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The Honorable Dana Rohrabacher
Chairman, Subcommittee on Energy and Environment
Committee on Science
House of Representatives

Dear Mr. Chairman:

As part of our ongoing review of the National Oceanic and Atmospheric Administration's (NOAA) weather satellite systems, you asked for interim information on NOAA's plans for acquiring future spacecraft for its Geostationary Operational Environmental Satellite (GOES) system. The GOES satellite system provides critical data to weather forecasters, particularly about extremely hazardous weather such as hurricanes and severe thunderstorms. Specifically, you asked for information on (1) what cost savings NOAA currently anticipates from purchasing one or more functional equivalents, or "clones," of the current GOES series on a sole-source basis from the original contractor rather than holding a competition for replacement spacecraft, (2) the status of requirements definition for future replacement spacecraft, and (3) previous recommendations by other organizations to NOAA on exploring alternatives to its existing geostationary architecture.

BACKGROUND

The current satellites, GOES-8 and GOES-9, were launched in April 1994 and May 1995, respectively. Each is expected to operate for 3 years. NOAA has three additional satellites on order and currently anticipates launching the last of these in April 2001, at which time the first of a new series of follow-on GOES satellites will

be needed to serve as a backup.[1] NOAA, in collaboration with the National Aeronautics and Space Administration (NASA),[2] is now planning how to procure this follow-on series of up to five GOES satellites. According to the President's fiscal year 1997 budget, the projected costs for four additional satellites, including launch and operations, total $2.2 billion through completion.[3]

NOAA and NASA considered several approaches for procuring the five follow-on satellites. One approach involved procuring clones of the current series of satellites by awarding sole-source contracts to Space Systems/Loral, Inc., the current provider of the spacecraft itself (the spacecraft "bus"), and to the ITT Corporation, the current provider of the spacecraft's meteorological instruments. Another approach entailed procuring clones of the spacecraft's instruments from ITT but holding an open competition for the spacecraft bus, inviting bidders to propose commercially developed, off-the-shelf alternatives that might be less expensive than the current design.

A third approach would have been to consider completely new designs for the spacecraft bus and/or instruments. According to aerospace experts,[4] a major benefit of adopting new designs that incorporate significant technological advances

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[1]Satellites in the current series, including the three spacecraft on order, have been designed to last 5 years each. According to NOAA program officials, the two spacecraft currently in orbit have experienced technical problems, including instrument scan motor winding failures on both GOES-8 and GOES-9 and electrostatic discharge damage on GOES-8, that are likely to limit the lifetimes of those two satellites to 3 years each. NOAA plans to correct these problems for the next three spacecraft. If the next three spacecraft all lasted 5 years each, the first new follow-on satellite wouldn't be needed until April 2002. However, NOAA recently determined that the first of the corrected satellites is likely to last only 4 years, because of what it believes to be the added risk of failure associated with it being the first satellite to incorporate the planned fixes to the technical problems. Thus the stated need date for the first follow-on satellite has now moved up to April 2001.

[2]NASA is responsible for the procurement, development, and verification testing of the GOES spacecraft, instruments, and unique ground equipment as well as launching the spacecraft.

[3]NOAA expects the program to be complete after the last satellite is successfully launched and operated for 5 years. Launch of the last satellite is currently projected for 2010.

[4]Improving NASA's Technology for Space Science, National Academy of Sciences' National Research Council, National Academy Press, 1993.

is that once they are developed and tested, they can make the satellites considerably less expensive and more efficient to build and operate. NOAA officials told us that they rejected this approach because they believe a new meteorological satellite design would be too expensive, take too long (10 years) to develop, and would be technically risky.

Agency officials do not believe that even a spacecraft using a commercial off-the-shelf bus design and clone instruments could be ready for launch by April 2001 because they believe an additional 2 years would be needed to conduct the competition. Accordingly, NOAA recently made a tentative decision to adopt a strategy based on combining the first two approaches discussed above. A sole-source contract for one or two clones of the current spacecraft would be awarded in order to meet the April 2001 need date. This would be followed by a competition for buses for the following two to four spacecraft. Up to four of the new spacecraft would carry identical copies (clones) of the current set of meteorological instruments. NOAA officials said that enhancements to the instruments might be considered for the later satellites in this series.

SAVINGS NOT EXPECTED FROM SOLE-SOURCE "CLONE" PROCUREMENT

NOAA officials told us that they did not perform a cost analysis specifically to determine whether their planned sole-source contract for one or two GOES clones would be cheaper than holding a competition for replacement spacecraft. In making this decision, NOAA officials believed that they could not complete a competitive procurement in time to meet their perceived need date of an additional satellite by 2001. However, at an earlier point in NOAA's planning process, NASA's Goddard Space Flight Center compared estimated costs for purchasing four spacecraft, either as clones of the existing series through a sole-source contract or through a competitive procurement. According to NOAA, the NASA analysis showed that a sole-source contract would be 5 percent more expensive than a competitive procurement.

