11.11 GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE SERIES R (GOES R) CONCEPT OF OPERATIONS (CONOPS)

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1. INTRODUCTION AND SCOPE

The National Environmental Satellite, Data, and Information Service (NESDIS) mission is: *"to provide and ensure timely access to global environmental data and information services from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life."* [National Oceanic & Atmospheric Administration (NOAA) NESDIS Mission Statement, 2000.] The GOES R Concept of Operations (CONOPS) document is designed to give an overall picture of how the next generation of geostationary satellites will address the NESDIS mission. This document is a system-level piece of the NESDIS 2012 – 2020 (Draft, 2002) (Figure 1). It is a conceptual document that provides a discussion on the missions being addressed, a system description (characteristics and capabilities), and a breakdown of operational criteria to include:

- user needs
- launch, sustainment, and on-orbit operations of space-based platforms
- ground system operations
- data ingest
- product generation, analysis and dissemination
- archive, access, and scientific stewardship of environmental data

The GOES R CONOPS uses the same structure as the NESDIS 2012 – 2020 CONOPS to highlight linkages between segment level concepts and specific concepts for future geostationary operations.

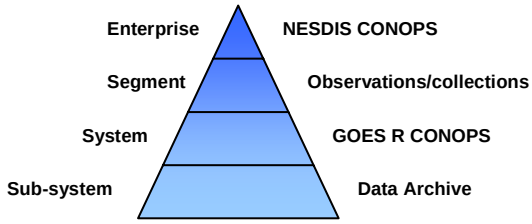

Figure 1 Enterprise Hierarchy

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1.1 GOES R Concept

The GOES R system will build on the NESDIS core competencies (data acquisition, archiving and assessment), expanding capabilities and functions as necessary to meet user needs. The NESDIS Strategic Plan is the road map guiding this effort, ensuring cohesiveness with other NOAA and NESDIS initiatives, as well as the need to provide for system integrity and security to ensure homeland security needs are met.

As NESDIS moves into the future, it is also exploring new partnerships with industry, and other U S and foreign agencies with the GOES R program.

2. OPERATIONAL NEED

The GOES R system goals are:

- Maintain continuous, reliable operational environmental, and storm warning systems to protect life and property
- Monitor the earth's surface and space environmental and climate conditions
- Introduce improved atmospheric and oceanic observations and data dissemination capabilities (increased spatial, temporal and spectral resolution)
- Develop and provide new and improved applications and products for a wide range of federal agencies, state and local governments, and private users

The following sections describe the operational needs and the requirements process, including the known shortcomings of the current GOES system and emerging user requirements.

2.1 Shortcomings of the Existing/Planned GOES Systems

In the following sections the shortcomings of the current GOES I-M and GOES N series systems are identified as a basis for why the GOES R system development is necessary. The shortcomings, covering both the space and ground segment, include: mission continuity; data losses; simultaneous hemispheric, synoptic, and mesoscale imaging; and data latency/timeliness.

2.1.1 Mission Continuity

Replacement satellites are required to sustain United States' (US') geostationary capabilities beyond 2012.

Expected mean mission duration for the GOES I-M and GOES N series will support full mission availability through 2012. Currently available instrument capabilities are inadequate to meet emerging requirements, necessitating the development of new technologies.

2.1.2 Data Losses

The pre-GOES R series spacecraft can experience significant data losses due to several factors: (1) GOES data losses occur for several hours each day during the weeks around each equinox (eclipse); and (2) data losses also occur due to periodic routine orbit adjust maneuvers.

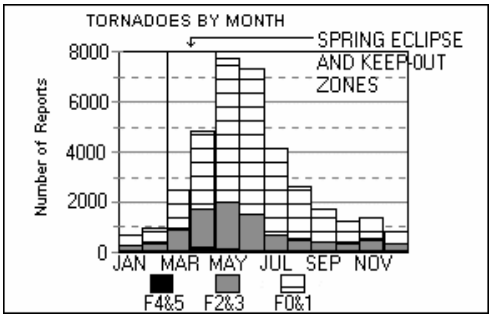

Figure 2 Spring Eclipse and keep-out-zones superimposed on the tornado season (Gurka, J.: Course Notes, GOES Assessment Results, COMET/SATMET COURSE Boulder, CO, April 4, 2000)

