

**NESDIS RESPONSE REGARDING
OFFICE OF RESEARCH AND APPLICATIONS' (ORA) FUNCTIONS
AND CAPABILITIES FOR THE
NOAA RESEARCH REVIEW TEAM DATA REQUEST
February 6, 2004**

- 1.) The most recent external evaluation of ORA, conducted by the NOAA Science Advisory Board, is provided in the attached file ORAExtSciRvw.pdf
- 2.) Mission and History of the Office of Research and Applications (ORA)

The Office of Research and Applications conducts research on the use of satellite data for monitoring meteorological, climatological and oceanographic environmental characteristics.

NESDIS has always had an operations-driven research unit, currently the Office of Research and Applications. It provides leadership, guidance, and direction for NESDIS product development, readiness and applications activities with respect to satellites and satellite data. The main objectives of ORA are to ensure that satellite remote sensing data and information products are of the highest quality possible and to enhance their utilization for the large community of government, commercial, and international users. ORA contributes heavily to the NOAA missions of environmental assessment, prediction, and stewardship today, and will continue to do so in the future. ORA provides counsel to NESDIS management to assure the Nation maintains a state of the art, vibrant operational environmental satellite program that evolves based on sound scientific principles. Through its Divisions, Cooperative Institutes, and the Joint Center for Satellite Data Assimilation, ORA conducts applied research in atmospheric, land and oceanic remote sensing for monitoring environmental characteristics and their change. ORA responsibilities include developing applications of satellite data as well as developing algorithms and prototype software systems that are transitioned into the operational production of satellite products relevant to NOAA's mission.

ORA advises and works with other units of NESDIS, such as the Integrated Program Office, the Office of Satellite Operations, the Office of Satellite Development, the Office of Satellite Data Processing and Distribution and the NESDIS Data Centers. Problems addressed by ORA of common interest within NESDIS include new satellite and instrument development, data and product calibration/validation, algorithm development and improvement, and mitigation of operational problems with satellite instruments and instrument calibration. ORA also works closely with the most important operational users of NESDIS data such as the NWS (NCEP, CPC) and other operational Numerical Weather Prediction (NWP) centers.

NESDIS is an operational unit of NOAA and as such requires operationally-driven applied research. As the research arm of NESDIS, ORA must maintain close collaboration with the NESDIS operational elements, with the satellite acquisition offices (IPO and OSD), the important users of satellite data in NOAA (like the National Weather Service), and in tune with many of our Nation's commercial users of the satellite data and products. At the same time, NESDIS/ORA maintains ties to other governmental and private sector users of NOAA supplied satellite data and products. User requirements are assessed by means of workshops, science advisory groups, academia and through direct interactions with the climate and science communities. Also, NESDIS maintains a database of required/desired measurements and accuracies for the plethora of possible environmental parameters from the entire user community (government, commercial, etc) that is used to guide and focus ORA efforts.

3.) List of Major Customers and Services Provided by ORA

National Weather Service's National Centers for Environmental Prediction: ORA ensures the quality of satellite observations used for numerical weather prediction, climate prediction and analysis. ORA develops significant portions of the methods for assimilating satellite data into NWP models. These services are also provided to the operational NWP centers of international partners. ORA also provides training in the use of satellite data and products to the NWS forecast offices and works collaboratively with the NCEP Hurricane Center on use of satellite data in tropical storm forecasts.

National Ocean Service: NESDIS provides near real-time environmental satellite data and data products for mission critical use in warnings, forecasts and research involving health of the marine ecosystem. ORA facilitates the delivery of these data to the marine user community. Also ORA supports NOS in targeted product development and deployment. ORA also supports general development approaches for using satellite data for ocean applications.

National Marine Fisheries Service: NESDIS provides near real-time environmental satellite data and data products for use in mission critical use in warnings, forecasts and research involving health of the marine ecosystem. ORA works closely with NMFS scientists to integrate satellite data and products are used to support mission requirements in habitat research, stock assessment, and endangered / threatened species protection and management

The Integrated Program Office: ORA provides scientific and technical expertise to support sensor design reviews, pre-launch sensor calibration, oversight of operational algorithm development for required data products, and planning for post-launch validation of data for the National Polar-orbiting Operational Environmental Satellite System.

NESDIS Office of Satellite Operations: Provide analysis of on-orbit sensor characterization data to detect and mitigate performance degradation for NOAA's operational polar and geosynchronous orbiting satellites.

