

**National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Comprehensive Large Array-data Storage System (CLASS)
006-48-01-13-01-3205-00-108-023
Operational Analysis
FY 2010**

Table of Contents

Executive Summary..... 2

1.0 Customer Results 3

 1.1 Customer Requirements and Costs 3

 1.2 Performance Measures 3

2.0 Strategic and Business Results..... 5

 2.1 CLASS Helps to Achieve Strategic Goals 5

 2.2 Business Results..... 5

 2.2.1 Program Management and Controls..... 5

 2.2.2 Monitoring Cost, Schedule and Performance..... 5

 2.3 Reviews 6

 2.4 Security 6

 2.5 Performance Measures 6

3.0 Financial Performance 8

 3.1 Current Performance vs. Baseline..... 8

 3.2 Performance Measures 8

 3.3 Cost Benefit Analysis..... 8

 3.4 Financial Performance Review 9

4.0 Innovation to Meet Future Customer Needs 10

 4.1 Number and Types of Users..... 10

 4.2 Challenges, Risks Ahead, and Mitigation Strategies 10

 4.3 Innovations..... 11

 4.4 CLASS Major FY10 Development and Evolution Accomplishments 11

 4.5 Funding Levels..... 12

Executive Summary

The Comprehensive Large Array-data Storage System (CLASS)¹ project supports the effort to understand climate variability and change to enhance society's ability to plan and respond through the application of modern, proven techniques and technology. By engineering a transition to an enterprise-capable data storage solution, CLASS will provide efficient management of high volumes (petabytes) of data critical to the United States Global Change Research Program and the scientific community. Management of the large volume of environmental data requires a rapid expansion in storage capacity at the Data Centers and automation of data ingest, archive, quality control, and access functionality. Significant increases in data volumes over the next 15 years and corresponding growth in the number and sophistication of system users necessitate this shift from the traditional archive paradigm to a fully operational and integrated system managed at the enterprise level. For example, data from the NPP and GOES-R programs will utilize CLASS in lieu of building standalone, dedicated data archival systems. To realize these benefits, the CLASS program has identified technologies and best practices to efficiently archive the vast quantities of NOAA satellite and in situ observational data; to safely and permanently preserve those valuable data for future generations to use; and to provide rapid data access in a cost-effective manner.

An Initial Baseline Review (IBR) for Contract Year 2 was completed in November 2009. The Contract Year 2 IBR represented a successful joint contractor / government assessment of the time-based project plan and project management processes for completion of the scope of work. The project recently completed the second year of the contract at the end of August 2010 and is currently preparing for the Contract Year 3 IBR.

Major accomplishments during FY10 include:

- CLASS developed an accelerated implementation schedule for Climate Model Data and completed Climate Model Data ingest and archive through Phase Two.
- CLASS began ingesting GOES-13 on April 14th, as it replaced GOES-12 as the GOES east satellite.
- Supported the re-ingest of DMSP SSMI TDR data in NetCDF from NCDC, which is approximately 3.3 TB.
- Upgraded all RH4 servers to RH5, which is FIPS 140-2 compliant.
- Installed and configured OSSEC on all AIX and RH5 servers.
- Promoted the OPeNDAP server for public access.
- Completed and delivered the Storage Area Network (SAN) Storage Technology Deployment Guide and installed 4 SAN servers at NSOF.
- Started preparations for necessary system upgrades for support of NPP and NPP/CalVal data.
- Began the migration of CLASS to run under the Linux operating system.
- Supported GOES-R SRR/SRD Delta Review.
- Supported Standard CMMI Appraisal Method for Process Improvement (SCAMPI)-A appraisal in April 2010 and identified process improvements to the configuration management-related documentation that will fill gaps identified in the SCAMPI-C/gap analysis assessment.
- Developed and promoted the following software releases to Operations: Release 5.2, Release 5.2.1, Release 5.2.2, Release 5.2.3, Release 5.2.4, Release 5.2.5, Release 5.2.6, Release 5.3, Release 5.3.1, and Release 5.3.2.

The CLASS Operational Analysis (OA) supports the operational components located in Suitland, MD, Asheville, NC, and Boulder, CO. This OA is an annual, in-depth review of the program's performance based on: Customer Results, Strategic and Business Results, Financial Performance, and Innovation. This report focuses on the operational state of the program as of September 30, 2010, and is based on guidance developed by the Department of Commerce. The CLASS program directly facilitates the NOAA Strategic Goal to "Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond" and DOC Goal 3 "Promote Environmental Stewardship". The current program meets established cost, schedule and performance parameters.