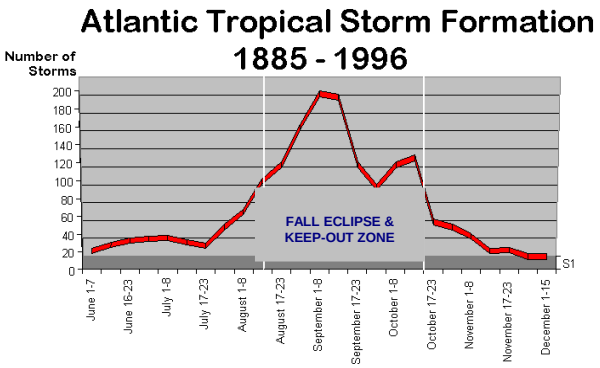

Figure 3 Fall Eclipse and keep-out-zones superimposed on the hurricane season (Gurka, J: Course Notes, GOES Assessment Results, COMET/SATMET COURSE Boulder, CO, April 4, 2000)

Essentially, there are two eclipse seasons for each GOES spacecraft. During the eclipse season, the satellites are in the Earth's shadow, requiring the spacecraft to be totally dependent on onboard batteries for a maximum of 72 minutes daily. Each eclipse season spans a 48-day period, symmetric around the equinox and the sun occultation [from NOAA Office of Satellite Operations (OSO) Web Page.] The Imager and Sounder instruments are powered down to conserve power, until the daily eclipse is over. There is a significant risk of the sun light directly entering the scanners, as the spacecraft enters and leaves the Earth's shadow, requiring the Imager and Sounder to be idle prior to and following eclipse. This is known as the "Keep Out Zone", or KOZ.

Historically, the size of these regions, and hence the KOZ, for the GOES imager and sounder is a six degree radial region. Therefore, if the sun were predicted to be within a six-degree radius of the instrument field of view for a particular image, that image would not be commanded [from the Cooperative Institute for Research in the Atmosphere (CIRA) / Colorado State University GOES FAQ web page.]

The impact to GOES operations is that during the seasonal eclipse periods the image regions in the proximity of the sun will be deleted. There is typically a 0–3 hour outage of imagery each day as GOES progresses through eclipse season. The maximum outage of 3 hours will occur at or near the equinox. This is a significant loss of data for National Weather Service (NWS) impacting critical forecasting and modeling operations. The spring eclipse and KOZ period coincides with the beginning of the tornado season while the fall eclipse and keep-out zone period coincides with the peak of the Atlantic Hurricane season (see figures 2 and 3).

In addition to the data losses during the GOES eclipse episodes, data is also lost during periodic spacecraft maneuvers that are required to adjust the drift and orbit of the geostationary satellites and to counteract the gravitational forces from the sun and the moon. The time needed for the current GOES I-M satellites and the GOES N series to return to normal operations after such maneuvers may be up to 9 hours. This excessive delay is unacceptable for forecast and modeling operations that require and depend upon timely satellite data input.

2.1.3 Simultaneous Hemispheric, Synoptic, and Mesoscale Imaging

The current GOES I-M and GOES-N series cannot provide simultaneous hemispheric (Full Disk), synoptic [Contiguous United States (CONUS) Regional] and mesoscale (Rapid-Scan) imaging. They are unable to provide Southern Hemisphere images during Rapid-Scan operations (invoked to support severe weather outbreaks) and cannot meet the temporal requirements for Full Disk and CONUS updates. Imaging and derived high-density wind products below the equator are also required during mesoscale imaging. The current lack of these winds degrades performance of global forecast models by as much as 10%.

2.1.4 Data Latency (Timeliness)

Product delivery must be done in near real-time to capture rapidly changing, relatively short-term events, (e.g., severe weather, thunderstorms, and flash floods).

The usefulness (forecast value) of the current GOES imagery is greatly diminished if the images are not available for analysis by the forecaster before the start of the next image, i.e. in near real-time. Data latency sometimes exceeds two hours from the time measured until available for use at national forecasting centers. Reducing data latency will allow more timely and accurate warnings and forecasts.

