

**National Oceanic and Atmospheric Administration
National Weather Service
Telecommunication Gateway (NWSTG)
006-48-01-12-01-3106-00
Operational Analysis
2007**

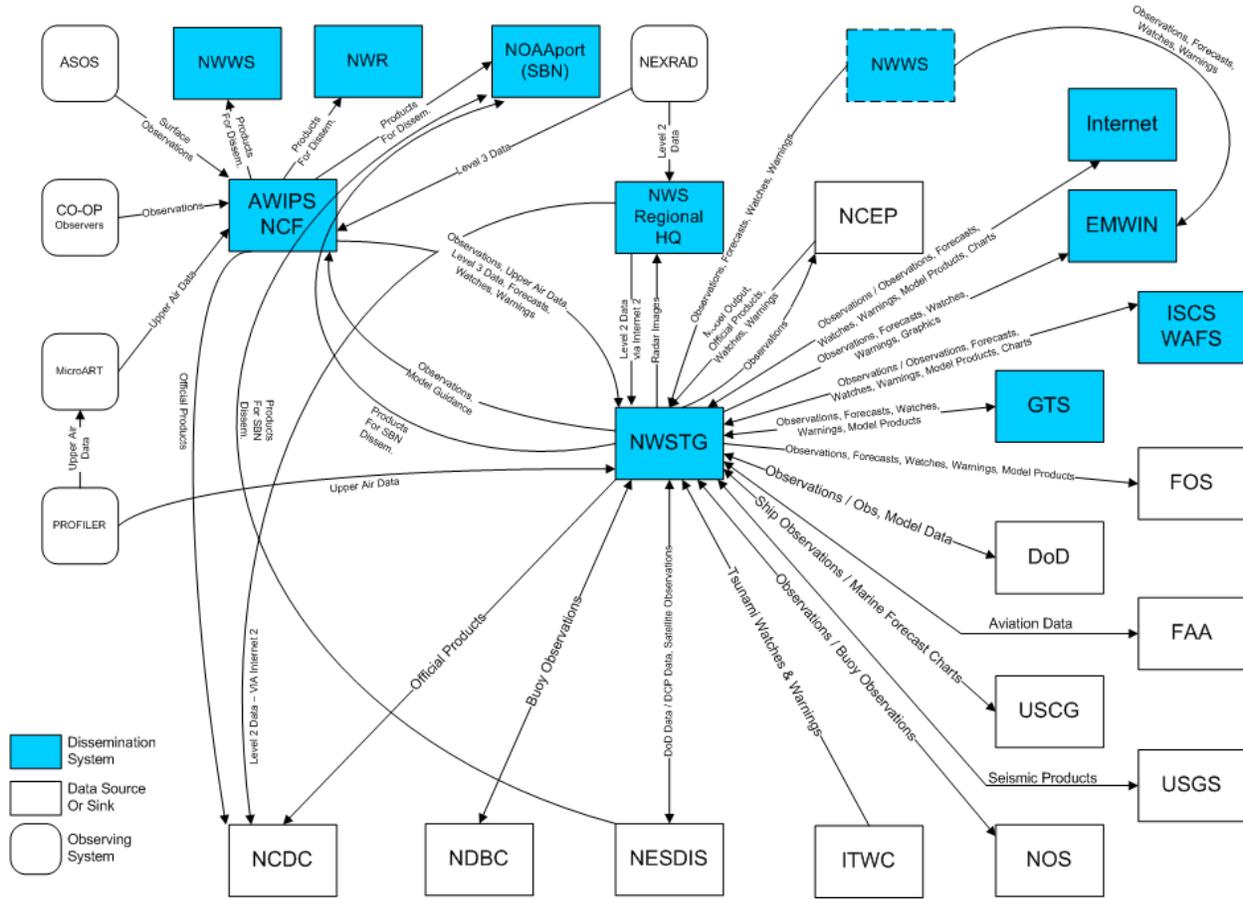
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Executive Summary