NESDIS Office of Satellite Data Processing and Distribution: ORA develops algorithms and operational software systems for deriving new and improved satellite data products for transition to operations by OSDPD. ORA also supports near-real calibration and validation of OSDPD products and works closely with our sister production organization to ensure all products are the highest quality possible given that aging sensor must have their data adjusted to standard values for consistent and widespread use across the community of users.

National Aeronautics and Space Administration: ORA develops product retrieval algorithms and provides validation and supports transition to operational use for data from NASA satellite sensors, for example, from sensors on the TERRA and AQUA spacecraft. These spacecraft contain the prototype sensors that will support the next generation of weather satellites (NPOESS and GOES) and their sensors in preparation for future operations. To ensure future operational readiness, ORA must work on these advancements today (seven or more years ahead of the first operational mission) .

Department of Defense: ORA provides on-orbit characterization for the DMSP satellites sensors for use in civilian and military weather prediction programs, and delivers imagery from NOAA satellites in support of military operations. ORA also works collaboratively with the Naval Research Laboratory in the calibration, validation, and operational weather product development for the Navy's WindSat/Coriolis polarimetric radiometer satellite

NESDIS Office of Satellite Data Processing and Distribution: ORA develops algorithms and operational software systems for deriving new and improved satellite data products for transition to operations by OSDPD. ORA also supports near-real calibration and validation of OSDPD products and works closely with our sister production organization to ensure all products are the highest quality possible given that aging sensor must have their data adjusted to standard values for consistent and widespread use across the community of users.

Federal Aviation Administration and Commercial Aviation Industry: ORA develops improved satellite data products for detecting aviation hazards such as icing and volcanic ash.

Environmental Protection Agency: ORA is developing air quality data products derived from satellite observations.

4. Summary of research being conducted in ORA and related NOAA program areas to support product development, readiness and applications of satellite data are discussed below:

a. Research themes and brief explanations.

ORA has organized its applied research via key related subjects in research project plans (RPP) which contain approximately 40 focus areas for improving product development, readiness and applications of satellite data. Some of the more important applied research focus projects are grouped and summarized below:

Sensor development, characterization, and calibration

The NESDIS satellite instrument data can not be used until the sensors are calibrated. This is a fundamental activity of ORA and is absolutely required on an ongoing basis. The sensors also have to be characterized for assimilation into NWP models and for climate use. ORA supports and advises the IPO on the design, development and deployment of new spacecraft and sensors. This is a critical activity of ORA and supports goal-wide elements. ORA undertakes field campaigns involving ships, buoys, and aircraft in support of satellite calibration requirements for USG and foreign environmental satellites. In certain classes of satellites ORA scientific and engineering capability in calibration and validation is internationally unique.

Atmospheric retrievals (wind, temperature, moisture, ozone and trace constituents)

The most important use of atmospheric retrievals (including sounder radiances) is initial conditions for operational NWP models. The sounder data make up most of the information going into the forecast models. Atmospheric retrievals are also used for real-time hurricane forecasting. Other important uses of ozone and atmospheric trace constituents are for climate monitoring and research. The ORA does research into retrieval methods and derivation of long term time series. This research is a core activity of ORA and supports goal-wide elements.

Hazard detection (wildfires, volcanic eruptions, sea ice, harmful algal blooms)

Improved techniques for detecting and retrieving information about natural hazards is of considerable importance to agencies managing the nation's natural resources and agencies responsible for prevention and mitigation of natural

disasters. This effort contributes to the Weather and Water program element.

Data assimilation

Direct assimilation of satellite data and products into NWP and climate models shows great promise as an efficient and effective way of using satellite information. The Joint Center for Satellite Data Assimilation is the means by which ORA works closely with partners (NCEP, NASA, and DoD) to conduct research in data assimilation. This effort contributes to Weather and Water and Climate program elements.

Clouds and aerosols

Better cloud and aerosol products are of interest as future products for assimilation in NWP models, for correction of surface products (SST, NDVI) that are impacted by aerosol effects, and as diagnostics of and contributors to climate change. That is the rationale for continuing ORA research into cloud and aerosol algorithms. The research contributes to NOAA program activities in Weather and Water and Climate.

Air quality

ORA has a project underway to use current operational aerosol products to monitor air quality and explore the assimilation of the aerosol data in NCEP's air quality forecast model. This effort is expected to demonstrate the usefulness of aerosol assimilation in improving air quality forecast and lead the way to use aerosol products from next generation instruments on the EOS-Aura, NPP, NPOESS and GOES-R platforms. In the current phase of this project, a combination of ground observations, photochemical model simulations, and aerosol retrievals from current operational satellites is being used to study regional air quality in US and conduct various cross validation studies. The next phase will involve aerosol assimilation work to conduct impact studies on the usefulness of satellite data in improving air quality forecast.