¹ The Public website for CLASS is available at:

<http://www.nsof.class.noaa.gov/saa/products/welcome;jsessionid=003F03E7854B5462D415940D37A2D621>

1.0 Customer Results

The CLASS program is fully meeting the customer’s needs and the program is delivering the services that it is intended to deliver as outlined in the NOAA and NESDIS operational plans. CLASS archives and provides access to data used by the NOAA National Data Centers (NNDCs) as well as an extensive user community. To enhance the relationship with the Data Centers, the CLASS program provided on-site representatives who have direct access to data center leadership and provide hands-on assistance to data center personnel using the CLASS system. CLASS data are used to support a broad range of products that impact nearly every economic sector of the nation. In addition, CLASS is instrumental in preserving long-term data records of environmental conditions. The nation is a stakeholder; other customers include federal agencies including National Aeronautics and Space Administration (NASA), state and local governments, academic researchers, individuals, first responders, and corporations in the agribusiness, lumber, utilities, transportation, travel, real estate development, and health industries.

1.1 Customer Requirements and Costs

Feedback from current customers indicate the CLASS program is fully meeting the customers’ current needs and requirements and is delivering the data and services as outlined in the NOAA and NESDIS operational plans. The value of CLASS data archiving has been well documented and continued need for this investment has been recognized, most recently by the designation of CLASS as a NOAA enterprise system.

1.2 Performance Measures

The CLASS mission is twofold: storage archival of valuable climate data, and data distribution to a large user community to support immediate needs for environmental data and to facilitate scientific research. CLASS performance measures address both components of the CLASS mission.

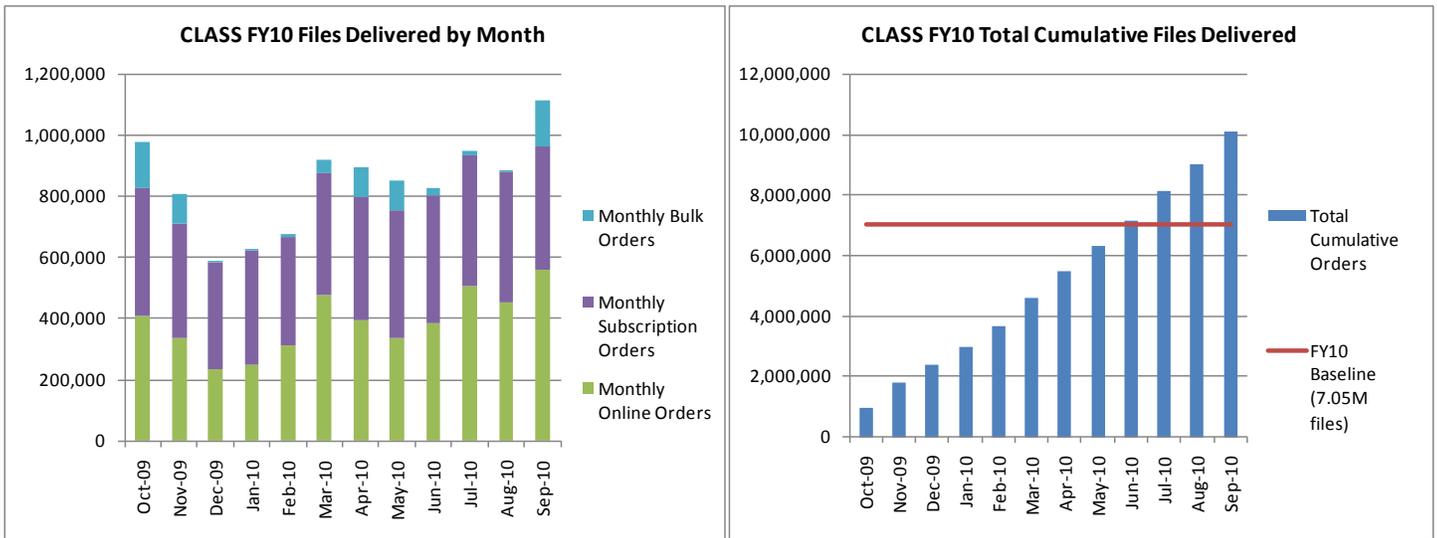
Both performance measures are important and complementary. CLASS must strive to continue enhancing its data availability and at the same time continue its outreach and interface enhancement activities to make the data easily accessible by a wider user community.

