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1. INTRODUCTION

The National Environmental Satellite, Data, and Information Service (NESDIS), a line office within the National Oceanic and Atmospheric Administration (NOAA), is responsible for the archiving and dissemination of environmental data collected by a variety of ground-based and space-based observing systems. Within NESDIS, the National Climatic Data Center (NCDC) is responsible for managing the Nation's resource of global climatological data and information. In support of these objectives, NESDIS seeks to develop a Geostationary Operational Environmental Satellite (GOES) Active Archive (GAA).

NESDIS currently manages the NOAA Satellite Active Archive (SAA), which supports the receipt and distribution of Level 1b data from the Polar-orbiting Operational Environmental Satellite (POES) and the Defense Meteorological Satellite Program (DMSP). The GAA is envisioned to provide generally the same capabilities as the SAA, including, access to entire period of record inventories; selection of data sets by geographic region, dates, times, and satellite identifier; option to download the data via FTP or by physical media; and access to online documents.

An implementation study to address the system and customer requirements and design phases of the GAA was conducted last year, the results of which will drive the final design and functions of the GAA.

2. BACKGROUND

2.1 Current GOES Data Management Architecture

In the current GOES system configuration, the GOES Imager and Sounder data are collected by two geostationary satellites, GOES-East, which is positioned above the equator at 75 degrees West longitude, and GOES-West, which is positioned above the equator at 135 degrees West longitude. Both satellites transmit raw instrument data and telemetry directly to the Command and Data Acquisition (CDA) Facility in Wallops, Virginia, where the data are processed, calibrated, earth-located, and converted to GOES Variable (GVAR) data format. The GVAR data are rebroadcast to the

satellite, which, in turn, broadcasts the GVAR data to direct readout users needing real-time GOES data and images.

NOAA's key downlink site for archive purposes is the University of Wisconsin Space Science and Engineering Center (SSEC) in Madison, Wisconsin. SSEC has been recording and storing GOES data since 1978. Up until October 1997, the data were recorded on Sony U-Matic cassettes. Beginning in October 1997, SSEC switched to much higher density IBM 3590 tapes, capable of storing about 20Gb of data, or about one day's worth of data per day per satellite. To ensure no loss of data, a copy of the data tapes are sent to NCDC for archive each week. Currently, the data on U-matic cassettes are also being copied onto IBM 3590 tapes under a "data rescue" agreement with NCDC. The data rescue project of the entire GOES archive is to be completed sometime in early 2003.

Per directed ESDIM funding for FY 2001, NCDC increased its bandwidth capacity to enable it to transfer GOES GVAR data and metafiles from SSEC into NCDC's mass storage system known as the Hierarchical Data Storage System (HDSS). The primary communications facilities involved are a T-3 line to the University of North Carolina at Asheville which connects to the Abilene Network and a fractional T-3 line to the Internet. The bandwidth is sufficient to transfer real-time GVAR data. However, additional bandwidth is sought to electronically transfer the retrospective data from SSEC. The data volume to transfer just the real-time GVAR data from two satellites is 40Gb per day.

For the last seven years, NCDC has been receiving and archiving a variety of GOES data products via FTP from NESDIS where the products are operationally created. Starting in 1998, the products were automatically ingested and inventoried in the HDSS allowing direct access to the inventories and files by customer servicing personnel up to the present day. The GOES products archived include GOES Soundings, Water Vapor Winds, Cloud Drift Winds, and ASOS Supplemental Cloud Height/Amount.

2.2 NCDC Customer Servicing

NCDC services requests for retrospective satellite data and imagery. These requests are received at NCDC via phone, fax, mail, and e-mail. During peak periods, NCDC forwards some of these requests to SSEC for servicing. The occasional

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request for imagery and satellite data, prior to October 1997, is forwarded to SSEC by e-mail, which in turn fills the request for the customer. For the older image requests, SSEC will pull the data from tape, which may take several days since many of the tapes are stored offsite, and place the data files on a secure server for NCDC to retrieve. NCDC then processes the data into images according to the customer requirements. The software used to create all GOES imagery is called the Man-computer Interactive Data Access System (McIDAS), owned and licensed by SSEC.

It should be noted here that SSEC provides GOES data to many of its McIDAS users as part of the annual subscription fee and to universities participating in UNIDATA, which is a National Science Foundation (NSF) sponsored data and software support program.

2.3 NCDC GOES Data Management System

The NCDC operates three distinct GOES data management systems for the satisfaction of customer servicing requirements: the Geostationary Satellite Archive System (GSAS), the Historical GOES Browser, and the GOES product archival.

The primary servicing system for processing GOES orders is GSAS. GSAS, developed by SSEC in 1997, is a graphical user interface (GUI), which allows NCDC and SSEC customer servicing personnel to input customer orders and track status of orders via a web browser. The Set-up Request page includes options to select satellite id, data type (i.e. Imager or Sounder), satellite sectors (i.e. CONUS, NH, SH, FD, all, etc.), date range, and temporal range. A more detailed search option exists to include a search on a particular latitude/longitude point or area. After all of the parameters are entered, the GSAS will search the inventory, located at either SSEC or NCDC, and then list all available scenes meeting the input criteria. The desired scenes are checked-off and carried forward to the next stage where the data are further subsetted. This includes selection of channels, spatial resolution, and geographic coverage. Also, the data can be either two-byte or one-byte depending on the user's software. At this point, the tapes are pulled from the tape library by computer support personnel in the computer operations room. Once the tapes are loaded, the extraction process is initiated using GSAS. The output format is in McIDAS AREA format. The data are then processed into either NetCDF format or images using McIDAS software. Delivery to the customer is usually by anonymous FTP. The process is manual, including sending FTP notices to the customer. For the average GOES order, the data are ready within five days.

