

**National Oceanic and Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Geostationary Orbiting Environmental Satellite Ground System (GOES GS)
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Operational Analysis
2007**

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Executive Summary

As a single entity, the GOES Ground System supports the NESDIS GOES mission.

NESDIS operates GOES satellites to provide data for short-term weather warnings and forecasts. These satellites orbit the Earth at 22,600 miles above the equator. Two GOES satellites remain operational at all times; one providing coverage for the eastern United States and most of the Atlantic Ocean, and the other providing coverage for the western United States and Pacific Ocean basin. GOES satellites provide images of the entire United States every 15 minutes. NESDIS can also acquire GOES images as frequently as every minute to monitor the development of severe weather. The National Weather Service (NWS) uses GOES temperature and water vapor data in powerful numerical prediction models to form the basis of local weather forecasts. More than 120 NWS Forecast Offices use GOES images to provide local weather forecasts and warnings of severe weather events. GOES imagery is utilized daily, across the Nation, by the public and private industry for business, education, awareness and planning. GOES images are converted to videotape for use on all the national television weather shows.

The GOES Ground System is a real-time "System-of-Systems" that comprises the end-to-end framework for collecting, processing, and disseminating critical environmental data and information from the GOES satellites. It supports the launch, activation, and evaluation of new satellites and the in-depth assessment of satellite data. Moreover, the health and safety of these national resources are monitored around the clock to ensure that any identified anomalies are resolved as soon as possible. Data from the satellites are received at ground facilities. Here data is processed to monitor and control the satellite and to generate products used by NOAA, its users, and the World Meteorological Community. The GOES ground system consists of components at the Satellite Operations Control Center (SOCC) at Suitland, MD; Command and Data Acquisition (CDA) facilities at Wallops, VA and Fairbanks, AK; and Wallops Backup (WBU) facility; located at NASA Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. Operational elements are located at Fairbanks, Alaska; Wallops, Virginia; Suitland, Maryland; Greenbelt, Maryland. GOES GS contains components of the following major sub-systems: (SOCC/CDA), Office of Research and Applications (ORA), and the NOAA National Data Centers (NNDC).

This operational analysis (OA) is an annual, in-depth review of the program's performance for Calendar Year 2006 based on the following:

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

This report focuses on the operational state of the program as of December 31, 2006, and is based on guidance developed by the Department of Commerce. The GOES GS program directly facilitates NOAA's Strategic Goal to "Advance understanding and predict changes in the Earth's environment to meet America's economic, social and environmental needs." The current program meets established cost, schedule and performance parameters.

1.0 Customer Results

The Office of Satellite Development GOES Ground Systems (GS) 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. The OSD GOES GS program primarily serves internal NESDIS customers, i.e. the Satellite Operations Control Center (SOCC), as well as Wallops and Fairbanks Control and Data Acquisition Stations (CDAs) within the NESDIS Office of Satellite Operations (OSO). Other customers this year have included the GOES N spacecraft who used the system for Launch and Orbit Raising and NASA/GSFC who used the system to control the satellite and collect data during the Post Launch Testing to verify that the GOES meets NESDIS requirements.

The GOES GS provided to OSO are used to command and control the GOES constellation of satellites, navigate and calibrate spacecraft instrument data, provides satellite-transmitted data to the ESPC for further processing. The ESPC generates products which impact all economic sectors of the nation. The impact of these data and products are documented in the Economic Statistics for NOAA This document is available from the following website:

1.1 Customer Requirements

The primary customer for the GOES GS program (and indicated previously), is the NESDIS Office of Satellite Operations. Secondary customers include NASA Goddard Space Flight Center (GSFC), and its contractors. Delivered systems include systems to command, control, and navigate GOES satellites, as well as process GOES instrument data for distribution to NESDIS and outside users.

GOES GS operational requirements are gathered during the initial project planning process, and proceed through formal Preliminary Design Reviews (PDRs), Critical Design Reviews (CDRs), and subsequent Technical Interchange Meetings (TIMs). In addition, formal Configuration Control Boards (CCBs) track the status of developmental and operational systems, allowing maintenance of developed systems to proceed in an ordered fashion. Once a system is handed over to a user the new requirements or failure of a system to meet customer requirements is tracked in an incident reporting system.

