



Acquisition of Space-based Scientific Data from
Commercial Sources to Supplement NOAA's
Weather and Climate Observation
Requirements

Report to Congress

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL ENVIRONMENTAL SATELLITE, DATA, AND INFORMATION SERVICE
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1.0 EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) prepared this document in response to the following direction provided by the Explanatory Statement which accompanied the Omnibus Appropriations Act, 2009 (P.L. 111-8). The direction requested a report from NOAA on its plans to obtain data from commercial sources. The specific requirements of this report are:

Space-based scientific data - NOAA is directed to report to the House and Senate Committees on Appropriations, within 60 days after enactment of this Act, on its plans to obtain space-based scientific data from commercial sources over the next three years.

Further, the Consolidated Appropriations Act, 2010 (P.L. 111-117) reiterated its request, specifically:

The conferees direct NOAA to report to the House and Senate Committees on Appropriations within 60 days of enactment of this Act on how the agency could benefit from acquiring space-based scientific data from commercial sources over the next three years, its plans to obtain such data, and an analysis of expected availability.

NOAA develops, acquires, and operates the Geostationary Operational Environmental Satellites (GOES) and the Polar-orbiting Operational Environmental Satellites (POES) to meet the Nation's core operational weather, climate, space weather, and environmental observation requirements. To support this mission, NOAA also:

- Builds relationships with other federal agencies, such as the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD), to develop next generation operational satellites.
- Develops international partnerships to meet its data needs.
- Acquires data and services from the commercial sector to supplement data provided by GOES and POES.

In Fiscal Year (FY) 2008, NOAA asked the commercial sector about its ability to provide satellite-based environmental data through either a data purchase or by hosting government furnished payloads on commercial satellites to meet NOAA requirements for Earth and space-weather observations. The solicitation, a Request for Quotation (RFQ), was divided into three sets labeled A, B, and C, based on priority and immediate need. NOAA issued the Set A RFQ in August 2008 and awarded contracts in September 2008 for price validation and technical feasibility studies. NOAA analyzed these study reports and found that several of the potential services have potential value and could be advantageous to the Government.

In March 2009, NOAA issued a RFQ for set B. NOAA awarded contracts in June 2009 for price validation and feasibility studies, and NOAA is currently reviewing and analyzing the final study reports. In August 2009, NOAA issued the third and final RFQ for set C data requirements and

contracts were awarded in September 2009. The results of the three RFQ sets will be considered in future NOAA budget planning.

NOAA purchases Sea-viewing Wide Field-of-view Sensor (SeaWiFS) ocean color data from GeoEye Inc. NOAA also purchases high-resolution imagery from the space-based commercial remote sensing industry and space-based synthetic aperture radar (SAR) data from commercial sources in Canada and Europe for ice detection and monitoring. The Consolidated Appropriations Act, 2010 funded an Administration initiative to purchase data from commercial sources for specialized data to support the operational needs of the National Ice Center. The President's FY 2011 budget request proposes a continuation of these data purchases from commercial sources.

Pending the availability of funds and NOAA's data requirements, NOAA will continue to purchase commercially available Earth observation data. Where feasible and appropriate, NOAA will develop contracts for purchasing commercial data. Pending further analysis of the RFQ results, NOAA may also develop proposals for government furnished payloads on commercial satellites.

2.0 INTRODUCTION

NOAA develops, acquires, and operates satellite systems to meet the Nation's core operational weather, climate, space weather, and environmental observation requirements. NOAA meets this requirement through two core satellite systems—GOES and POES. NOAA has also partnered with NASA to develop and acquire the next generation geostationary observing satellites—the Geostationary Operational Environmental Satellites Series R (GOES-R). NOAA will continue to provide data from the next generation polar-orbiting observation satellites through the Joint Polar Satellite System (JPSS), the NOAA portion of the restructured National Polar-orbiting Operational Environmental Satellite System (NPOESS) Program. NOAA works through its programs and those of other federal agencies to define and refine additional observation requirements, and assesses and pursues the most effective means of satisfying these requirements. NOAA may also develop international partnerships to meet its data needs. NOAA determines whether required observations can be obtained from non-NOAA sources, such as NASA's research satellites and foreign civil environmental satellites, or purchased from the commercial sector to supplement data provided by NOAA's two core satellite systems.