These measures align with the “Customer Results Measurement Area” of the Performance Reference Model developed by the Federal Enterprise Architecture Program Management Office (FEA-PMO). Table 1 summarizes the customer performance measure.

Table 1: Customer Results Performance Measure

Measurement Area	Indicator	FY2010 Baseline	FY2010 Actual Result	Comments
Customer Results	Increase volume of environmental data files delivered to customers	7.05M	10.11M files delivered as of 9/30/10	Performance Measure in reflected in Exhibit 300. Files delivered represent 43% increase over baseline.
Customer Results	User notification of system issues: Timely and accurate notification of service interruptions and failures (% of notifications made within defined standards (four hours during business hours; otherwise, eight hours)	100%	100%	

The charts below provide additional detail behind the volume of environmental data files delivered. The chart on the left shows files delivered each month broken into bulk, subscription, and online orders. The chart on the right displays the total cumulative files delivered which shows that CLASS was able to meet its FY10 Baseline of 7.05M files delivered by the end of June.



2.0 Strategic and Business Results

The CLASS program is meeting its own goals and objectives as well as those of the agency. Program management and controls are in place to ensure the program continues to meet its goals and objectives and monitor how well the CLASS program performs.

2.1 CLASS Helps to Achieve Strategic Goals

As of FY2008, CLASS is designated a NOAA enterprise level program, reflecting its vital role in meeting NOAA strategic goals. In line with the current NOAA Strategic Plan for FY2009-FY2013, the CLASS program directly supports the mission goal to “Understand Climate Variability and Change to Enhance Society's Ability to Plan and Respond.” Today there are significant demands on virtually all of NOAA's programs to provide information to the Nation and the World community on the health of the environment in real-time. The CLASS website provides worldwide continuous availability of NOAA environmental data.

2.2 Business Results

2.2.1 Program Management and Controls

The CLASS program is guided by the Office of Management and Budget (OMB), DOC, and NOAA guidelines and policies. Oversight is provided by NESDIS, including the NESDIS Information Technology Resource Management (ITRM) team and the NESDIS Chief Information Officer (CIO). A baseline of annual activity is contained in the matrix Annual Operating Plan (AOP) which is approved by the line office.

CLASS performs extensive, continuous analysis of the performance of the CLASS system's operational components. This ensures that the system resources and the ancillary supporting infrastructure (security, training, facilities, etc.) as well as labor resources remain optimally functional and configured to support NOAA goals.

CLASS conducts an objective measurement of resource and performance metrics of the CLASS elements. For all IT components, performance thresholds have been established and performance is measured continuously through mainly automated process, supplemented by a manual process when required. Performance data are gathered at the functional level and reported on a weekly basis. CLASS management reports to Ground System management on a monthly basis. In addition, CLASS reports to NESDIS and NOAA management as requested. Performance deficiencies in the CLASS operational system resulting from hardware are referred to the maintenance contractor for remediation. Performance deficiencies for IT systems resulting from software problems are also handled by the maintenance contractor. Key performance issues and risks are identified through these reviews and tracked by CLASS management.

The CLASS operational environment includes a large IT component. Therefore, CLASS managers must keep abreast of changes in technology that would impact operations. They identify risks to current operations and identify viable alternatives for improving CLASS systems and processes. The results of this analysis are the basis for CLASS input to the Ground System Five Year Plan as well as the CLASS Ten Year Plan.

2.2.2 Monitoring Cost, Schedule and Performance

Cost – CLASS conducts a variety of budget analyses throughout the fiscal year. Obligations and expenditures are tracked on a weekly basis. Labor costs and full time equivalent usage are tracked on a bi-weekly basis. Earned Value Management (EVM) of cost and schedule variances are analyzed monthly and reported to OSD Management. A needs analysis is conducted annually in conjunction with the Planning, Programming, Budgeting and Execution System (PPBES) and the Ground System Division's budget planning processes. Key budget issues and risks are identified through these reviews and tracked by CLASS management.

Schedule – Weekly CLASS Project Management Team (CPMT) meetings allow the project manager to track progress towards key milestones and other operational aspects of the program (e.g., IT security compliance, data availability, etc.).