NOAA’s National Weather Service Telecommunication Gateway (NWSTG) consists of the NWSTG primary message switching system in Silver Spring, MD and the backup message switching system in Mount Weather, VA. The NWSTG is a critical element allowing NWS to satisfy the requirements for collection and distribution of hydro meteorological data. The NWSTG allows the NWS and its partners - public, private, and commercial - to perform their core functions. The NWSTG supports the NWS mission by collecting and distributing raw and processed hydro meteorological data and products. The National Weather Service Telecommunication Gateway (NWSTG) interfaces with a wide variety of partners and customers. All observational data ingested by the NWS passes through the NWSTG. The NWSTG acts as a message switch and routes these products to meet our customer’s requirements. The NWS CIO/Telecommunication Operations Center (TOC) operates and maintains the NWSTG.

NWS Data Flow – NWSTG-centric View
 OCIO – Darling – 15 March 2005



This report focuses on the operational state of the program as of December 31, 2007, and is based on guidance developed by the Department of Commerce. The NWSTG program directly facilitates NOAA’s Strategic Goal to “Serve society’s needs for weather and water information”. The current program meets established cost, schedule and performance parameters.

This operational analysis (OA) is an annual, in-depth review of the program’s performance based on the following:

- Customer Results
- Strategic and Business Results
- Financial Performance
- Innovation

1.0 Customer Results

The NWSTG impacts all economic sectors of the nation and is instrumental in the collection and distribution of weather and climate data critical to general public safety as well as the nation's economic well-being. Customers include the aviation, energy, and private weather forecasting industry sectors and the general public. The nation is a stakeholder; other customers include federal agencies as DoD, FAA, NASA, state and local governments, and academia. Additionally, the NWSTG is a global acquirer and distributor of weather messages in support of the NWS commitment to the WMO World-Wide data exchange.

1.1 Customer Requirements and Costs

The principal internal customers are the NWS forecast offices and national which rely on the timely and dependable flow of observations, guidance and forecast products through the NWSTG. The principal external customers and stakeholders are other government agencies, the private sector, the public, and the global community. The NWSTG supports customer requirements through the timely dissemination of data delivered by customers to the NWSTG.

Through conferences, seminars, stakeholder meetings and other venues the TOC seeks to establish and develop effective dialogue with users to identify, document and prioritize requirements of major stakeholders for current and future NWSTG services and to identify mechanism(s) to review and update these requirements. User conferences attended by NWSTG representatives in 2007 include:

AMS/FOS Jan 15-19 2007

WMO RA-IV Mar 26-30 2007

Hurricane Conference April 2-5 2007

WMO ET/DR&C April 23-27 2007

20th NAM-EUR DEX May 21-25 2007

Asia/PAC OPMET June 3-6 2007 Bangkok, Thailand

APANPIRG CNS/MET SG/11 July 16-20 2007 Bangkok, Thailand

APSDEU Oct 9-12 2007

PCSC Australia Nov 12-16 2007

WMO EC WIS/WIGOS Dec 3-7 2007

1.2 Performance Measures

Several key system level performance measures are tracked on a regular basis to determine the effectiveness of the program. Key performance measures are: (1) System Availability, (2) Warning Message Latency, (3) Routine Message Latency, and (4) Traffic Volume. For Message Latency, Thruput Circuit Analysis is conducted for a 24 hour period on representative lines to produce average message latency from edge to edge of the message switch. System Availability is measured monthly as the percentage of the total hours for the month that NWSSTG services were available to any of the four major customer sectors: NCEP, AWIPS, Government (DoD, FAA, etc.), and Family of Services. Non-availability is considered as loss of NWSSTG services to all four major customer sectors due to unplanned or planned downtime.

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 performance measures.

Table 1: Customer Results Performance Measure

| Measurement Area | Indicator | 2006 Baseline | 2007 Actual Result | Comments |
|-----------------------|-------------------------|---------------|--------------------|----------|
| Customer Requirements | System Availability | 99.99 | 100% | |
| | Warning Message Latency | 10 seconds | .75 sec | |
| | Routine Message Latency | 60 seconds | .75 sec | |
| | Daily Traffic Volume | 1.2TB | 1.4TB | |

2.0 Strategic and Business Results

The NWSSTG 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 NWSSTG program performs.