3. SYSTEM OVERVIEW

The GOES R system is planned to operate for a period of at least 14 years, providing a remote sensing capability to acquire and disseminate regional environmental imagery and specialized meteorological, climatic, terrestrial, oceanographic, solar-geophysical and other data to central processing centers and distributed direct users. This section provides a description of the proposed system. However, the GOES R architectural elements identified in the following subsections may vary depending on the final system architecture concept and its complexity. Regardless of the final system design, the following functional elements must be addressed:

- Capacity. Address how the system will optimize assigned resources, support mission growth, handle large data volume, and meet contingency requirements.

- Command, Control, and Communications (C^3). Address how the system will integrate into the existing command and control structure, and how it will evolve with the C^3 challenges of the future.

- Operability and Flexibility. Address how the system will maintain continuity of operations to assure mission accomplishment. Address to what extent the system will be self-contained.

- Survivability and Endurability. Address the level of disaster/conflict the system will survive/endure to assure mission accomplishment.

- Standardization and Interoperability. Address how the system will be standardized and interoperate with existing infrastructure, both within and outside of NESDIS. Identify procedural and technical interface standards to be incorporated into the system or operational design to ensure the required degree of interoperability between the system or operation. A system will be designed to conduct normalized operations and maintenance consistent with the mission and responsibilities delegated to it. Areas to address may include how standard commercial-off-the-shelf (COTS) hardware and software may be utilized for mission execution and for enhancing commonality of replacement parts with other like units. Address considerations for government-off-the-shelf and non-developmental item (NDI) hardware and software. This commonality of hardware/software will enable systems with compatible and/or similar missions to share the same resources.

- Reliability, Maintainability, and Sustainability. Address any reliability/maintainability issues that may include single point failures, common maintenance support, and operation & maintenance (O&M) or life cycle costs.

- Manpower, Basing, and Program Management Structure. Address basing and manning constraints and identify expected program management structure. Areas to consider may include automation to minimize manpower requirements and cooperation with other government agencies to take advantage of economies of scale. Facility considerations must also be addressed.

From an architectural perspective, the GOES-R system will consists of six segments: 1) Space; 2) Launch Support; 3) C^3; 4) Product Generation and Distribution (PG&D); 5) Archive and Access; and 6) User Interface. While the GOES R Space, Launch Support, and C^3 Segments will be new assets and unique to GOES R, the PG&D, Archive and User Interface Segments will build on existing operational segments that will be modified to support the GOES-R series. Applied research will interface with all of the above segments. Figure 4 provides a GOES R Segment overview and more details on each of the segments are provided below

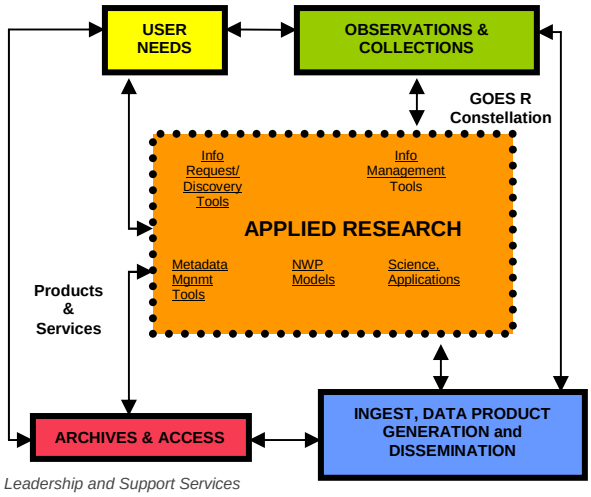

Figure 4 GOES R Segment Overview

3.1 Space Segment

The Space Segment will consist of the spacecraft and its meteorological, oceanographic, terrestrial, space, solar, and environmental monitoring sensors, in addition to other systems for surface data collection/location and

search and rescue. All sensed data will be transmitted at its optimum resolution to the Command and Data Acquisition (CDA) sites, delivered to the NESDIS PG&D Segment and retransmitted for direct readout users, under the control of the C^3 Segment. The PG&D segment will geolocate and calibrate the raw data to Level 1, acquire required ancillary data, merge this data with other satellite data, and derive further required derived Level 2 and beyond products. The two levels of data will be distributed to both users and archive facilities as required. Real-time data will also be continuously broadcast to direct readout users within the satellite field of view. In summary, the Space Segment could support the following sensors, equipment, and functions:

- Imager
- Sounder
- Instruments of Opportunity (IOO)
- Data Collection Platform Interrogate and Report (DCPI&R)
- Search and Rescue (S&R)
- Low Rate Information Transmission (LRIT)
- Emergency Managers Weather Information Network (EMWIN)
- Space Environment Monitoring (SEM)
- Energetic Particles Sensor (EPS)
- High Energy Proton and Alpha Particle Sensor (HEPAD)
- X-ray Sensor (XRS)
- Magnetometers
- Solar X-Ray Imager (SXI)
- Multi Use Data Link (MDL) - Diagnostic data
- Commanding
- Telemetry

Other federal, state and local agencies, academia, and industry, on a worldwide basis, will be able to access GOES R series real-time broadcast data. Broadcast capabilities of the GOES R series will be designed to produce the minimum impact possible to GOES N series receiver terminals and procedures. The issue of how to perpetuate the current policy of global broadcasting of all processed data has not been resolved. Ending the global broadcast from GOES would reduce the Radio Frequency (RF) requirements and alter the satellite design, but would severely impact low end users. Commercial communications satellites and the use of landlines are also being considered.

3.1.1 Raw Sensor Data

In order to support the new imagery and sounding capabilities expected to be provided by the GOES R series of spacecraft, the raw sensor downlink for the spacecraft will be significantly different from the corresponding GOES-N series downlink. At this time, the data rate needed for the high rate data is the primary factor in determining the overall performance factors for this link.

3.1.2 Sensor Data Rebroadcast

The full set of processed and calibrated instrument data has been designated GOES Rebroadcast-Full (GRB-F). Due to the increased volume of data expected from the GOES R series enhanced imagery and sounding capabilities, the baseline parameters for this link assumes that a suitable compression process can be implemented that will meet all user requirements. Compression systems such as "Principal Components" and "Wavelets" are under consideration. If a suitable compression process cannot be found, other options are being considered to meet user requirements but may impact spacecraft weight, power and cost.

GOES Rebroadcast-Lite (GRB-L) is a selected subset of the processed and calibrated instrument data. This link provides a service similar to the current GOES Variable Format (GVAR) for users who may not be able to easily transition to the higher data rate of the GRB-F. The need for the GRB-L link is being studied.

3.1.3 LRIT Broadcast

The Low-Rate Image Transmission (LRIT) signal will replace the previous analog Weather Facsimile (WEFAX) signal user data rate of 128 kbps used on the GOES N series spacecraft. In the GOES-R era, upgrades to the (LRIT) broadcast are needed to provide more data at reduced lead times to users. This will require an increase in data rate and change in modulation for this link.

3.1.4 Emergency Managers Weather Information Network (EMWIN)

The EMWIN is required to provide Local Emergency Managers and the Federal Emergency Management Agency (FEMA) with a relatively inexpensive and lightweight method of receiving GOES digital data for their operational needs. The nominal downlink frequency will remain the same as it is for the GOES N series, but the uplink frequency will be changed to simplify the generation of the translation frequency on the spacecraft and minimize potential intermodulation products that fall in-band for any of the uplink signals. As part of other options, NOAA may choose to shift the uplink frequency to the X-band or move the downlink frequency 3 Megahertz (MHz) higher to provide additional spectrum for the GRB-F signal, if this signal is kept at L-band.

3.1.5 SARSAT System

The GOES Search and Rescue (SAR) subsystem is part of the U.S. Search and Rescue Satellite-Aided Tracking (SARSAT) Program, and the international Cospas-Sarsat Program. As part of the international Cospas-Sarsat Program, the U.S. and other countries operate satellites with SAR payloads in low-earth and geostationary orbits; the system has contributed to the rescue of over 11,000 people. The SAR subsystem

onboard the GOES satellite is a dedicated transponder that detects 406 MHz distress signals transmitted by Emergency Locator Transmitters (ELT) carried on aircraft, Emergency Position-Indicating Radio Beacons (EPIRB) aboard marine vessels, and Personal Locator Beacons (PLB) used in land-based applications. The distress signals are relayed by the GOES satellite to a ground station located within the field-of-view of the satellite. The information is then passed to a mission control center and ultimately to a rescue coordination center from where help is dispatched.