Performance – Contract performance is monitored to support both budget and performance measurements. CLASS operations are conducted utilizing contractors. For these contracts, CLASS management receives monthly status reports and meets at least quarterly with contract management to review performance, priorities, lessons learned, and work plan. A more formal review is held at the end of each contract year to assess the performance, come to agreement on ways to maximize CLASS efficiency and productivity, and to decide on potential corrective actions and milestones. Hardware maintenance contracts are reviewed on a semi-annual basis for technology advances impacting system maintainability, reliability, and interoperability.

The CLASS monthly project report, which summarizes CLASS cost, schedule, and performance, provides the Ground System Division management with information for monitoring the CLASS program.

2.3 Reviews

As part of the NOAA program management structure, the CLASS program is reviewed continuously throughout the year. Each data center and program manager is responsible for monitoring their individual monthly spending and reporting to the NESDIS Headquarters Financial Officer any unacceptable deviations, along with explanations and a corrections plan.

The CLASS project underwent a programmatic review at NOAA and DOC as part of its acquisition activities.

2.4 Security

The CLASS system is accredited under requirements in NOAA 212-13(03/07/03) and NESDIS Information Technology Security Policy that are based on OMB and NIST guidance. System Security Plans, Risk Assessments, and Contingency Plans were certified and approved for CLASS. The CLASS system has been through the C&A Process and has been granted Full Authority to Operate. CLASS C&A was completed in August 2008 and an update is planned for August 2011. The CLASS Contingency Plan was updated and received AO approval signature in July 2010. Validation of the annual continuous monitoring activities was completed in July 2010 and the Security Team responded to OCIO comments in August.

The CLASS system is classified as Mission Critical. CLASS has an approved System Security Plan, Risk Assessment, and Contingency Plan in place. Management, operational and technical security controls are in place to ensure the confidentiality, integrity, and availability of information.

2.5 Performance Measures

The performance measures in Table 2 show the CLASS program’s performance with respect to Strategic and Business Results. These measures align with the “Mission and Business Results Measurement Area”, “Processes and Activities Measurement Area”, and the “Technology Measurement Area” of the Performance Reference Model developed by the FEA-PMO.

Table 2: Business Results Performance Measures

Measurement Area	Indicator	FY2010 Baseline	Actual FY2010 Result	Comments
Mission and Business Results	Increase availability of environmental data as measured by number of files in the catalog	15.70M	20.19M as of 9/30/10	Performance Measure reflected in Exhibit 300. File catalog increased by 29%.
Processes and Activities	Operational Effectiveness	IOC for new systems.	Working with IRMT.	Performance Measure