NOAA develops an acquisition plan through its annual programming and budgeting process known as the Planning, Programming, Budgeting, and Execution System (PPBES) process, to prioritize observation options and ensure data requirements are met. NOAA uses the PPBES process to evaluate, document, and pursue the most effective approach for meeting these observation and data requirements. Appendix A provides further information about the PPBES process.

Possible approaches (not in priority order) include:

- Placing sensors on NOAA's existing satellite systems,
- Placing sensors on new NOAA satellite systems,

- Purchasing data from commercial entities,
- Seeking secondary government payload opportunities on non-NOAA satellites (i.e., U.S. agencies, foreign government, or commercial satellites), and
- Contracting for small commercial satellites provided by industry.

The commercial sector is significantly involved with NOAA's satellite acquisition activities. Through contracts, NOAA leverages the expertise of the commercial sector to develop concepts and to build spacecraft, instruments, and ground systems for the government.

NOAA routinely purchases space-based scientific data from the commercial sector. NOAA purchases ocean color data from a hosted U.S. government sensor called SeaWiFS aboard the Orbview II satellite, which is operated by GeoEye Inc. NOAA also purchases high resolution imagery from the space-based commercial remote sensing industry and space-based synthetic aperture radar (SAR) data from commercial sources in Canada and Europe for ice detection and monitoring. The Consolidated Appropriations Act, 2010 funded an Administration initiative that included an increase of \$880,000 to purchase SAR imagery scenes from commercial sources so that the National Ice Center can create operational products which identify safe navigation routes through ice covered waters. The President's FY 2011 budget request will continue these data purchases from commercial sources.

3.0 STRATEGY AND INITIATIVES

NOAA receives numerous unsolicited requests from the commercial space industry to provide input for future planning of NOAA's data acquisition strategies. Companies ranging from aerospace prime contractors and satellite manufacturers to satellite fleet operators and entrepreneurs have offered their capabilities for meeting NOAA requirements.

To better assess the feasibility of developing future partnerships with the commercial sector, NOAA developed a formal process in FY 2008 to solicit information on the commercial sector's capabilities. NOAA established this process to evaluate the feasibility of using commercial sources to obtain additional types of weather, climate, and space weather information in the future as a supplement to NOAA's core next-generation satellite systems – GOES-R and JPSS. While NOAA does not anticipate any new commercial service acquisition from this formal process prior to FY 2011, in preparation for any potential commercial acquisition, NOAA has awarded study contracts to determine the validity, price, and technical feasibility of such commercial sources.

Subject to available resources, NOAA anticipates issuing continued requests for information and requests for quotations from the commercial sector to supplement its data requirements.

3.1 Progress in FY 2008

On December 20, 2007, NOAA posted a Request for Information (RFI) titled "Commercial Solutions to Meet Space-based Earth and Space Weather Requirements of the United States Government." NOAA issued this RFI to identify interested parties capable of providing commercial solutions to meet U.S. government requirements for space-based Earth and space

weather observations. The observations and data sources pursued in the RFI are either unavailable today or are in danger of experiencing an observation gap when the current data source is no longer available. The primary areas of interest included: the availability of sensor accommodations on commercially manifested satellite missions, commercial satellite systems that complement or meet U.S. Group on Earth Observations (US GEO) observing requirements, and potential commercial Earth and space weather observation data purchases.

To facilitate responses from interested parties, NOAA hosted an Industry Day titled “Seeking Commercial Capabilities to Address U.S. Government Requirements for Satellite-based Observations” at the Department of Commerce on January 28, 2008. There were several dozen attendees, representing large, medium, and small firms. The Industry Day was a venue for government representatives to present agency missions and goals related to Earth observing capabilities and examples of space-based Earth and space weather observation requirements.

The information gathered through this process facilitated the development of a follow-on RFQ solicitation for price validation and technical feasibility studies for using commercial services to meet space-based Earth and space weather observation requirements. The RFQ described 12 data collection requirements and requested quotes on contracts to study ways to meet those using commercial sources. The RFQ solicitations were released in three sets: A, B, and C.