3.1.6 Data Collection System (DCS)

3.1.6.1 Data Collection Platform Interrogation (DCPI)

Data collection will continue to be done through the Data Collection System (DCS). The GOES DCS will continue to collect near real-time environmental data from more than 19,000 data collection platforms located in remote areas where normal monitoring is not practical. The DCS receives data from platforms on ships, aircraft, balloons and fixed sites. These data are used to monitor seismic events, volcanoes, tsunami, snow conditions, rivers, lakes, reservoirs, ice cover, ocean data, forest fire control, meteorological and upper air parameters.

Over 200 river and rain gauges are under each NWS radar umbrella to provide complimentary data for use in their forecast and warning system. Due to the importance of this data a back-up capability for the DCS is required in the GOES R series era.

Compared to GOES N, the nominal uplink frequencies for the GOES R series will be changed to simplify the generation of the translation frequency on the spacecraft and minimize potential intermodulation products that fall in-band for any of the uplink signals. As part of possible options, NOAA may choose to shift the uplink frequencies to the X-band; otherwise the actual performance requirements for this link remain the same as for the GOES N series.

3.1.6.2 Data Collection Platform Response (DCPR)

The required Effective Isotropic Radiated Power **(**EIRP) on the spacecraft will be increased to ensure reliable operation of the individual Data Collection Platform Report **(**DCPR) channels with any possible combination of 100, 300, and 1200 bps service. Another possible change could occur if an option was exercised to increase the frequencies of the downlink bands by 3 MHz.

3.2 Launch Support Segment

The Launch Support Segment includes all launch support equipment including Aerospace Ground Equipment (AGE), additional ground test equipment, Real Property Installed Equipment (RPIE) and launch facilities. AGE consists of computer checkout systems and other equipment to support satellites prior to launch. RPIE includes items such as power equipment, air conditioning equipment and non-flight fuel stores. The launch facilities include payload test facilities and other required equipment and facilities to place the spacecraft into operational orbit.

3.3 C^3 Segment

The C^3 Segment will be similar to the current GOES system, providing all functions required for mission management; day-to-day operations, state-of-health monitoring of all operating GOES R series satellites, and support of the delivery of data to the PG&D segment. Near real-time data will continue to be provided to users via near real time communications links between the spacecraft and direct read-out users. The GOES-R C^3 Segment will consist of shared and dedicated C^3 resources such as antennas, communication links, and other command and control equipment needed to fulfill the GOES R series mission. Spacecraft simulators are also considered part of the C^3 Segment.

The primary CDA station will continue to be at Wallops Island, Virginia (VA); the back-up CDA at National Aeronautics & Space Administration 's (NASA's) Goddard Space Flight Center (GSFC) in Greenbelt, Maryland (MD). The primary satellite operations control center (SOCC) is located in Suitland, MD. The CDAs will carry out the command, data acquisition and processed data relay functions for the GOES program. They will transmit commands to the operational satellites and acquire and record instrument and engineering data received from the satellites. Raw data will be processed at the CDAs. The processed data will then be retransmitted to the satellites for rebroadcast to the SOCC and users. The SOCC will provide the capability for monitoring and commanding the spacecraft during launch, orbit attainment, and flight checkout. It will be responsible for performing the operational functions of satellite command and control, mission planning and management, data network enterprise management, antenna resource scheduling, launch and early orbit operations, anomaly resolution, data access and the relay of data to Product Generation and Distribution Segment. The C^3 Segment envisioned for GOES R will be comprised of the following components:

- A GOES Telemetry and Command (T&C) System (GTCTS) to provide the transmit and receive IF interface. The GTCTS will be located at the NOAA CDA and Backup CDA (BUCDA) facilities.