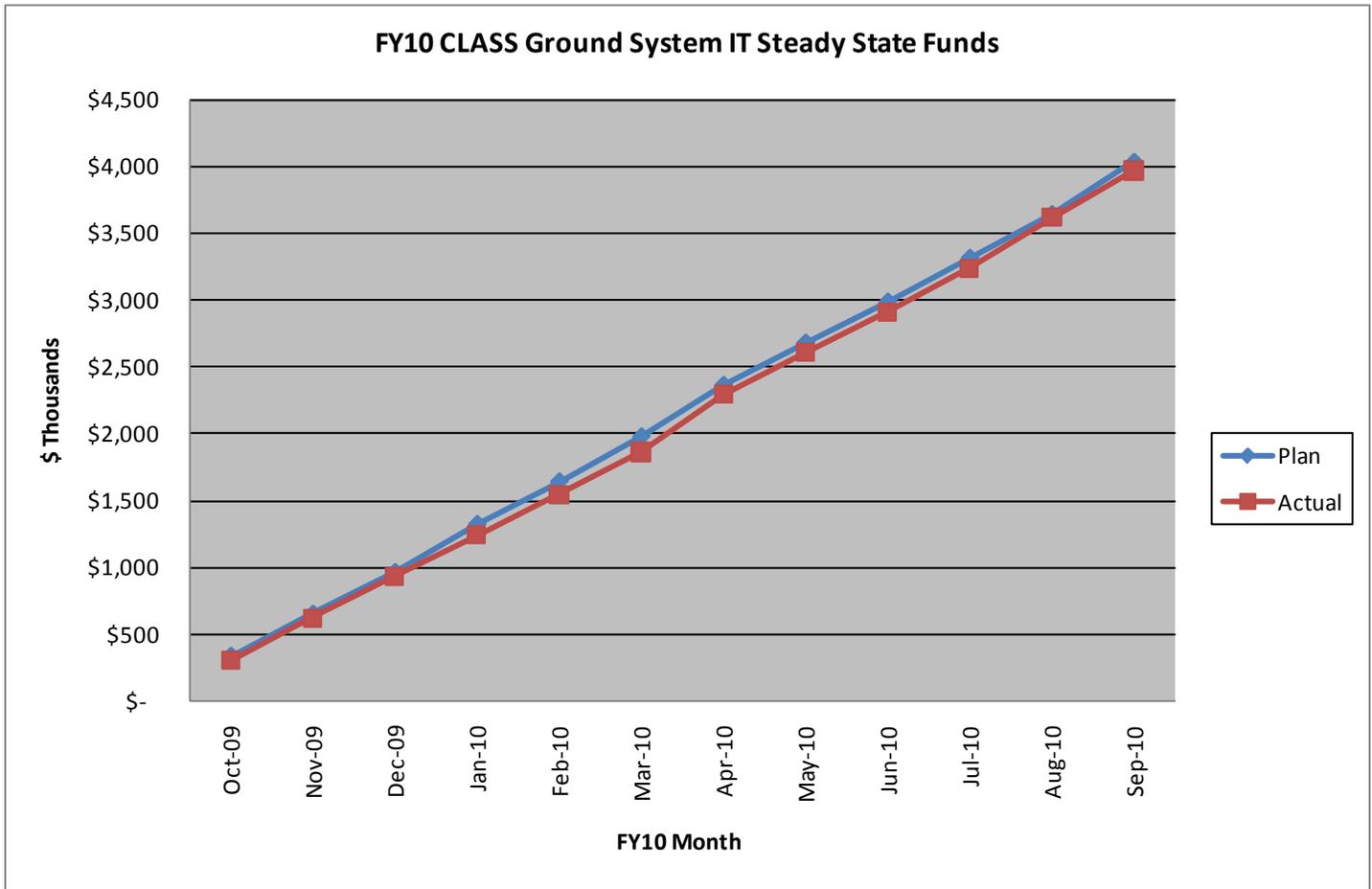
Measurement Area	Indicator	FY2010 Baseline	Actual FY2010 Result	Comments
				reflected in Exhibit 300.
Technology	Communication Infrastructure	Current communication infrastructure.	Met with GOES-R to establish joint study team.	Performance Measure reflected in Exhibit 300.
Technology	System monitoring, maintenance and configuration for unplanned outages: % of time nodes are available	As an individual node measure, each node must operate reliably on a 24 x 7 basis with availability of 98% of the time.	NCDC: 98.28% NGDC: 99.68%	
Technology	Planned system maintenance: % of time nodes are available	As an individual node measure, each node operates reliably on a 24 x 7 basis with availability of 96% of the time.	NCDC: 98.22% NGDC: 99.55%	
Technology	System monitoring, maintenance & configuration: % of time system available	Operate efficiently and reliably on a 24 x 7 basis with an availability of 99.9%.	100%	

Other Alternatives: Currently, there are no other organizations capable of doing this work better, more efficiently, or at lower cost. Alternatives Analysis information is in the CLASS OMB Exhibit 300.

3.0 Financial Performance

3.1 Current Performance vs. Baseline

The current CLASS financial performance, see below, compares actual cost of the program compared to a pre-established cost baseline (i.e., annual spend plan). Financial performance information is provided for FY2010, however, September data is based on estimates as the CLASS Contract Year 3 began in September and establishment of the contract year baseline is currently in progress.



3.2 Performance Measures

The current CLASS financial performance is based on a pre-established cost baseline (e.g., annual spend plan). Program operational costs consist of contractor labor dedicated to CLASS, travel, communications and corporate overhead. During FY2010 the CLASS program consistently stayed within a ten percent variance.