Aviation weather products

Specialized products for the aviation community provide important information about hazards such as fog and low clouds, enroute aircraft icing, convective microbursts, turbulence, and volcanic ash clouds. In addition, cloud motion vectors help to identify jet streams and other significant upper air features over data-void regions. This research contributes to NOAA activities that provide Safe and Efficient Transportation.

Land products (vegetation, drought, snow cover, etc.)

This research is aimed primarily at providing surface boundary conditions to operational NWP models. Other uses are agricultural monitoring, hazards detection and mitigation, climate monitoring and research, and environmental monitoring. Research involves better and more current land surface characteristics (snow, green vegetation fraction, albedo) delivered to NWP centers

and better long term time series data sets for climate monitoring. This research supports NOAA program activities under Weather and Water, Climate and Ecosystems.

Climate Data records

The satellite data record now exceeds two decades in length and for some products is even longer. However, for climate monitoring and research, the satellite data needs to be reprocessed into Climate Data Records (CDRs) for which careful attention is paid to calibration and product stability over time. Research into procedures for producing and validating CDRs is a long term activity for ORA. It supports the NOAA Climate program area.

Precipitation

Satellite estimates of precipitation and rain rate are the best source of precipitation information over the oceans and less populated parts of the Earth. Satellite precipitation estimates are important for validating and forcing NWP models, for climate monitoring, and for hydrological interests. Improved precipitation algorithms and products are a long-term ongoing research activity in ORA and support the Weather and Water and Climate program areas.

Ocean Color

Ocean color data and products are developed and distributed to researchers by the ORA. These products are used to characterize the health and activity of marine plant life and to make inferences about the viability of ecosystems which are dependent on that life. This activity supports the Ecosystems and Climate program areas.

Ocean Surface Winds

Satellite-based microwave scatterometers provide near-surface wind vectors covering three-fourths of the globe. Global ocean surface wind data are useful for NWP, and for marine meteorological analysis, offering improved identification and location of low pressure systems and cyclonic storms. ORA's research with ocean surface winds and scatterometry supports the weather and water and climate program areas. ORA conducts flight research using NOAA's WP-3D aircraft to directly measure the wind modulated ocean surface and characterize satellite-based scatterometer measurements. ORA also develops improved, high resolution scatterometer wind products and wind retrieval algorithms for the WindSat polarimetric radiometer.

Sea Surface Temperature

Sea Surface Temperature (SST) is an important NESDIS product used as a boundary condition in NWP and climate models, as information for maritime interests, and as a climate indicator. The current SST does not meet user requirements for a number of reasons including aerosol effects, reduction of coverage due to clouds, and high accuracy required by climate models. SST remote sensing research for product development and utilization is needed and will be ongoing over the long term. This activity supports Weather and Water,

Ecosystem and Climate mission goal areas.

Educational Outreach and Training

In addition to outreach via established Cooperative Institutes, the ORA participates in a collaborative program, Remote Sensing Science and Technology (CREST) Center that provides opportunities for students and faculty at participating minority-serving academic institutions to take part in environmental satellite research. By increasing awareness of NOAA research and applications, educational outreach activities broaden the future customer base for those products. Moreover, the activity identifies and develops potential future NOAA research staff. This component is intended to be long-term, and multiple program areas, including weather and water, climate, and ecosystems.

b. Geographic scope of research (regional, national, global).

The scope of ORA research is dependent on the satellite and specific sensors used. The polar orbiters provide global coverage and deliver products where the emphasis is on global scale. These products are critical for global weather forecast models. Geostationary satellite products are confined to a region observable from geostationary orbit – usually constrained to within 60° latitude/longitude of the satellite subpoint. Specialized products can be developed for regional or localized purposes, for example, for mesoscale forecasts or hazard mitigation, from either the polar or geostationary systems. Often the solution of choice for global, regional and local issues is directly tied to satellite and instrument characteristics.

c. Provide research time frames.

Research time frames in ORA vary with the scale of the research projects. Because NOAA satellite systems have life cycles measured in decades, much ORA research should be classified as long term. Satellite/instrument design, procurement, and launch takes as much as 10 years followed by operational use for more than 25 years, as demonstrated by the TIROS-N series polar orbiters. Within the long-term cycle there are short-term projects, say to correct instrument calibration, make an accuracy or stability improvement to a product, prepare for a new satellite launch. Other research may have a longer term perspective, such as required for development of a new product or new way of retrieving products. Much (at least 50%) of NESDIS long-term research is done externally and competitively through grants and contracts, and it includes funding provided to NOAA cooperative institutes.

