

On NOAA Requirements for Polar-Orbiting Environmental Satellites: Letter Report

Committee on Earth Studies, National Research Council

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On NOAA Requirements for Polar-Orbiting Environmental Satellites

On April 30, 1992, Committee on Earth Studies Chair John H. McElroy sent the following letter to Mr. Russell Koffler, deputy assistant administrator for NOAA's National Environmental Satellite, Data, and Information Service.

At its recent meeting in Washington, D.C., the Committee on Earth Studies (CES) conducted the preliminary review you requested of the draft document entitled *NOAA Requirements for Support from Polar-Orbiting Satellites*. Although the committee notes omissions and makes suggestions for further work, it finds the draft to be a proper first step in defining an objective and quantitative basis for projecting future observational requirements for polar-orbiting satellites.

The document states many of the measurements that the CES perceives to be required. Because the scope of NOAA's programs is so broad, the cumulative requirements presented correspond, in some respects, to the nation's overall needs for polar-orbiting remote sensing of the atmosphere, oceans, coastal areas, ice, and marine life. Since NOAA is the federal agency charged with meeting these long-term, operational needs, the committee suggests that NOAA consciously survey their requirements from an integrated perspective.

In spite of the document's appearance of inclusiveness, there are shortcomings; for example, the needs of the National Marine Fisheries Service are described in less detail than those of any other NOAA line office. This treatment does not adequately reflect the future needs of the Fisheries Service.

Even nearer term, the document shows no current or projected use of Landsat or Landsat-like data, not even for estuaries and coastal regions. The measurement of sediment plumes from estuaries, pollution, and coastal mapping are all illustrations of important applications of Landsat data for NOAA offices.

The committee recommends that the draft be revised to reflect a change in philosophical perspective. A document that looks decades or more into the future should be more expansive. Indeed, the present document assumes that none of the numerous polar-orbiting research satellites scheduled for launch in the 1990s

and early 2000s will affect the instrument complement of NOAA's polar-orbiting operational satellites of the future.

The spacefaring nations of the world are developing new techniques for Earth remote sensing and are advancing past successes. These new capabilities are correctly noted in the draft, but the assumed NOAA baseline system for 2002 and beyond is simply a continuation, admittedly with some modest change, of the observing system that has been in place since the late 1970s. Further, spacefaring and non-spacefaring nations alike are expanding their use of satellite-derived remote-sensing data and improving the application of these data to research and operational needs. With profound changes occurring in technological capability and in the application of enhanced capabilities, it does not appear reasonable for NOAA's baseline to be unaffected over a period of 25 years or more.

The CES recognizes that the nation has severe budget problems today, and may have them again in the future. A multi-decadal planning document, however, should reflect what are evident future possibilities, and not be limited in its vision by current, transitory restrictions. Future budget decisions may indeed restrict NOAA's ability to exploit the latest scientific and technical developments, but the anticipation that adverse budget decisions will be made at some hypothetical point in the future should not constrict the consideration of future prospects.

In planning the observing systems to be deployed 10 or more years in the future, NOAA should not only build upon what is known at present, but also make plausible projections of what will be learned from systems to be flown in the interim. NOAA should also examine the advances in the use of data from these and operational systems. Planning must assume an intellectually plausible degree of success and then be flexible enough to respond to greater or lesser degrees of success. Thus NOAA must project both its line-offices' needs and the results of missions that are currently under way and/or approved for the next decade. This is not done in the section of the draft that relates the planned satellite baseline to future requirements.

An example regarding ocean measurements should clarify this point. NOAA has the charter to provide weather, marine, and climate forecasts. There is no rationale that would suggest that society's needs for such forecasts will diminish in the future. However much such forecasts improve, society will continue to demand even more improvement.

To be more specific, our need to understand the ocean surface better is an evident and increasingly important objective for many user communities. Regular marine operations, whether for fishing or the transport of goods, require a better knowledge of present conditions and an improved prediction of future conditions. Likewise, the production of improved weather forecasts through numerical computer models will require a better characterization of the atmosphere-ocean interface (fluxes of heat, moisture, gases, and momentum on synoptic time scales). Still further, the understanding of climate change requires an improved

understanding of ocean circulation and basin-scale air-sea interaction. Thus three communities of users quite predictably will seek a better knowledge of ocean conditions.

There are a number of instruments that can contribute to a better understanding of the ocean, but two—the radar altimeter and scatterometer—have become a consensus choice, if consensus is measured by the number of such instruments that have been flown or will be flown in space by a number of nations. The state of development of these instruments has progressed to the extent that the relevant communities are convinced that their long-term and operational use will contribute to the objectives of improved support to marine operations, weather forecasting, climate prediction, and marine research in general. The CES notes that all of these applications require a continuing, permanent observational capability and that the instruments must be designed to produce scientifically useful data of sufficient accuracy, resolution, and spatial coverage. The instruments will evolve and data processing techniques will continue to improve, but the measurement of sea conditions must continue permanently.

In this instance, the assumption of success is less speculative than in almost any multi-decadal projection the CES members can imagine. Therefore, when planning observational systems for operation beyond 2002, NOAA's baseline should either include altimeters and scatterometers on its satellites or secure data of comparable quality on an operational basis from other national or international partners. NOAA has made a commendable effort to use data collected by other organizations, and should continue to do so in the future. However, if the data are indeed required, NOAA must ensure that the agreements it enters into address explicitly not only quality and type, but also the continuity, reliability, and freedom of use necessary to meet the needs of NOAA's operational and research constituencies.

In sum, the CES believes that the draft report *NOAA Requirements for Support from Polar-Orbiting Satellites* is a necessary start. The report should, however, be recirculated within NOAA to ensure its completeness. This is particularly needed with respect to the treatment of National Marine Fisheries Service requirements and of the potential use of Landsat or Landsat-like data in all of the line offices. Most importantly, however, the planning perspective for the early 2000s should be considerably more aggressive for all of NOAA's offices.

The committee believes that the document should be revised and completed promptly, and then periodically reviewed and updated as programs evolve. In particular, the document's statement of physical parameters to be measured by satellites, together with their spatial, spectral, and temporal resolution and their corresponding precision, needs to be evaluated on a continuing basis.

The CES will continue its assessment of the revised NOAA draft document at future meetings. The committee also intends to study the requirements of some of NOAA's line offices in more detail. To carry out this review, it will be necessary for CES to obtain a better understanding of the overall flow of polar-orbiting satellite

data and the related ground processing systems. One topic that the committee especially wishes to investigate is how improvements in numerical weather and climate forecasting models will drive the requirements for data from operational satellites.