- A GTCS that will perform all spacecraft and instrument housekeeping and health & safety telemetry processing and monitoring; all spacecraft command operations; and configuration monitoring and control for all other ground system

components. The GTCS will be located at the NOAA SOCC, CDA, and BUCDA facilities.

- A GOES Scheduling System (GSS) that supports spacecraft operations scheduler planning and performs generation of all scheduled spacecraft command sequences (either ground or onboard executed). The GSS will be located at the NOAA SOCC, CDA, and BUCDA facilities.

- A GOES Sensor Processing System (GSPS) that ingests and processes instrument wideband data; performs [To Be Determined (TBD)] calibrations and (TBD) image navigation and registration (INR) corrections to the science data; extracts and archives offline radiometric and INR analysis data; extracts and sends in real-time radiometric and instrument housekeeping data to the GTCS and INR observation data to the GOES Orbit and Attitude Tracking System (GOATS); and packages and distributes instrument data to the users via (TBD). The GSPS will be located at the NOAA CDA and BUCDA facilities.

- A GOATS that generates INR correction information based on spacecraft attitude data and instrument INR observations and sends the correction information to the GSPS; monitors spacecraft attitude and INR performance in real-time; generates products used to support instrument scheduling in the GSS; and supports all spacecraft station keeping and attitude maneuvers that may be defined by the spacecraft contractor. The GOATS will be located at the NOAA SOCC, CDA, and BUCDA facilities.

- A GOES Product Monitor (GPM) that ingests the user-packaged science data and performs radiometric data quality monitoring. The GPM will be located at the NOAA SOCC, CDA, and BUCDA facilities.

- A GOES Diagnostic Data System (GDDS) that ingests and decommutates all multiplexed spacecraft diagnostic data; provides an archive server to (TBD) analysis workstations for access to the diagnostic data; and extracts and sends housekeeping data to the GTCS for any instruments whose data streams are solely contained within the downlinked spacecraft diagnostic data. The GDDS will be located at the NOAA SOCC, CDA, and BUCDA facilities. (If supported by the spacecraft.)

3.4 Product Generation and Distribution (PG&D) Segment

This segment will consist of the hardware and software necessary to

- receive and store raw data,

- process derived products as necessary, and

- make derived products available to users and archive and access facilities.

The operational NOAA/NESDIS Product Generation and Distribution system will be located in Suitland, MD. The PG&D systems will have components to ingest, pre-process, generate or reformat, and distribute products in numerous environmental areas such as imagery, atmospheric soundings, sea surface temperature, ozone, snow/ice, hazards, vegetation index, cloud parameters, winds, etc. This will be a shared component of NESDIS in that is not unique to the GOES system. These components will operate 24 hours a day, 7 days per week.

The GOES PG&D segment is but one component of the NESDIS Enterprise operational product generation and distribution system. The PG&D system used to process the GOES N series data will need to be thoroughly reviewed for modifications or new developments required in the GOES R series era to handle the substantial changes expected for the imagery and sounding capabilities. Modifications in areas such as data access, calibration, product generation, quality control, and product distribution will be needed. Upgrades are envisioned to concentrate in the areas of enhanced system and distribution network capabilities to handle the increased volume of data and in science support to meet product type and accuracy requirements and to optimize the processing and usefulness of the enhanced data.

3.5 Archive Segment

The Archive Segment will be capable of archiving telemetry statistics for all operating spacecraft after launch and the data for all operating spacecraft for the previous 3 months. It will be capable of providing automatic telemetry trending and generating trending plots of predefined parameters at predefined intervals.

The GOES data will be archived and distributed to retrospective users through the existing NESDIS Archive and Access Segment. This will be a shared component of NESDIS in that is not unique to the GOES system. National Climate Data Center (NCDC) in Asheville, North Carolina, is the main archive of the GOES imagery and sounding data. The Space Environment Center (SEC) in Boulder, Colorado, maintains the archive for the solar and space environment instruments. In the GOES R series era, the archive system will have components of Data Ingest, Data Preparation and Quality Assurance, Data Storage, Customer Access, Data Retrieval and Repackaging, Product Data Visualization, Data Distribution Data Migration and System Management. These components will operate and be accessible 24 x 7.