Table 1, illustrates a schedule for the award of the contract studies and the estimated data requirement need dates.

Table 1. Contract Study Award Schedule for FY 2008 and FY 2009

Earth and Space Weather Observation Requirement	Study Contract Award(s) Date	Set
GPS Radio Occultation Atmospheric Profiles (Temperature, Pressure, Water Vapor)	September 2008	A
Wind Speed and Direction (Surface -- Ocean) (Scatterometry)	September 2008	A
Total and Clear Sky Radiative Flux	May 2009	B
Total Solar Irradiance	September 2008	A
Atmospheric Constituents (Ozone Profiles)	September 2009	C
Atmospheric Constituents (Aerosol Polarimetry)	September 2009	C
Sea Surface Height/Topography (Altimetry)	May 2009	B
Atmospheric Profiles (Temp., Pressure, Water Vapor) (Geostationary High Spectral Sounder)	May 2009	B
Ocean Color	May 2009	B
Wind Speed and Direction Profiles (Tropospheric and Stratospheric)	September 2009	C
Space Weather (Solar wind—geomagnetic storm alerts)	September 2008	A
Space Weather (Coronal mass ejection imagery—geomagnetic storm forecasts)	September 2008	A

On August 4, 2008, NOAA issued the Set A RFQ for price validation and technical feasibility studies. On September 17, 2008, NOAA awarded eight Set A RFQ study contracts with a total value of \$200,000 to five U.S. companies¹:

- Iridium Satellite, LLC of Bethesda, Maryland, was awarded \$50,000 (two contracts, \$25,000 each), for a study validating the price and technical feasibility for Solar Irradiance measurements and a study validating the price and technical feasibility for GPS Radio Occultation measurements.
- Space Services Inc. of Houston, Texas, (now Sentinel Satellite, Inc.) was awarded \$50,000 (two contracts, \$25,000 each), for a study validating the price and technical feasibility for Solar Wind measurements and a study validating the price and technical feasibility for Coronal Mass Ejection measurements.
- ORBCOMM Inc. of Fort Lee, New Jersey, was awarded \$50,000 (two contracts, \$25,000 each), for a study validating the price and technical feasibility for GPS Radio Occultation measurements and a study validating the price and technical feasibility for Coronal Mass Ejection measurements.
- Sierra Nevada Corporation, Space Systems of Littleton, Colorado, was awarded \$25,000 for a study validating the price and technical feasibility for Solar Irradiance measurements.
- GeoOptics LLC of Pasadena, California, was awarded \$25,000 for a study validating the price and technical feasibility for GPS Radio Occultation measurements.

The studies were evaluated to assess whether commercial approaches, including data purchases, will fulfill NOAA's need for obtaining specific types of Earth, space weather, and climate information. The awards are among NOAA's first steps to explore potential commercial options to procuring environmental data. NOAA has received and reviewed the initial and final reports from these five vendors. The reports are marked competition-sensitive and proprietary by the vendors and cannot be released to the public.

3.2 Progress in FY 2009

On March 20, 2009, NOAA issued the set B RFQ for additional price validation and technical feasibility studies. (See Table 1 for a list of the set B requirements.) NOAA received the set B RFQ proposals on April 14, 2009. NOAA awarded ten study contracts on June 8, 2009, with a total value of \$250,000 to seven companies and one university. NOAA received reports at the end of August and has completed its analysis of the study reports.

- Iridium Satellite, LLC of Bethesda, Maryland, was awarded \$50,000 for a study validating the price and technical feasibility for Sea Surface Topography measurements and a study validating the price and technical feasibility for Earth Radiation Budget measurements.

¹ Mention of a commercial product or company does not constitute or imply an endorsement by NOAA for the award of future contracts.