The latest performance data, as of November 30, 2007, show the NWSSTG is meeting or exceeding all of its performance goals. The extraordinarily high system availability performance is attributable to the high level of redundancy within the core infrastructure and the fact that the key NWSSTG functions are segregated in terms of data paths and server platforms so that the more likely result of a malfunction is degradation in overall NWSSTG service rather than a total outage. This robustness is likely to decrease as the ongoing transition from diverse point-to-point circuits to a network centric topology converges data paths on to common platforms. However, this vulnerability will be negated to a large degree by the availability of the NWSSTG Backup System. Moreover, non-availability due to scheduled downtimes for maintenance can be reduced since operations can be transferred between the primary and backup systems to accommodate many maintenance requirements. The NWSSTG Backup System has completed operational testing to demonstrate its ability to meet the same operational and performance criteria as the NWSSTG. As customers modify their connectivity to connect to the network centric topology, they will acquire the catastrophic backup provided by the NWSSTG Backup System while those not having done so remain dependent on the viability of the network access router at the NWSSTG. This transition is the customer’s responsibility and it is estimated that all will have completed the transition by 3QFY08.

2.1 [Project/Investment Name] Helps to Achieve Strategic Goals

This is covered in two sections. The first section relates how the NWSSTG and NWSSTG Backup support NOAA strategic goals. The second section provides specific examples of products transiting the NWSSTG with a critical time factor.

NOAA Strategic Goals

Supports NOAA Mission Goal 3: Serve Society's Needs for Weather and Water Information

- Performance Objective: Increase application and accessibility of weather and water information as the foundation for creating and leveraging public (i.e., federal, state, local, tribal), private and academic partnerships.
- Performance Objective: Increase coordination of weather and water information and services with integration of local, regional, and global observation systems.
- Outcome: Better, quicker, and more valuable weather and water information to support improved decisions.
- Outcome: Increased customer satisfaction with weather and water information and services.

The NWSSTG is the major NOAA hub for acquisition, interconnectivity and dissemination between weather, climate and water data systems, telecommunication networks and information producers. The reliability and timeliness of data communication services through the NWSSTG is critical to the U.S. weather enterprise, including direct support to our partners in the private sector, academia, and government who help disseminate critical environmental information. The improved message transit times and catastrophic backup capability resulting from the recent NWSSTG replacement and the impending NWSSTG Backup directly contribute to the desired outcomes for quicker weather and water information and increased customer satisfaction. Severe weather warnings will be delivered quicker to state emergency managers via Emergency Managers Weather Information Network (EMWIN)) and to ships at sea via Global Maritime Distress and Safety System (GMDSS). The NWSSTG improvements will accelerate delivery of products ranging from Earthquake and Avalanche Warnings, to Hazardous Materials and Radiological Hazard Warnings to the Department of Homeland Security via the HazCollect system.

Supports NOAA Mission Goal 4: Support the nation's commerce with information for safe, efficient, and environmentally sound transportation

- Performance Objective: Enhance navigational safety and efficiency by improving information products and services.
- Performance Objective: Reduce human risk, environmental, and economic consequences resulting from natural or human induced emergencies.
- Outcome: Safe, secure, efficient, and seamless movement of goods and people in the U.S. transportation system.

The NWSSTG provides the primary path for delivery of airport forecasts and aviation support products including aviation model data to the Federal Aviation Administration

and to the Airlines themselves. The NWSTG provides the data streams to feed the International Civil Aviation Organization World Area Forecast System, a global satellite-based aviation support system. It also is an Operational Meteorology Databank for the Aeronautical Fixed Telecommunication Network. The NWSTG collects data from and provides data to the maritime community including Service Argos and the Global Maritime Safety and Distress System. The NWSTG also supports data needs for national and local surface transportation requirements. The improved message transit times and catastrophic backup capability resulting from the recent NWSTG replacement and the impending NWSTG Backup enhance the timeliness and reliability of data delivery to the U.S. transportation system and, therefore, directly contribute to the desired outcome for safe, secure, efficient, and seamless movement of goods and people in the U.S. transportation system.