1.2 Performance Measures

The performance measures evaluate the ability of the delivered GOES GS to provide accurate and timely data transmitted from the GOES satellites to our primary and end-user customers. Table 1 summarizes the performance measures

Table 1: Customer Results Performance Measure

Measurement Area	Indicator	2006 Baseline	2006 Actual Result	Comments
Customer Results	Percent of data delivered within navigation spec	95%	99.19%	
Processes and Activities	Percent of transmitted data meeting quality/timeliness requirements	98.5%	99.43%	

2.0 Strategic and Business Results

The GOES GS 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 GOES GS program performs.

2.1 GOES GS Helps to Achieve Strategic Goals

In line with the current NOAA Strategic Plan for FY2006-FY2011, the GOES GS program directly supports the mission goal to serve society's needs for weather and water information. 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. Hence, GOES GS supports the reception and processing of the data required to meet the NOAA mission strategy of Monitor and Observe. In addition, the GOES GS supports the Department of Commerce (DOC) theme to Observe, Protect, and Manage the Earth's Resources to Promote Environmental Stewardship

Within the Agency Enterprise Architecture, GOES GS supports NOAA's "Ingest/Process Satellite Observations" component: "allows data & observations to be acquired from both NOAA and non-NOAA satellite sources and processed to a level necessary to prepare the data to be further refined into the required product sets".

2.2 Business Results

2.2.1 Program Management and Controls

The GOES GS program is managed using the Office of Management and Budget (OMB), DOC, and NOAA guidelines and policies. Oversight is provided by NESDIS, including the NESDIS Information Technology Architecture Team (ITAT) 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.

The GOES ground systems support the GOES satellite programs under the Office of System Development (OSD) management. All resulting tasks are assigned a Project Manager. This manager is directly responsible to coordinate and carry out the Technical Interface meetings, the Preliminary and Critical Design Reviews, coordination meetings, monthly program reports, and status meetings. The monthly reports are to include summaries of all accomplishments and status of all tasks, a financial status which is to include man-power utilization, schedules updated to reflect accurately the status, planned activities, and all issues and concerns which includes risk and mitigation strategies. These reports are provided to Senior Management for review, highlight of risk areas, and review of risks and associated mitigation activities.

GOES GS managers perform continuous analysis on the performance of its operational systems. This ensures system resources and ancillary supporting infrastructure (security, training, facilities, etc.) as well as labor resources remain optimally functional and configured to suit the NESDIS / NOAA's goals.

2.2.2 Monitoring Cost, Schedule and Performance

Cost – OSD conducts a variety of budget analyses throughout the fiscal year. Obligations and expenditures are tracked on a monthly basis. Variances to budget plans are analyzed monthly by both OSD and the RO. Significant variances are reported to OSD Management as well as NESDIS management. A Needs Analysis is conducted annually in conjunction with the Planning,

Programming, Budgeting and Execution System (PPBES) and Ground System processes. Key budget issues and risks are identified through these reviews and tracked by OSD management.

Schedule – The matrix annual operating plan is used to track key milestones. The final matrix annual operating plan for OSD includes the significant GOES Ground System milestones. The majority of activities are below the threshold for reporting with the annual operating plan. These tasks are tracked through Microsoft Project and Excel. Schedules are developed in coordination with the RO and OSD.

Performance – Contract performance, when applicable, is monitored to support both budget and performance measurements. Typically, the integration of new hardware is conducted by either government staff or contract staff in the RO. As required, support can be secured through existing Operations and Maintenance contracts or through the vendors. Hardware maintenance contracts are reviewed on a semi-annual basis for technology advances impacting system maintainability, reliability, and interoperability.

Through the GOES GS, OSD provides NESDIS-wide support for various tasking, including IT Security, Program Management, Business Continuity Planning, Systems Engineering and Budgeting. These contracts are Time and Materials. For these contracts, OSD receives monthly status reports and meets at least quarterly with contract management to review performance, priorities, lessons learned, and work plan.