Short-term Readiness (0-2 years):

A key example of short term readiness is maintaining the calibration and validation of the sensor data and the products derived from the data. As instruments age, various calibrations and adjustments are required to ensure that the sensor measurements indicating values for an environmental parameter continues to represent that same measured value over the life cycle of the instrument. These calibrations ensure the data and products are useful for the entire user community by providing a constant reference. In addition, it is performed in the most optimal and cost effective manner: the calibrations are determined in the Office of Research and Applications and then updated within the NESDIS operational product generation systems for

the benefit of all users.

Intermediate Readiness (2-5 years)

ORA develops products based on user requirements for environmental parameters and products. These requirements often entail measuring an environmental parameter within a specified accuracy or improving the timeliness, resolution, or refresh rates of global, regional, and local products. These improvements may require new technology, better understanding of physical principles, or the adaptation of techniques to achieve the stated goals. ORA routinely generates improved or new products like vegetative indices, sea surface height, or other products to satisfy user needs.

Future, long term readiness (greater than 5 years):

In the long term ORA, supplies advice and specifications on new or planned sensors, new product or data requirements, or other environmental monitoring considerations. ORA tries to help meet the operational needs and requirements specified by users for future capabilities by assisting with the planning for sensors, spectral band specifications, physical science considerations, and other scientific information important to the long term mission of NESDIS and NOAA.

5. List of 3-5 major accomplishments in the last five years.

i) New and improved products for operational NWP:

In partnership with the NOAA, NASA, and the DoD, NESDIS established a Joint Center for Satellite Data Assimilation (JCSDA) in Camp Springs, MD. The JCSDA is a research effort designed to accelerate the use of data provided by new satellites and sensors for operational NWP use. The net result is optimized increases in forecast accuracy derived from data assimilation improvements. In support of accelerated use of satellite data in operational weather forecast models ORA has

- 1) developed and transitioned to operations computationally fast transmittance models and radiative transfer algorithms that make possible the direct assimilation of virtually all radiometric satellite observations by National Weather Centers for operational NWP models.
- 2) delivered satellite radiances and products from new, experimental and prototype instruments (AIRS; AMSU-A) for operational use by operational NWP centers. ORA also delivered necessary transmittance models for use with those new instruments.
- 3) transitioned surface data products, including global green vegetation fraction, insolation, land surface temperature and snow cover from research to operational use in the NCEP analysis and forecast systems improving surface temperature forecasts.
- 4) improved and expanded satellite-based wind observations were developed and transitioned to operations. These include the retrieval of Cloud Track Wind at high latitudes using MODIS from Terra and Aqua. Improved ocean surface winds were made available from the WINDSAT scatterometer.

ii) New and improved products for climate monitoring

- 1) ORA has substantially improved calibration of the Microwave Sounding Unit (MSU) and the GOES sounder, effectively enhancing the quality of data available for NWP and for long-term climate studies.

- 2) The Solarbackscatter Ultra Violet (SBUV) time series has been reprocessed and extended with improved calibration and retrieval algorithms.
 - 3) ORA has provided advice/counsel/oversight to ensure that future satellite instruments ensuring that future sensors specifications will attain sufficient quality to satisfy stated user requirements
 - 4) ORA has developed data reprocessing algorithms to allow the cross calibration of data between older generation satellites and newer one enabling the data to be used for climate applications (“climate quality”).
- iii) New and improved products for hazards monitoring
- 1) Algorithms for improved Aviation Hazard Detection, for example, potential for icing, have been delivered to commercial airlines, NWS, and Department of Defense.
 - 2) Smoke monitoring products have been developed using GOES imager data and have been implemented into operations at NESDIS.
- iv) Expanded cooperative and collaborative research with universities
- 1) ORA responded to rapid changes in requirements and augmented our government expertise by developing collaborative relationships with universities. These Cooperative Institutes provide the diversity of scientific thought to extend and supplement ORA’s government staff and provides the program flexibility to adapt quickly to new concepts and changing ideas. As an example, after Hurricane Mitch, our international partners requested assistance forecasting hurricanes. Using our cooperative institutes, a workstation was developed and deployed in South America that provided our international partners with a significant improvement in forecasting derived from the automated receipt and processing of satellite data.
 - 2) ORA established the Cooperative Institute for Ocean Satellite Science (CIOSS) at the Oregon State University in 2003 as the first Cooperative Institute established by an open competitive process.
 - 3) ORA has established collaborative efforts with Cooperative Remote Sensing Science and Technology (CREST) Center, a cooperative institute emphasizing minority-serving institutions.
6. A summary of legal mandates for the work performed in ORA was recently compiled. This summary is attached as the file DRAFT ORA Reply_legal_mandates.doc

Basis of all: The National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4321 et seq.)