Supports NOAA Mission Goal 5: Provide critical support for NOAA's mission

- Performance Objective: Enhance applicability of NOAA services to homeland security efforts.
- Performance Objective: Increase quantity, quality, and accuracy of satellite data that are processed and distributed within targeted time.
- Performance Objective: Increase internal and external availability, reliability, security, and use of NOAA information technology and services.
- Outcome: A safe operating environment with efficient and effective financial, administrative, and support services.
- Outcome: Ship, aircraft, and satellite programs that ensure continuous observation of critical environmental conditions.
- Outcome: NOAA homeland security-related capabilities that are fully integrated into national planning and available at all times.
- Outcome: Secure, reliable, and robust information flows within NOAA and out to the public.

The NWSTG allows for a high speed line interface to satisfy DHS data requirements. The NWSTG provides for dissemination of Civil Emergency Management messages including alerts from DHS. The NWSTG provides distribution of satellite data from NESDIS and other satellite data providers. The NWSTG is absolutely critical to meet the requirements for increased quantity, quality, accuracy, timeliness and reliability for data and information flow to support NOAA, national and International missions.

Specific examples of time critical products

Products benefiting directly from reduction in NWSTG latency

- Observation delivery to WFOs to support forecast process such as tornado observations from non-NOAA sources.
- Observation delivery to FAA to support flight service
- Observation delivery to Lightning data delivery to field
- Hazcollect message delivery to field for NOAA Weather Radio All Hazards dissemination
- Tsunami/Seismic data delivery to EMWIN and GTS
- Fire Weather Forecast dissemination to SPOT and Department of Interior
- Radar imagery dissemination to public, NWS regional headquarters, and emergency managers

- Economic benefit derived by quicker delivery of data to commercial entities
- Hydrologic data delivery to RFCs/WFOs to support flood and flash flood watches and warnings

Products delivered exclusively through NWSTG

- Receipt and delivery of watch, warning, observation and forecast data to other federal and state agencies
- Acquisition and dissemination of international observations, forecasts and warnings
- International model output products such JMA and ECMWF

Products requiring periodic and punctual availability delivered through NWSTG. These are impacted any time the NWSTG develops a backlog of operations to perform.

- Observations to DoD to support model runs and operations
- Data availability requirements control initiation of some NCEP jobs and affects the output quality of others. The NCEP model begins to deteriorate immediately when observations are not received and becomes unusable within 24 hours
- Products issued by field offices such as the hourly weather roundup require observations to be delivered by certain times.
- The FAA requires certain forecasts to be available by critical times for aviation support.
- Products issued by Canadian agencies are highly dependent on receipt of U.S. data especially data near the border

2.2 Business Results

2.2.1 Program Management and Controls

At the NOAA level, the NOAA's Program Planning and Integration (PPI) and Program, Analysis and Evaluation (PA&E) offices provide management oversight using the Planning-Programming-Budgeting-Execution (PPBES) process. At the NWS level, the Chief Information Officer provides management oversight for the NWSTG and accepted Project Management practices are applied to monitor progress and control costs and resources. At the program level, work progress is rigorously tracked against established milestones and success criteria.

2.2.2 Monitoring Cost, Schedule and Performance

Cost – Budget reviews are conducted weekly as part of the TOC Program Review

Schedule – Project schedules are updated and reviewed weekly as part of the TOC Program Review

Performance – Project performance reviews are conducted weekly as part of the TOC Program Review. Monthly quad charts are prepared for the NWS CFO to track Cost, Schedule, and Performance and alert NWS Senior Management to issues, risks and mitigation strategies.