STATUS OF REQUIREMENTS DEFINITION FOR THE FOLLOW-ON SERIES

Although NOAA is proceeding with its procurement plans for both the spacecraft and instruments, GOES system requirements have not been formally revalidated since the late 1980s. Most of the current requirements were established in 1983 by the National Weather Service (NWS) for the GOES-Next series. Additional requirements were generated in 1989 by a GOES follow-on requirements working group. A revised high-level requirements document was drafted in 1994 but never finalized.

According to NWS officials, the uses of GOES data have changed considerably since NOAA's needs were last evaluated. Recognizing this, NWS and the National Environmental Satellite, Data, and Information Service (NESDIS) have proposed a plan to assess the utilization of GOES data in order to determine future requirements. They estimate that the plan will take 2 to 3 more years to complete, once approved.

ALTERNATIVE ARCHITECTURES

A number of scientific committees, including the National Research Council, and most recently, an advisory panel convened at the request of the Congress to review the feasibility of shifting to smaller satellites for the Intelligence Community, have concurred on the feasibility of adopting cheaper and more flexible satellite system architectures for many kinds of space missions. With respect specifically to GOES, several reports have recommended that alternatives to the existing architecture be explored. For example:

- The 1991 GOES-N Report, prepared by the Advanced Missions Analysis Office of NASA's Goddard Space Flight Center, recommended that NOAA assess the benefits of flying a constellation of three spacecraft, each dedicated to a single instrument.

- A 1993 MITRE report concluded that the GOES imaging instrument could be replaced by newer technology flown on commercial communications spacecraft. The report outlined a program plan for developing the instrument and identified launch opportunities.

- Most participants in a 1995 Office of Technology Assessment workshop agreed that the potential of using small satellites or commercial systems as possible adjuncts or substitutes for GOES warranted further investigation by NOAA. However, NOAA officials believe that legal constraints against the commercialization of weather satellite systems may limit this option.

Several proposals have been submitted to assess the feasibility of these recommendations. In 1995, NOAA submitted two proposals to NASA's New Millennium Program to explore technologies and concepts for advanced instruments for future GOES satellites. However, NASA has not yet funded either of these proposals. More recently, NASA's Goddard Space Flight Center proposed a technology demonstration project, called the Geostationary Advanced Technology Environmental System, to test the applicability of small satellite technology to the GOES mission. NOAA officials told us that they cannot afford to pursue NASA's proposal using NOAA resources because doing so would divert funds critical to carrying out their operational program. However, they urged NASA to fund the project itself.

AGENCY COMMENTS

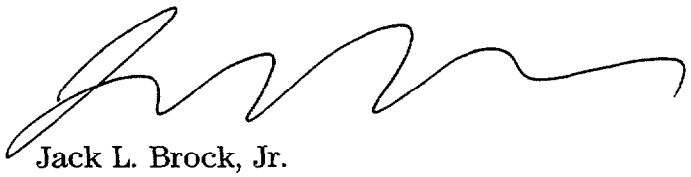
In commenting on a draft of this report, the Department of Commerce provided updated information regarding the status of NOAA's two operational GOES satellites, its plans for procuring additional satellites, and activities related to examining technical options for future spacecraft. We have incorporated this information in our report, where appropriate.

NOAA provided the information about planning activities for future spacecraft as an indication that it is taking steps to define requirements for replacement GOES satellites. We discussed these activities with NOAA and NASA officials and reviewed the related documentation that was made available to us. We do not believe that these activities, which focus on technological enhancements to the spacecraft's existing meteorological instruments as well as the development of new instruments for possible future incorporation into the GOES system, to be part of a formal requirements determination process. The formal discipline of establishing requirements begins with an analysis of users' needs in order to ensure that these, and not solely the advance of technological capabilities, drive a system's design. This is the objective of NWS and NESDIS' planned assessment mentioned above.

To provide this interim report, we met with NOAA officials from the GOES Program and the Satellite Acquisition Office to discuss the status of planning for the GOES follow-on program. To determine the status of the requirements definition process, we also met with program officials and representatives from NWS. In addition, we reviewed GOES program documentation and reports and proposals from the satellite research and development community and spoke with the authors of several reports. We have been conducting this review in accordance with generally accepted government auditing standards since March 1996. Our review is ongoing.

We are sending copies of this letter to each member of the Subcommittee on Energy and Environment, House Committee on Science, and other interested parties. We will send copies to others upon request. If you have questions or wish to discuss the issues in this letter, please contact me at (202) 512-6240 or John de Ferrari, Assistant Director, at (202) 512-6335. Major contributors to this letter are Elizabeth Johnston and Jamelyn Smith.

Sincerely yours,



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