7. The financial and staffing data previously provided by ORA has been slightly modified with respect to the number of staff supported at Cooperative Institutes. The spreadsheet with these revised numbers is attached.

For additional information or clarification, please contact:

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Legal Mandates and Relation to ORA Mission

ORA is a component of NESDIS' Satellite Services that work collaboratively (1) to operate and collect data from the environmental satellites (OSO), (2) to maintain daily operations that generate 470 unique products derived from satellite information (OSDPD) and (3) to ensure current and future readiness of new, improved and enhanced products from the current operational satellites, NASA's prototype satellites/sensors, and planning for the next generation of improved environmental measurement from satellites (ORA). The mandates, policy statements, MOUs and agreements listed below all call on NOAA to undertake research or development in pursuit of the purpose of the public law. These mandates justify the ongoing activities of ORA.

Identify all requirement drivers, e.g., legal mandate, policy, treaty or international agreement, etc. for this program.

Public Laws, U.S. Code, and Congressional Acts

- **Public Law 102-555 “Land Remote Sensing Policy Act of 1992” (Senate - October 07, 1992) Title VI—Prohibition Of Commercialization Of Weather Satellites Sec. 601. 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.” Satellite Services supports all NOAA efforts related to the collection, research, analysis, and distribution of GOES and POES satellite data that exists and operate to satisfy this policy of Government-provided Earth-orbiting satellites.
- **Public Law 98-8 “Congressional Approval Requisite to Sale, Lease, Transfer, or Dismantling of Agency** “... It is the sense of Congress that a reliable and comprehensive national weather information system responsive to the needs of national security; agriculture, transportation, and other affected sectors; and individual citizens must be maintained through a strong central National Weather Service that can work closely with the private sector, other Federal and State government agencies, and the weather services of other nations . . . Further, the Nation’s civil operational remote sensing satellites (METSAT and LANDSAT) shall remain under the National Oceanic and Atmospheric Administration. No effort shall be made to dismantle, transfer, lease, or sell any portion of these systems without prior congressional approval.” Satellite Services has developed and supports over 450 environmental products that directly contribute to fulfilling both the NWS mission and Weather Services of other nations.
- **Public Law 107-253, the Inland Flood Forecasting and Warning System Act of 2002**-Authorizes NOAA through research, modeling, training and outreach to enhance the capability to accurately forecast inland flooding, including flooding caused by coastal and ocean storms. Satellite Services, through the operational satellite systems, collects remotely sensed data and operates the Data Collection System that provides data required to monitor flood conditions that serve as the

bases for flash flood warnings. In addition, satellite services researches and applies new/improved techniques of using remotely sensed data to improve flood applications within NOAA and other agencies.

- **United States Code Title 15 Chapter 9:** “Sec of Commerce shall have charge of forecasting of weather, the issuance of storm warnings, and display of weather and flood signals for the benefit of agriculture, commerce, and navigation...” Satellite Services supports the near real time data collection and dissemination of satellite products and services to support NWS forecasts, warnings, and displays. Satellite Services research, application, and product development ensures the services charged to the Secretary of Commerce are continually improved over the lifetime of the operational satellite systems, for future satellite systems, and for use in agriculture, commerce, and navigation.
- **United States Code Title 49 Chapter 44720:** “The Administrator of the Federal Aviation Administration shall make recommendations to the Secretary of Commerce on providing meteorological services necessary for the safe and efficient movement of aircraft in air commerce. In providing the services, the Secretary shall cooperate with the Administrator and give complete consideration to those recommendations...” Satellite Services data, products, research, and services provide the factual basis for FAA decisions affecting the safe and efficient movement of aircraft.
- **National Weather Service Organic Act and Global Change Research Act (15 U.S.C § 313.)** “The Secretary of Commerce shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation, the gauging and reporting of rivers, the maintenance and operation of seacoast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rain-fall conditions for the cotton interests, the display of frost and cold-wave signals, the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties.” Satellite Services take meteorological observations from satellites to support all aspects of research and application development for the remotely sensed environmental parameters derived from the satellite data that support both weather forecasting and climate applications. This near-real-time information is used to provide timely and more accurate forecasts in support of commerce, agriculture, navigations, etc. This same data is used to evaluate the climatic conditions of the United States when evaluated over extended periods of record.
- **Ocean Satellite Data (33 U.S.C. Section 883j)** States that the NOAA Administrator shall take such actions, including the sponsorship of applied research, as may be necessary to assure the future availability and usefulness of ocean satellite data to the maritime community. Satellite Services is responsible for acquisition of ocean satellite data as well as the subsequent ocean products generation/distribution and product development, algorithm maturity, and

application enhancements required to expand the usefulness of the data to the maritime community.