3.3 Cost Benefit Analysis

The CLASS value proposition is the data archiving capabilities offered as consolidated data management services to separate programs. Previously, satellite and in-situ sensor data sets were archived, managed, and distributed by different centers in NESDIS. The legacy approach met previous needs, however the increasing volume and complexity of data that they are responsible for are estimated to have taxed the prior system to capacity by 2015. By the year 2015, plans for the campaigns of POES, GOES, NEXRAD, NPP, METOP, Climate Model Data, and National Ocean Service (NOS) Continuously Operating Reference Stations (CORS) will increase the volume of data from less than 1 to more than 14 petabytes. CLASS is being carried out to ensure that NESDIS can continue to provide services in the face of that increase. It is estimated the preservation of this valuable data will yield benefits net of costs of approximately \$400 million per year.

3.4 Financial Performance Review

Financial performance is typically subjected to a periodic review for reasonableness and cost efficiency. Monthly budget reviews are held with the program manager, CORs and contract managers to ensure contracts are within cost and on schedule. Monthly reports from contractors are required to ensure the Government has the information it needs to evaluate cost performance. A detailed review of work and priorities is undertaken if cost is significantly above base lined values. Also, any necessary corrective actions are identified and implemented.

4.0 Innovation to Meet Future Customer Needs

4.1 Number and Types of Users

CLASS has two primary types of users: customer campaigns, data from systems which utilize the CLASS archiving and distribution capabilities, and end-users, who consume the data products archived by CLASS.

CLASS provides the capabilities to archive and distribute large array-data for the following data campaigns, including new *in-situ* and remotely sensed data:

- 1) POES, including DMSP (Polar-orbiting Environmental Satellites for NOAA and DOD, Defense Meteorological Satellite Program)
- 2) GOES (Geostationary Operational Environmental Satellites)
- 3) NEXRAD (NEXt generation weather RADAR)
- 4) NPP (NPOESS Preparatory Project)
- 5) METOP (European Meteorological Operational Satellite)
- 6) Climate Model Data
- 7) National Ocean Service (NOS) Continuously Operating Reference Stations (CORS)

CLASS has a varied and large end-user community. End user customers include other Federal Agencies, especially NASA, state and local governments, the academic and research community, private corporations in the agribusiness, lumber, utilities, transportation, travel, real estate development, and health industries, and other private citizens. Discrete end user tracking is not currently available, but based on the average file size and up-to-date traffic estimates, CLASS delivers data to many thousands of users daily. For example, in July, 2010, CLASS delivered 946,431 files to the user community.

4.2 Challenges, Risks Ahead, and Mitigation Strategies

IT Security

Staying compliant with the most current Federal IT security policies is an ongoing challenge for most Government programs as policies and their interpretations are subject to periodic changes. The CLASS project team has performed well in maintaining compliance with IT security policies, particularly in tracking and closing POA&Ms as well as supporting the annual certification and verification activities. A focus for CLASS over the past year has been for a more proactive approach to security and CLASS plans to review the system security architecture to incorporate necessary changes for the acquisition, deployment, and operations of automated security tools. The CLASS project's ability to meet these challenges is thanks in part to the routine communication the IT security team has established with the ISSO that has helped clarify changes to requirements.

The other part of the CLASS project's ability to maintain a compliant IT security system has been the right mix of resources allocated to the IT security team. While the current team can support the requirements associated with a Risk Impact Level of "Moderate" if the CLASS designation is changed to "High" additional resources may be necessary as the requirements become more stringent.

Subsequent to any decision changing the CLASS Risk Impact Level to "High" the CLASS project will given the opportunity to present a plan for meeting the additional requirements including identification of any cost or schedule impacts associated with the change.

4.3 Innovations

The following projects have been implemented in FY2010 to address future challenges, better meet customer needs, make better use of technology, and lower operating costs.

Contract Milestones: Successful IBR Completion and Second Contract Option Period

The current CLASS contract was awarded in June 2008. During the next ten years, CLASS funding sources and total funding will increase as CLASS takes over the data archiving functions of many NESDIS systems. CLASS will receive funding from each of these systems in return for performing their data archiving. The funding that CLASS will receive from each of these systems will pay for the IDIQ CLASS contract. CLASS provides a net saving and performance improvement to NOAA by replacing stove-piped legacy archiving systems with a modern centralized archive data management system. The Integrated Baseline Review (IBR) for the second year of this contract was completed in November 2009.

Develop and Implement New Technologies to Increase CLASS Capabilities.

The CLASS project continues to assess new and emerging technologies for suitability within the CLASS architecture. During FY10 the CLASS project team completed a study to identify the most effective Storage Area Network (SAN) solution, executed the procurement, and began deployment of the solution.