- ITT Space Systems, LLC of Ft. Wayne, Indiana, was awarded \$50,000 for a study validating the price and technical feasibility for Geostationary Atmospheric Sounding measurements and a study validating the price and technical feasibility of Ocean Color measurements.
- GeoEye, Inc. of Dulles, Virginia, was awarded \$25,000 for a study validating the price and technical feasibility for Ocean Color measurements.
- Space Systems/Loral, Inc. of Palo Alto, California, was awarded \$25,000 for a study validating the price and technical feasibility for Geostationary Atmospheric Sounding measurements.
- Mississippi State University of Mississippi State, Mississippi, was awarded \$25,000 for a study validating the price and technical feasibility for Ocean Color measurements.
- Orbital Sciences Corporation of Dulles, Virginia, was awarded \$25,000 for a study validating the price and technical feasibility for Earth Radiation Budget measurements.
- Sierra Nevada Corporation, Space Systems of Littleton, Colorado, was awarded \$25,000 for a study validating the price and technical feasibility for Earth Radiation Budget measurements.
- Surrey Satellite Technology US, LLC of Englewood, Colorado, was awarded \$25,000 for a study validating the price and technical feasibility for Earth Radiation Budget measurements, Sea Surface Topography measurements, and Geostationary Atmospheric Sounding measurements.

On August 6, 2009, NOAA issued the set C RFQ for additional price validation and technical feasibility studies. (See Table 1 for a list of the Set C requirements.). NOAA received the set C RFQ proposals on August 21, 2009. NOAA awarded four study contracts to three companies on September 9, 2009, with a total value of \$100,000. Studies were completed at the end of calendar year 2009.

- Sierra Nevada Corporation of Louisville, Colorado, was awarded \$25,000 for a study validating the price and technical feasibility for ozone profile measurements.
- Orbital Sciences Corporation of Dulles, Virginia, was awarded two contracts. The first for \$25,000 for a study validating the price and technical feasibility for ozone profile measurements. The second contract for \$25,000 for a study validating price and technical feasibility for aerosol polarimetry measurements.
- Iridium Satellite LLC of Tempe, Arizona, was awarded \$25,000 for studies validating the price and technical feasibility for ozone profile measurements.

3.3 Challenges

There are numerous challenges to using commercial data sources to supplement NOAA's core satellite systems. NOAA's full and open data policy is derived from the Office of Management and Budget's (OMB's) Circular No. A-130 and the Management of Federal Information Resources and is reflected in the 2006 National Space Policy (see Appendix B). This policy allows NOAA to widely distribute its products and services to support its public safety and

global environmental monitoring mission. This free and open data policy could potentially conflict with the propriety data management incentives that the commercial space sector may require to devise an effective business strategy to satisfy its need for a reasonable profit.

Furthermore, pursuant to the existing National Space Policy, NOAA is responsible for developing, acquiring, and operating GOES and POES satellites to meet the Nation's operational weather, climate, space weather, and environmental observation requirements. NOAA may develop relationships with other federal agencies, such as NASA or DoD, to accomplish this task. NOAA may also develop international partnerships to meet its data needs and may acquire data and services from the commercial sector to supplement data provided by NOAA's two core satellite systems—GOES and POES. However, NOAA is prohibited from leasing, selling, transferring to the private sector, or commercializing its weather satellite systems. (See 15 §§ U.S.C. 5671-5672 and Appendix C). This provision could become a barrier if the acquisition of commercial data sources to supplement NOAA's core satellite system is viewed as an attempt to commercialize NOAA weather satellites.

There are also challenges that must be met by the commercial sector. Delivering precise Earth data records and measurements will require accommodating strict technical requirements set forth by the scientific community. The sensors used to gather these data require pointing accuracies and tolerances for platform stability that are often quite different from, and more demanding than, commercial operations. Through the RFQ process, NOAA intends to evaluate the technical feasibility of each company's proposal(s) to meet these requirements.

In addition, while established commercial operators have a proven record of performance and are well-funded corporate entities, standardized technical interfaces and integration processes are not well formed for accommodating United States Government (USG) requirements. Some USG precedents (for the procurement of services from the commercial space sector) do exist but these differing approaches are mostly one-of-a-kind missions and no clear standardization within the commercial sector has been established. Understanding and flexibility both within the USG and the commercial sector are needed to achieve a symbiotic relationship that allows for cost saving within the government programs.