- **Harmful Algal Bloom and Hypoxia Research and Control Act of 1998 (PL 105-383.)** The Harmful Algal Bloom and Hypoxia Act authorized DOC to conduct research, education, and monitoring activities related to prevention, reduction, and control of harmful algal blooms and hypoxia. Satellite Services provides research and monitoring capabilities from the application of satellite data to the algal bloom and hypoxia issues. Through new research and products, Satellite Services demonstrates how satellite data contributes to the education, monitoring and new developments that lead to the prevention, reduction, and control of algal blooms and hypoxia events.
- **Coral Reef Conservation Act (PL 106-562.)** The act is intended to restore coral reef ecosystems, promote wise management, develop sound scientific information, assist others in preserving reefs, provide financial resources, and provide a mechanism for funneling private funds to coral reef conservation projects. Satellite Services provides operational monitoring and scientific research to support an effective coral reef strategy.
- **Title 16-Conservation, Chapter 38-Fishery Conservation and Management, Subchapter 1-Generally, Sec. 1801.** The Congress finds and declares the following:
 - (8) The collection of reliable data is essential to the effective conservation, management, and scientific understanding of the fishery resources of the United States.
 - (9) One of the greatest long-term threats to the viability of commercial and recreational fisheries is the continuing loss of marine, estuarine, and other aquatic habitats. Habitat considerations should receive increased attention for the conservation and management of fishery resources of the United States. It is further declared to be the policy of the Congress in this chapter— (3) to assure that the national fishery conservation and management program utilizes and is based upon, the best scientific information available; involves, and is responsive to the needs of, interested and affected States and citizens; considers efficiency; draws upon Federal, State, and academic capabilities in carrying out research, administration, management, and enforcement; considers the effects of fishing on immature fish and encourages development of practical measures that minimize bycatch and avoid unnecessary waste of fish..... Satellite Services supports the collection of reliable data for Fishery Conservation and Management through earth observation satellites, both foreign and domestic. The data is analyzed to improve scientific understanding that leads to improved fisheries conservation and management. Satellite data provides large-scale coverage of ocean, sea, near-shore and lake attributes which affect fisheries conservation and management. Federal and academic capabilities are utilized to develop the best scientific information and research programs that contribute to improving the administration, management and enforcement of fishery management and conservation. Satellite Services provides operational monitoring and scientific research to support an effective fisheries monitoring program.

United States Code Title 15 Chapter 9: “Sec of Commerce shall have charge of forecasting of weather, the issue of storm warnings, and display of weather and flood signals for the benefit of agriculture, commerce, and navigation...” Satellite Services provides operational monitoring and scientific research to support weather forecasts and warnings.

Public Law 107-253, the Inland Flood Forecasting and Warning System Act of 2002, *authorizes NOAA to improve the capability to accurately forecast inland flooding, including flooding caused by coastal and ocean storms, through research and modeling, training, and outreach.*

The Federal Emergency Management Agency’s (FEMA) Federal Response Plan (FRP) – April 1999 that implements the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (42 U.S.C. 5121, et seq.) The FRP tasks the Department of Commerce (DOC) with acquiring and disseminating weather data, forecasts, and emergency information, providing information on natural resources, predicting pollution movement, and providing information on meteorological, hydrological, ice, and oceanographic conditions.

FEMA’s Federal Radiological Emergency Response Plan (FRERP) – May 1996. The FRERP tasks the Department of Commerce to “Prepare operational weather forecasts tailored to support emergency response actions...” and “Prepare and disseminate predictions of plume trajectories, dispersion, and deposition.” Satellite Services provides operational monitoring and scientific research to support the modeling of plume trajectories and dispersion.