2.3 Reviews

As part of the NOAA program structure, the GOES GS program is reviewed on an annual basis. The last review took place as part of the FY08 budget cycle and was completed in September 2006.

The GOES Ground System project is fully continues to meet the customer's needs and the program is delivering the services that it is intended to deliver. All program metrics are at or above expectations. The program continues to effectively and efficiently support NOAA's Strategic Goal to "Advance understanding and predict changes in the Earth's environment to meet America's economic, social, and environmental needs."

2.4 Security

The GOES Ground System investment contains two operational systems, one of which is used of the operation of the GOES I-M satellites and the other for the operation of the GOES NOP satellites. The GOES GS systems are certified and accredited to the relevant OMB and NOAA requirements, which are based upon FIPS 200 and NIST 800-53 standards. System Security Plans, Risk Assessments, and Contingency Plans were certified and approved for GOES GS in January and July 2005. Management, operational, and technical security controls are adequate to ensure the confidentiality, integrity and availability of information.

The contractors help maintain system operations. The required security clauses are inserted in the two IT services contracts by the Contracting Officer and independently verified by the Information Technology Security Officer. Upon contract award, contractor employees required to access this

system must be approved for a NOAA badge and undergo the appropriate background check to ensure employee trustworthiness. The Contractor Officer's Technical Representative verifies the identity of each contractor employee and submits appropriate forms to the NOAA Security Office for a background check and employee badge. A personnel security professional within the NOAA Security Office ensures that all information provided by the Contractor Officer's Technical Representative is correct and initiates a security background check for the contractor employee through the Office of Personnel Management.

After OPM performs the contractor employee's background check, the NOAA Security Office is notified and a personnel security specialist reviews the results of the background check and subsequently approves issuance of a NOAA badge.

2.5 Performance Measures

The performance measures in Table 2 show the GOES GS program's performance with respect to Strategic and Business Results.

Table 2: Business Results Performance Measures

Measurement Task Area	Indicator	2006 Initial Baseline	2006 Result	Comments
Mission and Business Results	Operational Status	Existing geostationary environmental satellite operations	Maintained existing geostationary environmental satellite operations	

The GOES GS also added the capability to support the new higher resolution spacecraft detectors that will be first flown in the GOES O mission which is presently scheduled for launch in December 2007.

3.0 Financial Performance

3.1 Current Performance vs. Baseline

The program planned costs vs. actual costs are shown in Figure 1. Program costs consist of contract staff dedicated to GOES GS activities. In addition, these funds support relevant GOES GS sub-systems, i.e. antennas, telemetry/command and archive/access systems and GOES GS infrastructure components such as both internal and external communications. NOAA PAC funds support the operational components of the GOES GS reported in this operational analysis.

The dollars on the Y-axis are in thousands. The financial operational analysis includes only Steady State IT dollars for calendar year 2006. The total Steady State IT planned expenditures for CY2006 were \$14,616,000; actual CY2006 expenditures were \$11,979,000.