2.3 Reviews

NITRB Post Implementation Review – August 14, 2007
 CITRB Post Implementation Review – September 26, 2007
 Weekly TOC Program Review

2.4 Security

The NWS Telecommunication Gateway system is accredited under requirements spelled out in NOAA Administrative Order 212-13 (03/17/03) and NOAA Information Technology Security Manual (05/15/2007) that are based on OMB and NIST guidance. System Security Plans, Risk Assessments, and Contingency Plans were certified and approved for the NWS Telecommunication Gateway system on 03/22/2007. Management, operational, and technical security controls are adequate to ensure the confidentiality, integrity and availability of information.

2.5 Performance Measures

The performance measures in Table 2 show the NWSTG’s performance with respect to Strategic and Business Results. Strategic and Business Results performance measures introduced in 2007 include network access, systems control, and product delivery. 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 Federal Enterprise Architecture - PMO.

| Fiscal Year | Strategic Goal(s) Supported | Measurement Area | Measurement Category | Measurement Grouping | Measurement Indicator | Baseline | Target | Actual Results |
|-------------|---|------------------------------|---|----------------------|---|--|---|--|
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Customer Results | Service Accessibility | Availability | access to NWSTG and NWSTG Backup via IP network | NWSTG access restricted to primary facility in Silver Spring, MD | NWSTG access available to backup facility in Bluemont, VA via IP network connectivity | As of July 20, 2007 access to NWSTG Backup available via local access point at primary facility in Silver Spring |
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Mission and Business Results | Controls and Oversight | Program Monitoring | Effective control of system configuration changes | Comprehensive configuration management system that encompasses all NWSTG internal software, hardware, and network components | Extend configuration management to NOAANet interfaces with the NWSTG | Configuration Management implemented 6/27/2007 |
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Mission and Business Results | Internal Risk Management and Mitigation | Contingency Planning | Currency and Accuracy of NWSTG Contingency Plan | Contingency plan updated annually | Review and update contingency plan on a semi-annual basis | NWSTG Continuity of Operations Plan completed in June 2007 |

| Fiscal Year | Strategic Goal(s) Supported | Measurement Area | Measurement Category | Measurement Grouping | Measurement Indicator | Baseline | Target | Actual Results |
|-------------|---|--------------------------|------------------------------|----------------------|---|--|---|---|
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Processes and Activities | Productivity and Efficiency | Efficiency | Product delivery time over wide area network to NWSTG customers | Improvements to product delivery times to customers are constrained by the bandwidth of the NWSTG access to the IP network | Increase NWSTG access bandwidth at least twofold | Fourfold increase in NWSTG access bandwidth achieved with installation of OC-12 circuit at primary NWSTG in December 2006 and at backup NWSTG in March 2007 |
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Technology | Reliability and Availability | Availability | Effective failover between primary and remote backup | no failover capability | NWSTG products are available within 12 hours of failover implementation | NWSTG Backup successfully completed operational testing but cannot proceed with failover testing without AWIPS connectivity scheduled for 1st Quarter FY08. |
| 2007 | 3.1 Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs. | Technology | Reliability and Availability | Reliability | System reliability | 99.9% or 8.75 hours maximum unscheduled downtime per year | 99.99% or 1.5 hours maximum unscheduled downtime per year | Contingent on completion of failover testing in 1st Quarter FY08 |

2.6 [Other]

3.0 Financial Performance

3.1 Current Performance vs. Baseline

NWSTG BUDGET PROFILE

| (\$K) | FY07 | FY08 | FY09 | FY10 | FY11 |
|--------------------|---------------|---------------|---------------|---------------|---------------|
| CAPABILITY: | | | | | |
| DME | 0 | 0 | 0 | 0 | 0 |
| SS (Steady State)* | 21,681 | 22,388 | 22,388 | 22,388 | 22,388 |
| Total | 20,961 | 21,058 | 21,058 | 21,058 | 21,058 |