The second data management system, the Historical GOES Browse Server, was developed late in 1996 as a web-based GOES browse tool. Since there was limited disc space at the time, the system captured just three scenes per day from the SSEC real-time data server. The scene region covered the Northern Hemisphere Sector at 8km resolution. To date, over 15,000 images (JPEG format) are immediately accessible to the outside user. URL address:

<http://wfwf.ncdc.noaa.gov/servlets/GoesBrowser>

The third data management system is the GOES product archival process, a highly automated process where files are FTP-pushed daily from the NESDIS to a staging area within NCDC and then migrated into the HDSS. Access to these data sets is restricted to only the customer service personnel.

3. GAA REQUIREMENTS

The GOES Active Archive program will deliver a highly automated, modern technology-based, retrospective and near real-time data reporting and access system for NOAA. In order for the system to succeed, customer and system requirements were recently reviewed and discussed at NCDC. The requirements were solicited from a number of government and private atmospheric research organizations, which have expertise in using GOES data. In addition to these personal interviews, a web-based survey was also provided to the general public for feedback.

At the same time, NESDIS finalized the system requirements for the Comprehensive Large Array-data Stewardship System (CLASS). It should be noted that these two requirements efforts were conducted independently. In the end, the full set of GAA requirements will be a blend of CLASS requirements, which are generic in nature, and the customer requirements, which are GAA specific.

3.1 CLASS Requirements

It is envisioned that CLASS will provide archive and access services to data collected from a variety of in-situ and remotely sensed observing systems. CLASS will provide an integrated, interoperable system, taking advantage of existing NESDIS technologies, where applicable, to provide archive and access services. The IT Architecture Description document developed by NESDIS last year provides a pathway for migrating NESDIS legacy data management systems into the CLASS operational concept. The CLASS study has determined that the Satellite Active Archive (SAA) provides a good beginning model on which to base CLASS. The recommended near-term implementation of CLASS includes the design and development of a CLASS Customer Access Portal

intended to fulfill Class customer access requirements.

Access to satellite data and products managed by the SAA and access to GOES data and products have been proposed for initial portal development and evaluation. The portal will be a proof-of-concept for CLASS.

Technologies proposed for CLASS include multi-environment, clustered processors; high-density, high-speed network accessible storage arrays; high-density system-managed, long-term storage libraries; and high-bandwidth telecommunication facilities for CLASS Intranet activities. All software and processes are proposed to follow object-oriented structures and guidelines. All processes and associated system metadata are to be managed through the implementation of a distributed, relational database management system.

3.2 Customer Requirements

In the web survey conducted last year, the customer requirements were separated into four categories: 1) Data Inventory, 2) User Interface, 3) Data Delivery, 4) and Customer Support.

Under the Data Delivery category, it has been determined that the GAA system will encompass all available retrospective GOES Imager and Sounder data. The GOES data will be stored at full resolution for all channels, along with calibration and navigation data. The system shall also provide predefined lower resolution datasets and all retrospective GOES Sounder and Imager data products as identified in the GOES Products and Services Catalog.

Under the User Interface category, it has been determined that the system will be a GUI web-based interface for customer access. The system will provide low-resolution browse images for every scene to support the customer's data selection process. The option to loop a series of browse images for a given sector and timeframe will be incorporated. The system shall allow the customer to search the archive inventory in much the same way as in the SAA (i.e. satellite id, date range, times, geographic area or point, data type, etc.) and to order the data for individual channels.

Under the Data Delivery category, it has been determined that users will have the option to have the data delivered in a number of available formats. Image data would be delivered as JPEG format (although this may be expanded). For image requests, users will have the option of selecting various overlays such as state, political, and coastal boundaries; and latitude/longitude grids at specified intervals. The system shall allow customers to

subscribe to data services for recurring orders. All data will be delivered via FTP.

Under the Customer Support category, it is been determined that the system shall be fully operational on a 24 x 7 basis. It shall provide online guidance on how to use the system and shall provide additional assistance via an e-mail system. The system shall enable customers to check on the status of their order. Access to online documentation including data format descriptions, satellite schedules, and tutorials on how to use the data, will also be included. A Frequently Asked Questions page will be added, as well.

4. CONCLUSION

At the time of this writing, many of the issues discussed on the systems and customers requirements are yet to be resolved. As the GAA development process unfolds, the goal of the design and implementation phases will be to satisfy the requirements that are specified in the approved Requirements Specification. The goal of the testing phase will be to develop tests and testing methods that will verify that the GAA does, in fact, meet these requirements.

During the requirements interviews, other data needs were mentioned for consideration for inclusion in the GAA. These include:

- Any available data from the standby GOES satellite(s)
- Data from non-US geostationary satellites
- Access to the International Satellite Cloud Climatology Program (ISCCP) archives (reduced resolution datasets)
- Access to data from polar-orbiting satellites
- Access to data from other sensors, such as radar or radiosondes.

However, data from non-GOES sensors falls within the CLASS purview rather than the GAA purview. Also, the initial GAA effort should be focused on establishing core capabilities. To do so improves the likelihood of successful implementation and avoids conflicts with other value-added data providers. Nonetheless, the GAA could provide links to other websites where customers could locate non-GOES data.

5. ACKNOWLEDGEMENT

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