GOES GS CY2006 Operations

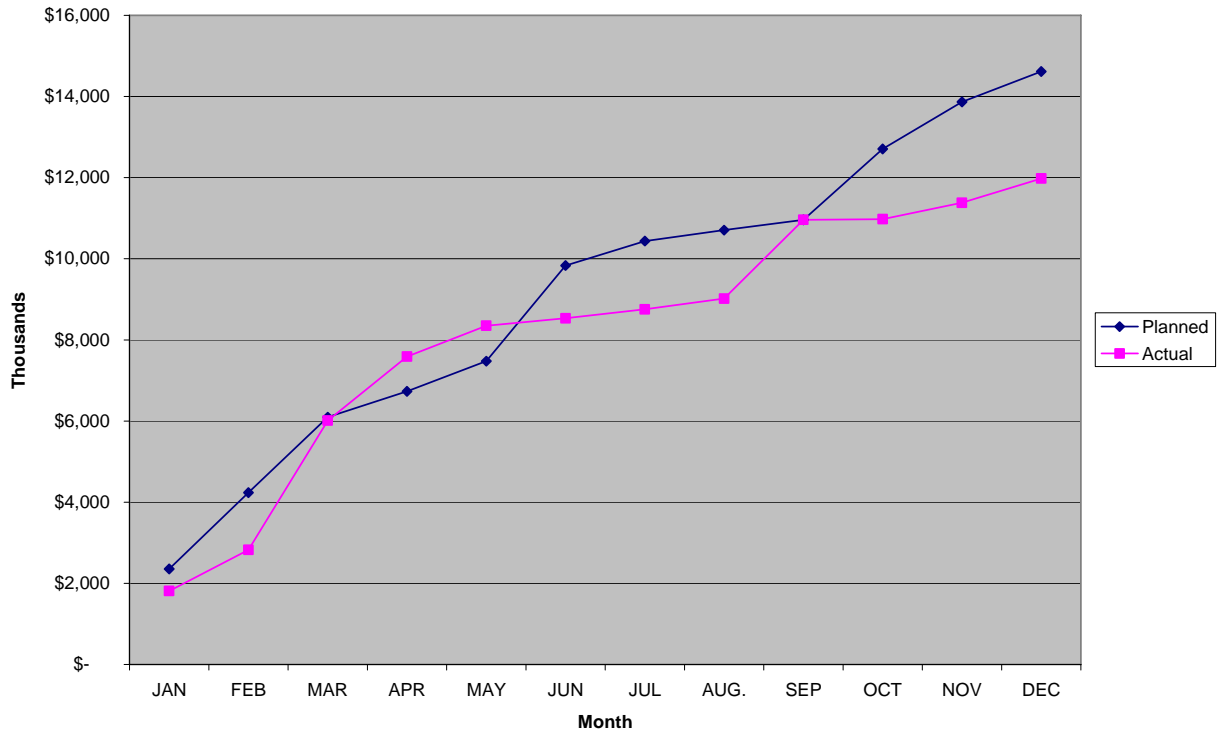


Figure 1: Budget vs Actual Costs

The GOES GS program plans and executes budget based upon a fiscal year calendar. A calendar year view comprises a snapshot of the program, and is likely to depict variance due to factors unrelated to performance. Actual expenditures have remained essentially flat in the first part of the calendar year due to the continuing resolution, hence depicting a large variance from October through December.

The high variance between actuals and planned in the July – August timeframe is due to a delay in funding planned acquisitions. These delays were caused by completion and approval of the necessary contractual documentation.

As a result, the planned expenditures reported are higher than expected because including the early months of FY07 results inflates the “Planned” expenditures. Although a calendar year view includes this variance between actual and planned expenditures, this variance is expected to be remediated in the course of the fiscal year, as indicated by the convergence of the lines in September.

3.2 Performance Measures

The current GOES GS financial performance is based on a pre-established cost baseline (e.g., annual spend plan). Program costs consist of labor and benefits for full time permanent staff dedicated to OSD, travel, communications, supplies and equipment, contracts, and corporate overhead.

3.3 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, contracting officer technical representatives (COTR) 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 following projects have been implemented in FY2006, and in some cases continue into FY2007, to address future challenges, better meet customer needs, make better use of technology, and lower operating costs.

4.1 Support for low fuel GOES Satellites

The GOES IM satellites are running out of fuel while the instruments are still working correctly. When a geostationary satellite runs out of fuel to perform North-South maneuvers the result is that it no longer remains at a constant relative location over the equator but instead drifts in a figure eight with the sub-satellite point drifting North and South a few degrees. This results in data that is not acceptable to the users. Prior to the GOES IM series the instruments would fail before the satellite ran out of fuel. OSD developed modifications to the ground processing software to remap the sensor data so that it appears to be coming from a stationary GOES satellite. This has extended the life of the GOES IM satellites.

4.2 Support for higher resolution sensor data on GOES-O and GOES-P

The GOES-O and GOES-P satellites incorporate a new sixth channel to support the generation of more detailed vertical profiles. Detectors for the new channel are 4km in resolution, as opposed to 8km for the channel that is being replaced. Components of the present GOES ground system are being upgraded to support those additional detectors. This includes the ability to ingest, calibrate, and perform QC monitoring.