**includes Legacy System Replacement PAC funding*

| IT COMPONENTS: | FY07 | FY08 | FY09 | FY10 | FY11 |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|
| Hardware | 916 | 1,642 | 500 | 500 | 400 |
| Software | 100 | 100 | 100 | 100 | 100 |
| Support Services | 3,233 | 950 | 850 | 850 | 850 |
| Telecommunications | 6,274 | 8,368 | 9,176 | 9,156 | 9,331 |
| IT Security | 668 | 1,004 | 1,004 | 1,004 | 1,004 |
| IT Training | 23 | 30 | 30 | 30 | 30 |
| Operations & Maintenance | 2,323 | 1,908 | 1,991 | 1,871 | 1,850 |
| Facility Infrastructure Refresh | 105 | 347 | 698 | 838 | 784 |
| Subtotal | 13,642 | 14,349 | 14,349 | 14,349 | 14,349 |

| FULL TIME EQUIVALENTS: | FY07 | FY08 | FY09 | FY10 | FY11 |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|
| NWSTG Steady State | 7,319 | 6,709 | 6,709 | 6,709 | 6,709 |
| Subtotal | 7,319 | 6,709 | 6,709 | 6,709 | 6,709 |

| FY07 Spending Totals (non labor) | |
|---|---------------|
| Support Services | 2,929 |
| Technical Refresh | 620 |
| Software | 123 |
| O&M | 4,186 |
| Telecom | 5,784 |
| Total | 13,642 |