Executive Directives

- **Presidential Decision Directive, NSTC-8, National Space Policy, 1996:** Defines NOAA’s role as having the lead responsibility for managing Federal space-based civil operational Earth observations necessary to meet civil requirements. In this role, NOAA will acquire data, conduct research and analyses, and make required predictions about the Earth’s environment; consolidate operational U.S. Government civil requirements for data products, and define and operate Earth observation systems in support of operational monitoring needs; and provide for the regulation and licensing of the operation of private sector remote sensing systems. Satellite Services performs the satellite data acquisition, research and analysis functions, and provides the consolidated operations of earth observing systems in support of monitoring needs.
- **Presidential Decision Directive, NSTC-2, Convergence of U.S.-Polar-Orbiting Operation Environmental Satellite Systems, 1994:** Directs the convergence of the NOAA TIROS and DoD DMSP polar-orbiting programs to reduce the cost of acquiring and operating polar orbiting operational environmental satellites, while continuing to satisfy U.S. operational civil and national security requirements. Satellite Services conducts the combined operation of NOAA TIROS and DoD

DMSP Polar-orbiting satellite programs as well as conducts the applied research for ensuring these combined systems and the products derived from them will satisfy the requirements levied by the large community of documented users.

- **Presidential Decision Directive/NSPD15 (2003) -- U.S. Commercial Remote Sensing Space Policy** - The policy's fundamental goal is to "advance and protect U.S. national security and foreign policy interests by maintaining the nation's leadership in remote sensing space activities, and by sustaining and enhancing the U.S. remote sensing industry." Satellite Services maintains the nation's leadership in remote sensing by conducting the continuous, reliable operation of the GOES, POES, and DMSP satellites. To ensure these systems meet the requirements levied upon them, Satellite Services provides applied research to ensure the remotely sensed data derived from these systems can generate products that satisfy user documented accuracy and specifications.
- **Presidential Decision Directive-63 - Critical Infrastructure Protection** - Critical infrastructures are those physical and cyber-based systems essential to the minimum operations of the economy and government. They include, but are not limited to, telecommunications, energy, banking and finance, transportation, water systems and emergency services, both governmental and private. Satellite Services develops and maintains remote backup facilities for all critical elements of satellite operations and product generation and distribution.

International Treaties, Inter-agency Agreements, Other Agreements/Working Groups

- **Basic Agreement Between the National Aeronautics and Space Administration and the U.S. Department of Commerce Concerning Collaborative Programs, 1998:** Defines principles and guidelines in areas related to environmental satellite programs, specifically including those activities related to the development of space-based capabilities (both the development of new instrumentation and flight opportunities and enhancements to existing systems), and data and information systems, the coordination of research and analysis activities and other areas of collaboration. Satellite Services establishes the collaborative programs that are supported by data and products from the space-based instruments.
- **Office of the Federal Coordinator for Meteorology operations plans:**
 - National Severe Local Storms Operations Plan – May 2001
 - National Winter Storm Operations Plan – November 2000
 - National Hurricane Operations Plan – May 2003
 - Federal Plan for Meteorological Services and Supporting Research – June 2002
 - Environmental Support Plan for Homeland Security – under developmentSatellite Services provides decision support system data and services in support of these plans. These services range from operationally changing satellite modes to the research and development of new applications to support new requirements for Homeland Security. Satellite data, products, research, and services support the operational plans listed above by providing timely, accurate, and relevant

satellite data at all hours of the day and night, providing effective perspectives of the situation from which efficient decision-making can occur.

- **The Federal Emergency Management Agency's (FEMA) Federal Response Plan (FRP) April 1999**, The Plan implements the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (42 U.S.C. 5121, et seq.) The FRP tasks the Department of Commerce (DOC) with acquiring and disseminating weather data, forecasts, and emergency information, providing information on natural resources, predicting pollution movement, and providing information on meteorological, hydrological, ice, and oceanographic conditions. Satellite Services routinely provides meteorological and environmental data from satellite systems to FEMA for its independent use. To provide the products, Satellite Services ensures the collection, analysis, calibration, development, and validation of data and applications to deliver the highest quality and most accurate products for FEMA to use in conducting its mission. NOAA satellite data, products, research, and services provide support for disaster relief and emergency assistance through timely, accurate, and relevant data at all hours of the day and night. The satellite-derived information provides important and effective perspectives of the environmental situation from which efficient decision-making can occur.
- **Interagency Agreement for Meteorological Services Among the Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, National Park Service of the United States Department of the Interior, the Forest Service of the United States Department of Agriculture, and the National Weather Service of the United States Department of Commerce.** Satellite services data, products, research, and services support park services, forest services, land management, and wildlife management through fire, smoke, ash and other satellite-derived products and services enabling other key agencies to more efficiently perform their charged functions.
- **Initial Joint Polar-Orbiting Operational Satellite System** - Agreement between the United States National Oceanic and Atmospheric Administration and the European Organization of Meteorological Satellites on An Initial Joint Polar-orbiting Operational Satellite System, Signature Copy dated November 19, 1989. Satellite Services supports the spacecraft operations, data acquisition, research, product generation and dissemination in support of POES and Metop operations.
- **ARGOS Joint Tariff Agreement** - ARGOS was developed under a Memorandum of Understanding (MOU) between the Centre National d'Etudes Spatiales (CNES, the French space agency), the National Aeronautics and Space Administration and NOAA (1979). The system utilizes both ground and satellite-based resources to accomplish its mission. This includes instruments carried aboard the NOAA polar orbiting environmental satellites (POES), receiving stations around the world and major processing facilities in France and the United States. Satellite Services supports data acquisition, research, and dissemination for ARGOS.
- **North America-Europe Data Exchange Agreement** - The North America-Europe Data Exchange seeks to maintain and improve the exchange of meteorological data and products between Europe and N. America, for use in