The project team further demonstrated its innovation and also its ability to react and adapt in developing an accelerated implementation schedule for Climate Model Data. The original schedule called for CLASS to be ready to ingest this data in July 2011 but the team modified their approach to use existing hardware and began ingesting Climate Model Data in January 2010.

CLASS technology evaluation studies in Contract Year 3 will include:

- Hierarchical Storage Management (HSM) and Shared File System (SFS): This study will evaluate the long-term suitability of StorNext as the solution for meeting current and future CLASS performance and capacity requirements. During this study, the Team will also evaluate other HSM and SFS tools that are suitable for CLASS. At the conclusion of the study, the DGP Team will provide a recommendation to either proceed with upgrading to StorNext version 4.X or replace it with a more suitable tool.
- Cloud Computing Study: The Cloud Computing Study will provide a detailed overview of current cloud computing technologies and their potential applicability to CLASS and the NOAA archives.
- Plug-in Bus Study: This study will describe in detail the architectural and functional characteristics of the Plug-in Bus. The white paper will include details on how the Plug-in Bus would operate in the CLASS environment. This will include an assessment of the performance and security considerations during the design and implementation phases, as well as the necessary standards and processes that need to be defined for proper implementation and operation of this architectural concept.
- System Modeling and Performance Metrics Tools Study. This study will evaluate two things. First, it will evaluate system modeling tools that can support models that include processor capacity (CPU and Memory), disk and tape storage, and network bandwidth requirements to be used for CLASS capacity planning. Second, it will evaluate enterprise performance metrics reporting tools that can collect and report system utilization metrics and collect system utilization metrics that can be fed into the system modeling / capacity planning tool. The system modeling tools and the enterprise performance metrics reporting tools will be evaluated together with the goal of having a single vendor provide both solutions with a single tool or within an integrated toolset.

4.4 CLASS Major FY10 Development and Evolution Accomplishments

Major CLASS accomplishments for FY2010 include:

- CLASS developed an accelerated implementation schedule for Climate Model Data and completed Climate Model Data ingest and archive through Phase Two.

- CLASS began ingesting GOES-13 on April 14th, as it replaced GOES-12 as the GOES east satellite.
- Supported the re-ingest of DMSP SSMI TDR data in NetCDF from NCDC, which is approximately 3.3 TB.
- Upgraded all RH4 servers to RH5, which is FIPS 140-2 compliant.
- Installed and configured OSSEC on all AIX and RH5 servers.
- Promoted the OPeNDAP server for public access
- Completed and delivered the Storage Area Network (SAN) Storage Technology Deployment Guide and installed 4 SAN servers at NSOF.
- Started preparations for necessary system upgrades for support of NPP and NPP/CalVal data.
- Began the migration of CLASS to run under the Linux operating system.
- Supported GOES-R SRR/SRD Delta Review
- Supported Standard CMMI Appraisal Method for Process Improvement (SCAMPI)-A appraisal in April 2010 and identified process improvements to the configuration management-related documentation that will fill gaps identified in the SCAMPI-C/gap analysis assessment
- Updated the CLASS Business Continuity Plan and the CLASS Contingency Test Plan and Test Cases.
- Developed and promoted the following software releases to Operations:
 - Release 5.2
 - Release 5.2.1
 - Release 5.2.2
 - Release 5.2.3
 - Release 5.2.4
 - Release 5.2.5
 - Release 5.2.6
 - Release 5.3
 - Release 5.3.1
 - Release 5.3.2.
- Supporting the implementation of Release 5.4 and preparation for upcoming CLASS Release 5.5
- Utilizing Accelerated Application Development (XAD) process in development of NEAAT Release 1 and NEAAT Release 2 and conducted NEAAT Release 1 ORR
- Developed prototype code in support of the plans for NEAAT Release 2 to support inventory-level searching on CLASS data.

4.5 Funding Levels

During the next ten years, the number of CLASS funding sources and total funding dollars will increase because CLASS will take over the data archiving functions of many NESDIS systems. CLASS will receive funding from each of these systems in return for performing their data archiving. The funding that CLASS will receive from each of these systems will pay for the new IDIQ CLASS contract. CLASS provides a net saving and performance improvement to NOAA by replacing stove-piped legacy archiving systems with a modern centralized archive data management system.