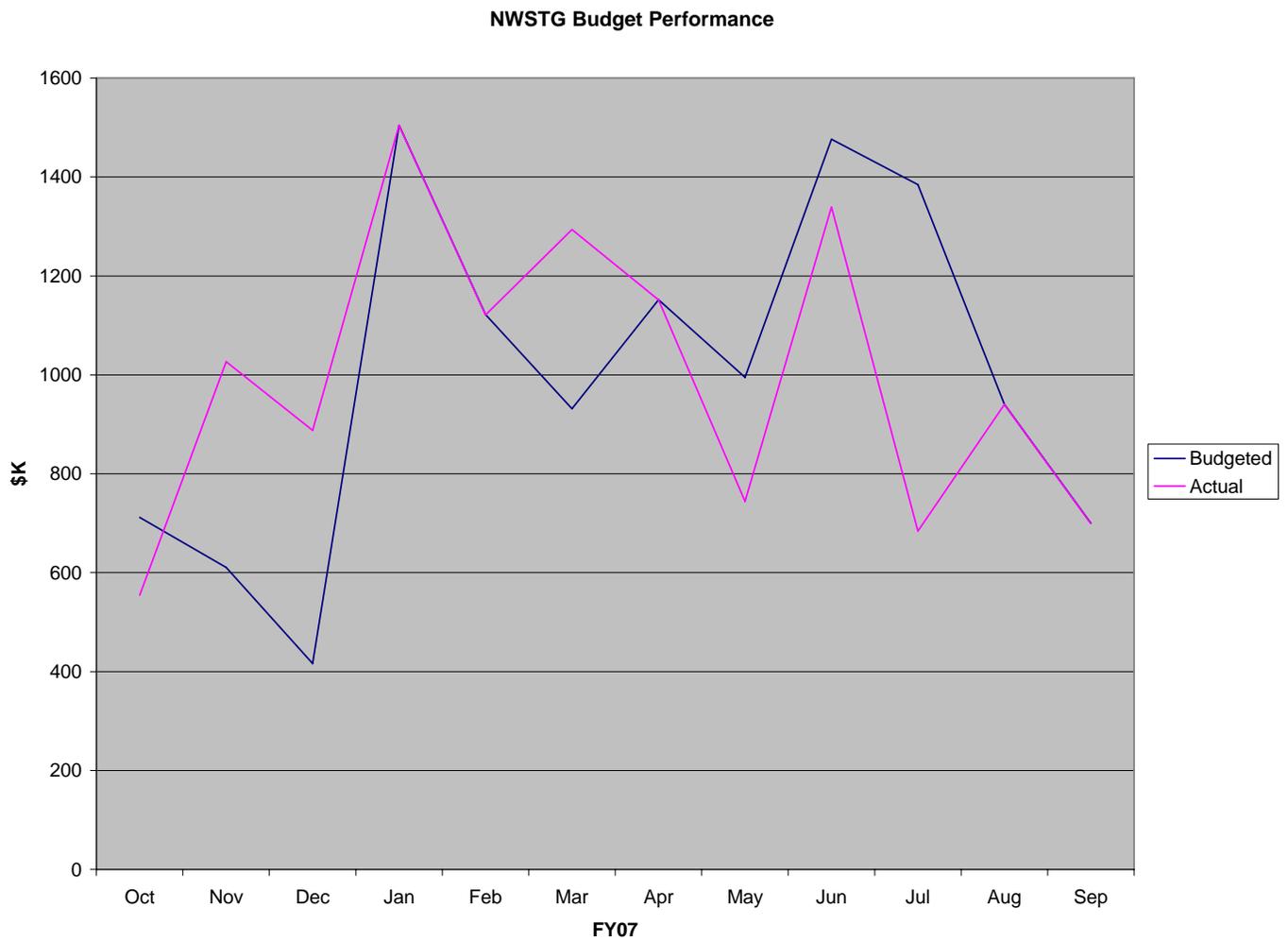


Figure 2: Budget vs Actual Costs

The CIO Telecommunications Operations Center (TOC) uses several systems to measure and track project cost and schedule.

a. Cost: CIO/TOC has oversight responsibility for the entire NWSTG O&M budget. The NWS CIO budget analyst coordinates budget planning and execution with the project/program managers and tracks funding commitments and obligations through the Commerce Financial Management System.

b. Schedule: The Legacy Replacement Full Operational Capability achieved in July 2006 culminated a 2 ½ year DME project. In 2007 TOC completed a SAN Infrastructure upgrade and is currently implementing Release II software development and technical refresh for the IBM pSeries enterprise servers that comprise the NWSTG message switch engine. The schedule status of these projects is reported to NWS senior management on a monthly basis via routine Major Investment Reviews. The NWSTG Backup System achieved Initial Operational Capability in December 2006 and is progressing to Full Operational Capability in 3rd Quarter FY2008 as NWSTG customers transition to the NOAA net MPLS network that interconnects the NWSTG primary and backup systems. Project schedules are developed and tracked on Microsoft Project 2003 Professional.

An annual, recurring O&M investment (\$13.64M non-labor in FY 2007) sustains the current high system availability and excellent overall performance level. The budget increased by \$2.5M for FY 2007 and beyond to fund the NOAA net MPLS network connectivity for the NWSTG. TOC has requested an increase of \$700K annually starting in FY 2008 to fund the cyclical technical refresh required to sustain the availability and performance levels.

This investment was reviewed by the Commerce IT Review Board (CITRB) in September of 2007 as a Post Implementation review. Cost, schedule, and performance were presented and generally well received at the CITRB briefing.

3.2 Performance Measures

Budget development and execution have been accomplished using PC-based spreadsheets (currently Microsoft Excel) linked to the NOAA financial management systems. These spreadsheets have been used to compare actual cost data to budget baselines and to make the required baseline adjustments for subsequent budget development cycles. Cost and financial data are monitored to identify discrepancies with the approved financial plan and to develop corrective actions. This data is also used to monitor contractor performance, contractor rate adjustments, support program/budget reviews, and to answer questions from NWS, NOAA, and DOC management, OMB and the Congress.

3.3 Cost Benefit Analysis

No Cost Benefit Analysis was conducted for the NWSTG during calendar year 2007

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 also identified and implemented.

4.0 Innovation to Meet Future Customer Needs

The Telecommunications Operations Center receives executive level guidance from the TOC Division Director, the Office of Climate, Water, and Weather Services (OCWWS), and the National Center for Environmental Prediction (NCEP). Further input is provided by WMO and ICAO who outline Data Management practices and standards for exchange of data and products.

