DUT shall be computed monthly as follows:

$$DUT = \left(\frac{TDT - DDT - NULL}{TDT - NULL} \right)$$

TDT = Total Development Time is the total number of processor minutes in a month not consumed by the NPS

DDT = Development Down Time is the total number of processor minutes when WCOSS resources were not available to run development applications

NULL = Development Down Time that the government has agreed to exclude from the monthly DUT calculation

DUT calculation will be rounded as noted in the following examples:

Example 1: if DUT is 98.5%, DUT will be rounded to 99%.

Example 2: if DUT is 98.49%, DUT will be rounded to 98%.

Down-Time: The period of time when the WCOSS hardware, software, facilities, and/or services are unavailable. The start of Down-Time is based on root cause analysis. Down-Time ends when the WCOSS is returned to NCEP in operable condition. The WCOSS, facilities, or individual component thereof, may be declared inoperative while problem diagnosis takes place. During a period of Down-Time, NCEP may continue to use operable components of the WCOSS when such action does not interfere with maintenance of the inoperable component.

LDM: Local Data manager (see <http://www.unidata.ucar.edu/software/ldm/>)

Normal Business Hours: Normal business hours are from 8:00 AM (Eastern Standard Time) – 5:00 PM (Eastern Time) Monday thru Friday (excluding Federal Holidays).

Operational Use Time: Operational Use Time (OUT) is defined as the percentage of time the NCEP Production Suite (NPS) can run on the WCOSS. OUT is determined by considering all WCOSS resources in which a subset of this total resource is necessary to execute the entire NPS. The NPS executes on either the Primary or Backup WCOSS. Within each 30-month lifecycle, see C.3.6, NPS consumes approximately 30% of the resources of one WCOSS during the start of the lifecycle and approximately 90% of the resources of one WCOSS during the end of the lifecycle. The NPS will never consume more resources than can be supplied by either the Primary or Backup WCOSS.

OUT shall be computed monthly as follows:

$$OUT = \left(\frac{TOT - ODT - NULL}{TOT - NULL} \right)$$

TOT = Total Operational Time is the total number of minutes in a month

ODT = Operational Down Time is the total number of minutes when WCOSS resources were not available to run the entire NPS

NULL = Operational Down Time that the government has agreed to exclude from the monthly OUT calculation

OUT calculation will be rounded as noted in the following examples:

Example 1: if OUT is 99.75%, OUT will be rounded to 99.8%.

Example 2: if OUT is 99.749%, OUT will be rounded to 99.7%.

Operational Support: Multi-tiered support in which a first tier is available on a 24X7 basis and deep expertise is available during business hours that can resolve the most difficult issues. Service levels are defined and agreed to for each level of support.

Reliability: The ability of a system or component of the system to perform its required functions under stated conditions for a specified period of time without failure or interruption in service.

System Availability: The percentage of time the WCOSS was available to run operational (NPS) and development (T2O) jobs. System Availability is determined for the Primary WCOSS and is determined for the Backup WCOSS. Each WCOSS maintains a separate monthly System Availability metric. System Availability shall be computed as the ratio of total processor minutes available for running the operational and development suites to the total processor minutes available each month. System availability shall be calculated as follows:

$$SystemAvailability = \left(\frac{TPT - DT - NULL}{TPT - NULL} \right)$$

TPT = Total Processing Time is the total number of processor minutes in a month for the Primary WCOSS and for the Backup WCOSS

Acquisition Sensitive

DT = Down Time is the total number of processor minutes when the Primary WCOSS resources and Backup WCOSS were not available to run operational and/or development applications

NULL = Total number of minutes that the government has agreed to exclude from the monthly DT calculation

In systems that contain hot, active, failover nodes, which may be configured as extra compute nodes, these nodes will not be used in determining TPT, such that System Availability shall never exceed 100%, either daily or in monthly statistics.

Acquisition Sensitive

APPENDIX B I/O DATA

Work/Data-Flow	Capacity(TB)	TOTAL BANDWIDTH (READS or WRITES)			TOTAL IOPS (READS or WRITES)				META DATA			DATA			FILESYSTEM	
		GB/s READ	GB/s WRITTEN	R/W Ratio	READS/Sec	WRITES/Sec	IOPS R/W Ratio	Tot Ave IOPS	Seperated	Replicated	COPIES	Seperated	Replicated	COPIES	BlockSize	Inodes
Development	2000	20GB/s	15GB/s	1.33	15,000	15,000	NA	30,000	YES	YES	2	NO	NO	1	4MB - 8MB	153,000,000
Production	1500	20GB/s	15GB/s	1.33	20,000	20,000	NA	40,000	YES	YES	2	NO	NO	1	4MB - 8MB	153,000,000
Total	3500	40GB/s	30GB/s	1.33	35,000	35,000	NA	70,000								306,000,000

Enlarged sections of the above table

Work/Data-Flow	Capacity(TB)	TOTAL BANDWIDTH (READS or WRITES)		
		GB/s READ	GB/s WRITTEN	R/W Ratio
Development	2000	20GB/s	15GB/s	1.33
Production	1500	20GB/s	15GB/s	1.33
Total	3500	40GB/s	30GB/s	1.33

Acquisition Sensitive

TOTAL IOPS (READS or WRITES)					
Work/Data-Flow	Capacity(TB)	READS/Sec.	WRITES/Sec.	IOPS R/W Ratio	Tot Ave IOPS
Development	2000	15,000	15,000	NA	30,000
Production	1500	20,000	20,000	NA	40,000
Total	3500	35,000	35,000	NA	70,000

META DATA				
Work/Data-Flow	Capacity(TB)	Seperated	Replicated	COPIES
Development	2000	YES	YES	2
Production	1500	YES	YES	2
Total	3500			

Work/Data-Flow	Capacity(TB)	DATA			FILESYSTEM	
		Seperated	Replicated	COPIES	BlockSize	Inodes
Development	2000	NO	NO	1	4MB – 8MB	153,000,000
Production	1500	NO	NO	1	4MB – 8MB	153,000,000
Total	3500					306,000,000