In the GOES R series era, an upgraded Comprehensive Large Array-data Stewardship System (CLASS), or its follow-on, will be in place to handle the extensive types and the high volume of environmental data required to be archived and accessed. This system is a re-engineering and upgrading of current archive capabilities of the National Data Centers for climate, geophysical, and oceanographic data [NCDC; National Geophysical Data Center (NGDC); National Oceanographic Data Center (NODC)]. Data which is currently archived include NWS Next Generation Weather Radar (NEXRAD), NWS Cooperative Observer Program (COOP), Automated Surface Observing System (ASOS), rocket and radiosonde, climatic and model data; National Ocean Service (NOS) hydrographic data, and bathymetric and topographic maps; National Marine Fisheries Service (NMFS); Office of Atmospheric Research (OAR) solar radiation, aircraft reports and wind profiler and geologic data; NESDIS Polar Orbiting Environmental Satellite (POES) and GOES data; and Department of Defense's (DoD's) Defense Meteorological Satellite Program (DMSP) data. This volume of data in 2000 was 1,000 TB annually. However with the added requirements for archiving and providing access to NASA Earth Observing System (EOS), National Polar-Orbiting Operational Environmental Satellite System (NPOESS), NPOESS Preparatory Program (NPP), the European Space Agency's (ESA's) Meteorological Operational Satellite (MetOp) and full NPOESS data in the 2005-2010 timeframe this volume will increase to over 13,000 Terabyte (TB) of data annually.

3.6 User Segment

The user needs segment is defined to be the interfaces between the user and documented requirements and between product distribution and how the costumer community utilizes the environmental satellite data and products. Historically these interfaces have not been well defined or understood. NESDIS provides user access to data, analyses, and interpretations by providing distribution of satellite products to a diverse clientele for a broad range of environmental applications. The primary users are:

- Government Agencies
- Department of Defense
- Commercial Users
- Public
- International Users
- University and Research
- GVAR Users
- FEMA
- WEFAX Users
- Real Time DCS Users

The GOES R system will be developed using solicited documented requirements from our major line offices and government agencies. Other requests from academia will be looked at to see if their requirements can be covered under current architecture. NESDIS will continue to provide user access to real-time or near real-time environmental data and information across varied pathways, including the capability to systematically evaluate and comment on satellite products and services. As new GOES R products are tested, evaluated, and deemed operationally useful, these products will be made available to the user community.

4. SUMMARY

The GOES R system will transition from and begin replacing the GOES N series beginning circa 2012. Based on new architecture concepts and system designs, the GOES R series will continue to meet and exceed GOES mission goals.

As part of the process to ensure that these goals are met, NESDIS is developing the GOES R CONOPS to follow the lines of an Enterprise CONOPS. This work is a conceptual living document that provides linkage to the system-element of the 2012 – 2020 NESDIS CONOPS; to the NOAA and NOAA Line Office Strategic Goals; and to the NOAA user community's requirements.

5. REFERENCES

Consolidated Observations Requirements List (CORL), Version 0.1, DRAFT, 2002

GOES R Operational Requirements Document, Version 0 (GORD0), DRAFT March 2002[1]

NESDIS, A Strategic Approach for the New Millennium, 2001

NESDIS Mission Observations Requirements List (MORL), Version 0.1, DRAFT, 2002

NOAA NESDIS Satellite Data Processing Center, Comprehensive Large Array-data Steward-ship System (CLASS) Archive and Access Requirements, July 20, 2001

CIRA/Colorado State University GOES FAQ Page, http://www.cira.colostate.edu/ramm/visit/goesfaq.asp

NOAA Office of Satellite Operations Web Page, http://www.oso.noaa.gov/goes/koz-eclipse/koz-eclipse.htm

Gurka, James J.: Course Notes, GOES Assessment Results, COMET/SATMET COURSE Boulder, CO, April 4, 2000, available at COMET web page www.comet.ucar.edu/class/satmet/12_Apr3_2000/docs/gurka/1)

[1] These requirements documents are essential to any CONOPS. They will be properly referenced within the document when they are more mature documents.