Additionally, the TOC complies with the OMB requirements of Circular No. A-11, Planning, Budgeting, Acquisition, and Management of Capital Assets; NOAA's Planning, Programming, Budgeting, and Execution System (PPBES), and the NWS Operations and Services Improvement Process (OSIP). These combined processes ensures the NWSTG O&M investment is exposed to a rigorous review and decision making process that assesses NWSTG performance relative to its contributions to NOAA's strategic goals and that it continues to be a viable and necessary investment.

A dedicated TOC program manager was created who oversees the NWSTG project execution of the four TOC Branches so all IT related activities are interlinked and communicated throughout the TOC, NWS and International community. Changes to the system either on the network, software or hardware side are controlled by an ITIL model infrastructure that uses an automated Configuration Management, Asset Management and Help Desk solution to document, archive and control all changes. An NWSTG Change Control Board (CCB) was established which reviews all change requests.

4.1 Number and Types of Users

Project to Address Challenge: *Support growth in NCEP model output.*

The estimated volume of output from the NCEP models will grow exponentially in the next few years. The challenge is to have the capability to ingest this data from NCEP and make it available to our customer base as they require. This requires growth in our network storage capacity and our NOAAnet bandwidth requirements which can be added easily with additional funding. In addition technical refresh and incremental computing growth can enable the NWSTG to process and route this additional data.

Project to Address Challenge: *Support requirements to ingest data from new sources.*

There are many new sources of observed environmental data that are becoming available from state and non-governmental sources. These data can be used by NCEP in the generation of the new forecast models to improve accuracy and reliability. The NWSTG is planning to ingest data from the MADIS system to obtain state Mesonet data along with other quality controlled miscellaneous observational data. Additional processing requirements should be met through technical refresh and incremental computing growth. In addition, operational support staff and monitoring tools may be required depending on support requirements.

4.2

Project to Address Challenge: *Weather Information System*

The NWSTG is required to support the World Meteorological Organization goals to support a Weather Information System (WIS). The WIS is designed around a series of catalogues which contain metadata describing what information and information access services exist within the WMO communities, what they contain, where they are and how to retrieve the required information. Synchronised copies of these catalogues, along with at least 24 hours of the entire set of WMO data and products available for routine global exchange, will reside in a series of Global Information and System Centres (GISC). As well as hosting the catalogues and information, the GISCs will collect and disseminate information from and to Data Collection or Production Centres (DCPC) and National Centres (NC) within its area of responsibility and distribute that information onto the other GISCs. The NWSTG will require a substantial upgrade in computing resources, network storage and networking capability to meet the requirements of a GISC. Also, additional IT staff to support this expanded system will be required.

4.4 Funding Levels

The NWSTG Replacement and Backup Systems were designed with sufficient capacity and scalability to meet projected current user requirements through 2010. Additionally, the systems have the capability to double the current sustained message throughput. It is expected that new user requirements will be accompanied with adequate funding to implement and maintain the necessary capacity increases. The current NWSTG budget includes sufficient funding to support a technical refresh program which allows the NWSTG to stay abreast of the evolving technology.

Annex A

1. Is the project bound by Memoranda of Understanding (MOU), international treaties, Service Level Agreements (SLA), or other agreements? If yes, please and describe below.

- The NWSTG supports global dissemination of weather data through international agreements under the auspices of the United Nations World Meteorological Organization
- Through Family of Services Agreements, the NWSTG provides external user access to U.S. Government obtained or derived weather information.
- The NWSTG exchanges data with the FAA and DoD in accordance with established MOUs

2. Name the management control processes. For example: Operational Monitoring, Daily Status Briefing, Weekly Status Meetings, Monthly Staff Meetings, Monthly Configuration Control Board, Monthly Budget Reviews, Working Groups, Program Steering Group, etc.

NWSTG Management Control Processes:

1. Ongoing real-time operational monitoring
2. Weekly Program Reviews (includes budget review)
3. Weekly Staff Meetings
4. Weekly Change Control Board Meetings
5. Weekly and Monthly Status Reports
6. Monthly Quad Chart Status Report on Critical Projects