3.4 Preliminary Findings and Impact on NOAA Planning

NOAA analyzed the eight study reports developed under the Set A RFQ contracts and found that the potential services described in the studies have potential value and could be advantageous to the government.

The services included data purchases, sensors on commercial satellites, and low-cost acquisition of and co-launch with, commercial class satellites. Some of the proposed services require a review by the Department of Commerce Office of General Counsel and contracting officials to implement. Review of the types of proposed commercial services is underway. Pending approval, these services could constitute a planning baseline for several requirements.

In addition, the potential for commercial services is greatly dependent on market conditions. NOAA intends to closely monitor the economic health of the industry. Based on the Set A RFQ studies, the following commercial solutions are potentially mature enough for further pursuit:

- Coronal Mass Ejection Imagery – commercial data purchase
- Total Solar Irradiance Monitoring – government developed payload on a commercial satellite
- Solar Wind Data – commercial data purchase
- GPS Radio Occultation – commercial data purchase or a government developed payload on a constellation of commercial satellites

For all four potential commercial approaches listed above, an independent cost estimate would be required to determine which acquisition approach provides the best overall value. Any future commercial approach would be subject to available resources.

4.0 CONCLUSIONS

NOAA is continuing to assess the availability and viability of data from commercial sources. NOAA will pursue potential agreements with the commercial sector when it can provide data that addresses NOAA's requirements at a reasonable cost to the taxpayer. The current RFIs from the commercial sector will assist NOAA with its assessment of what data can be acquired commercially. Some of the key considerations the commercial sector must demonstrate include:

- Ability to provide sustained and uninterrupted observations from space to meet operational requirements,
- Compliance with NOAA's data policy for full and open exchange and distribution of data,
- Demonstrated technical feasibility to acquire and deliver the observations and data in a reliable and timely manner, and
- Affordability of operations and cost-effectiveness to the Government.

In summary, NOAA's plan for the next three years includes:

- Subject to available resources, continue to purchase commercially available Earth observation data to meet current operational needs,
- Pending further analysis of the RFQ results and where feasible and appropriate, develop contracts for purchasing commercial data to meet Earth and space weather needs, and
- Where feasible and appropriate, develop contracts for Government-furnished payloads on commercial satellites, pending further analysis of the RFQ results.

APPENDIX A: Description of the NOAA Planning, Programming, Budgeting, and Execution System Process

The Planning, Programming, Budgeting, and Execution System (PPBES) is the process NOAA utilizes to link NOAA's strategic vision with programmatic detail, budget development, and annual operating plans. A major decision-making process, the PPBES permits the Line Offices, goal teams, and programs to undertake joint planning and link directly to NOAA's Programming, Budgeting, and Execution phases.

The PPBES process ties strategy, planning, program, and budget together. The objectives of the PPBES are to:

- Provide an essential focus on NOAA's policy, performance, and priorities for functional activities,
- Determine quantity and quality of required resources to support the national oceanic and atmospheric strategy,
- Distribute available manpower, dollars, and material among competing requirements per NOAA resource allocation policy and priorities,
- Convert program decisions on dollars and resources into requests for congressional authorization and appropriations, and
- Manage and account for funds to carry out approved programs.

APPENDIX B: Excerpts from the U.S. National Space Policy. August 31, 2006.

6. Civil Space Guidelines

The United States shall increase the benefits of civil exploration, scientific discovery, and operational environmental monitoring activities. To that end, the Administrator, National Aeronautics and Space Administration shall: execute a sustained and affordable human and robotic program of space exploration and develop, acquire, and use civil space systems to advance fundamental scientific knowledge of our Earth system, solar system, and universe.

The Secretary of Commerce, through the Administrator of the National Oceanic and Atmospheric Administration, shall in coordination with the Administrator, National Aeronautics and Space Administration, be responsible for operational civil environmental space-based remote sensing systems and management of the associated requirements and acquisition process as follows:

- The Secretary of Commerce, through the National Oceanic and Atmospheric Administration, in collaboration with the Secretary of Defense through the Secretary of the Air Force, and the Administrator, National Aeronautics and Space Administration will continue to consolidate civil and military polar-orbiting operational environmental sensing systems in accordance with current policy direction;
- The Secretary of Commerce, through the National Oceanic and Atmospheric Administration, shall continue a program of civil geostationary operational environmental satellites with support from the National Aeronautics and Space Administration; and
- The Secretary of Commerce, through the National Oceanic and Atmospheric Administration, and the Administrator, National Aeronautics and Space Administration shall ensure to the maximum extent possible that civil space acquisition processes and capabilities are not duplicated.