operational weather forecasting, research and related activities. Satellite Services exchanges data under this agreement.

- **Interagency Cooperation, e.g. with the U.S. Army Corps of Engineers, U.S. Department of Interior, U.S. Department of Agriculture, U.S. Bureau of Reclamation; and the National Aeronautics and Space Administration** assigns NOAA the responsibility for collecting climate, weather, and snow data and providing river level and flood forecasts and flash-flood warnings. Satellite Services provides the satellite-derived observations required to support monitoring and forecasting responsibilities under this agreement.
- **Asia-Pacific Satellite Data Exchange and Utilization** - The Asia-Pacific Satellite Data Exchange and Utilization Group was established to increase the amount of data exchanged among agencies in the region over existing communications links. Meeting participants include the Japanese Meteorological Agency, the Japanese Space Agency, NESDIS, NWS, the China Meteorological Administration, the Korean Meteorological Agency, the Australia Bureau of Meteorology, and the Hong Kong Observatory. Satellite Services exchanges data as the NESDIS member of this group.
- **MOUs/MOAs**

Memorandum of Understanding (MOU) between the National Centers for Environmental Prediction (NCEP) and the Air Force concerning backup responsibilities for numerical modeling and prediction.

United States Code Title 49 Chapter 44720: “The Administrator of the Federal Aviation Administration shall make recommendations to the Secretary of Commerce on providing meteorological services necessary for the safe and efficient movement of aircraft in air commerce. In providing the services, the Secretary shall cooperate with the Administrator and give complete consideration to those recommendations....”

Interagency Agreement for Meteorological Services Among the Bureau of Land Management, Bureau of Indian Affairs, U.S. Fish and Wildlife Service, National Park Service of the United States Department of the Interior, and the Forest Service of the United States Department of Agriculture, and the National Weather Service of the United States Department of Commerce.

Interagency Cooperation, e.g., with the U.S. Army Corps of Engineers, U.S. Department of Interior, U.S. Department of Agriculture, U.S. Bureau of Reclamation; and the National Aeronautics and Space Administration, assigns NOAA the responsibility for collecting climate, weather, and snow data and providing river level and flood forecasts and flash-flood warnings.

- **Numerous requirements documents, such as GOES-R and NPOESS**

GOES R Operational Requirements Document (GORD) -The system requirements for the next generation Geostationary Operational Environmental Satellite series (GOES R series) establish operational drivers for Satellite Services. The GOES R series is required to provide continuity and improvement of remotely sensed environmental data from a geostationary orbit. The user requirements were taken from existing documentation of NWS requirements in the areas of imagery and sounding and NOAA's Space Environmental Center (SEC) requirements for solar and space environment sensing.

To effectively meet the GOES R series requirements, a complete End-to-End approach must be implemented. New and/or upgraded capabilities are required for enhanced GOES R series functions in the areas of data acquisition; product processing and distribution; product research, algorithm maturity, and application identification and development; and IT infrastructure. Only with this end-to-end systems approach can satellite meet requirements, exploit the full potential of this data, and validate program costs and mission need.

Integrated Operational Requirements Document (IORD) for National Polar-orbiting Operational Environmental Satellite System Requirements set forth in the IORD are derived from mission needs in the Department of Defense (DoD) and Department of Commerce (DOC). The departments' environmental missions require a capability to acquire and receive in real time at field terminals, and to acquire, store and disseminate to processing centers, global and regional meteorological environmental and associated data. DoD needs are documented in the Air Force Space Command Mission Need Statement 035-92 for Environmental Sensing, validated 6 January 1993. DOC's need for this information is documented in the Department of Commerce, National Oceanic and Atmospheric Administration 1995-2005 Strategic Plan, 15 July, 1993, and Public Law 105, ISC 313 "Organic Act". Satellite Services support NPOESS product generation and distribution, and product science, including application identification, algorithm development, and product creation requirements.