The Secretary of the Interior, through the Director of the U.S. Geological Survey, shall collect, archive, process, and distribute land surface data to the United States Government and other users and determine operational requirements for land surface data.

The United States will study the Earth system from space and develop new space-based and related capabilities to advance scientific understanding and enhance civil space-based Earth observation. In particular:

- The Administrator, National Aeronautics and Space Administration shall conduct a program of research to advance scientific knowledge of the Earth through space-based observation and development and deployment of enabling technologies; and
- The Secretary of Commerce and the Administrator, National Aeronautics and Space Administration, and other departments and agencies as appropriate, in support of long-

term operational requirements, shall transition mature research and development capabilities to long-term operations, as appropriate.

The United States will utilize government and commercial space-based and related capabilities wherever feasible to enhance disaster warning, monitoring, and response activities; and take a leadership role in international fora to establish a long-term plan for coordination of an integrated global Earth observation system and promote the adoption of policies internationally that facilitate full and open access to government environmental data on equitable terms.

7. Commercial Space Guidelines

It is in the interest of the United States to foster the use of U.S. commercial space capabilities around the globe and to enable a dynamic, domestic commercial space sector. To this end, departments and agencies shall:

- Use U.S. commercial space capabilities and services to the maximum practical extent; purchase commercial capabilities and services when they are available in the commercial marketplace and meet United States Government requirements; and modify commercially available capabilities and services to meet those United States Government requirements when the modification is cost effective;
- Develop systems when it is in the national interest and there is no suitable, cost effective U.S. commercial or, as appropriate, foreign commercial service or system that is or will be available when required;
- Continue to include and increase U.S. private sector participation in the design and development of United States Government space systems and infrastructures;
- Refrain from conducting activities that preclude, deter, or compete with U.S. commercial space activities, unless required by national security or public safety;
- Ensure that United States Government space activities, technology, and infrastructure are made available for private use on a reimbursable, non-interference basis to the maximum practical extent, consistent with national security; and
- Maintain a timely and responsive regulatory environment for licensing commercial space activities and pursue commercial space objectives without the use of direct Federal subsidies, consistent with the regulatory and other authorities of the Secretaries of Commerce and Transportation and the Chairman of the Federal Communications Commission.

APPENDIX C: United States Code Title 15, Chapter 82 - Land Remote Sensing Policy
Subchapter VI - Prohibition Of Commercialization Of Weather Satellites

Sec. 5671. Prohibition

Neither the President nor any other official of the Government shall make any effort to lease, sell, or transfer to the private sector, or commercialize, any portion of the weather satellite systems operated by the Department of Commerce or any successor agency.

Sec. 5672. Future considerations

Regardless of any change in circumstances subsequent to October 28, 1992, even if such change makes it appear to be in the national interest to commercialize weather satellites, neither the President nor any official shall take any action prohibited by section 5671 of this title unless this subchapter has first been repealed.

APPENDIX D: Acronyms and Abbreviations

DoD	Department of Defense
FY	Fiscal Year
GOES	Geostationary Operational Environmental Satellites
GOES-R	GOES-R Series
GPS	Global Positioning System
GPSRO	GPS Radio Occultation
LLC	Limited liability company
NASA	National Aeronautics and Space Administration
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
OMB	Office of Management and Budget
PPBES	Planning, Programming, Budgeting, and Execution System
POES	Polar-orbiting Operational Environmental Satellites
P.L.	Public Law
R&D	Research and Development
RFI	Request for Information
RFQ	Request for Quotations
SAR	Synthetic Aperture Radar
SeaWiFS	Sea-viewing Wide Field-of-view Sensor
U.S.C.	United States Code
US GEO	U.S. Group on Earth Observations
USG	United States Government