17.7 FUTURE OF GEOGRAPHIC INFORMATION SYSTEMS IN THE SATELLITE SERVICES DIVISION

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1. INTRODUCTION

Geographic Information Systems (GIS) are becoming more widely used for data dissemination and integration. Satellite Services Division (SSD) is striving to provide satellite products in a more widely used format for interoperability in commercial software.

2. MISSION

The National Oceanic and Atmospheric Administration (NOAA) has an enterprise-wide effort for a geospatial foundation model for data sharing and is working toward the government wide effort for the concept of a Geospatial One-Stop website. The Federal Geographic Data Committee (FGDC) is involved in the I-Team Geospatial Information Initiative which is working toward implementing the National Spatial Data Infrastructure (NSDI) to integrate and disseminate accurate spatial data. The goal is to offer data in more widely used universal formats, that are spatially enabled with accompanying FGDC compliant metadata through a web interface.

3. OBJECTIVES

The Satellite Services Division (SSD) can play a role in this effort by utilizing the (SSD) Geographic Information System (GIS) Development Team (GDT) to convert existing image products into standard GIS compatible formats with accompanying metadata. Offering data in more widely used formats which are spatially enabled will not only bring more users, but will also prepare us for integrating our data to the National Geospatial Data Clearinghouse and NOAA Geospatial One-Stop or any other web interface data sharing portal.

Providing image products in more widely used formats aligns with the SSD Mission and Vision Statements by providing “near real-time environmental data from polar and geostationary satellites to a diverse community, and pioneering development and implementation of superior quality environmental satellite services and products which surpass customer requirements.”

GIS development in SSD would also align with the OSDPD mission to “provide environmental satellite data and derived products to domestic and foreign users, serving as an interface with users from the civil sector and providing plans for initiation of new services to meet user requirements.”

4. VISION

The SSD GDT is actively participating in the NOAA Enterprise GIS Committee. This group combines offices throughout NOAA with the goal of centralizing GIS efforts to provide a NOAA GIS community to share data, information and technical expertise with standardization. The ultimate goal of this group is to combine all NOAA GIS data into a NOAA Geospatial One-Stop web portal to provide a central location for easily accessible data not only to NOAA users but to other government offices and the public as well.

SSD image products are produced in formats which limit the number of users. There are a limited number of sites which can use the McIDAS file format. Offering the data in a more widely used format provides the user the ability to download and integrate data, creating value added products on the user end, reducing those efforts at the SSD level.

5. GIS STRATEGIC PLAN

GIS technologies are ready for assimilation into SSD operational products.

The GIS Strategic Plan presents a high level strategy and tactical plan for the enhancement of operational products throughout SSD. It lays out key strategies for fulfilling the expectations expressed in the Vision statement.

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The elements of the Plan present a GIS roadmap for the expansion of GIS that will require significant commitment of resources over the next several years. During the expansion phase of the GIS, further definition in all areas of the GIS program will be developed as an incremental process working from general to specific levels of detail.

In addition to providing a roadmap for GIS development, a key purpose of the Plan is to communicate the goals and approaches for expanding GIS technologies throughout OSDPD.

Key program needs include:

- Highly available and useful GIS information and tools to support current SSD customers.
- Improve service to the public with improved information access.
- Integration of GIS with existing and planned information systems.
- Enhancement and ongoing management of a GIS basemap consisting of raster and vector based spatial data sets.
- Enhancement of methods for generating dynamic sensor based data sets.
- Development and management of a GIS infrastructure providing secure and reliable access to information and applications.
- Development and management of Metadata collection, storage and dissemination techniques.
- A governance structure to address policy and operational program issues that is open to stakeholder input.
- Skilled support staff to develop, enhance, and maintain the core GIS program elements.
- An ongoing coordination effort that fosters collaboration on GIS program elements.
- Standards, specifications, and a quality management program that enables interdepartmental / interagency sharing of information.
- A long term funding strategy and structure to assure program longevity and sustainability.

The design of the GIS program is based on the following guiding principles and values:

- Focus on providing quality geographic information supporting SSD current and envisioned operational commitments
- Centralized GIS program administration and accountability is essential to ensure planned outcomes
- Support the established SSD GDT to coordinate development, use, and management of geographic information
- Provide enduring policy direction, funding mechanisms, and coordination among cooperating NOAA divisions
- Embrace an extended enterprise GIS program definition
- Encourage shared information resources
- Recognize that work flow and responsibilities must be adjusted to achieve the benefits of a collaborative GIS program
- Make information highly available and formatted for assimilation with disparate applications

Key strategies that set the character and direction of this program are as follows:

- A GIS utility serving SSD and external entities will address diverse needs through a reliable information infrastructure.
- Develop partnerships with non-Office of Satellite Data Products and Distribution (OSDPD) organizations to cooperatively develop and manage the GIS program elements.
- Through cooperative agreements, acquire existing best practices, digital information and technical methods of implementation where these elements meet SSD's specifications.
- Participate in NOAA's development of a shared Geographic information repository to provide a one-stop portal for accessing shared GIS information through an enterprise-wide network.
- Define standards for all GIS information, document the standards and other Metadata characteristics, and provide on-line access to facilitate users finding information that meets a variety of analytical and scientific needs.
- Enhance the existing GIS data generation methods to meet a defined quality standard that fulfills SSD's internal and user content and accuracy requirements.
- Establish guidelines and procedures for the continuation of copyright and distribution controls.
- Develop an integrated maintenance process to improve efficiency and effectiveness throughout all facets of GIS product development.
- Enhance and deploy a web-based GIS information browser application to meet the common needs expressed by SSD's user community for basic information retrieval.

Implementation of these strategies will result in significant changes to the current method of information management and access. Most profound will be the reduction in redundant information management efforts, significant improvement in information accessibility and usefulness, and streamlined development and implementation of GIS based processes. These changes will increase the efficiency of the SSD GDT and also provide improvements in nearly every aspect of geographic information management, development and access.

6. POTENTIAL STRATEGIC PARTNERSHIPS

Through the NOAA Enterprise GIS community efforts, the SSD GDT has developed various NOAA contacts for collaboration. Technical assistance from commercial vendors are also being explored.

The National Weather Service Office of Science and Technology approached the GDT of SSD for satellite data over the eastern Atlantic basin in a GIS compatible format. Goes East GeoTiFF images are integrated with NWS data in an experimental ArcIMS hurricane tracking website. The SSD GDT was able to provide data for this task with little effort. OST would like to obtain this data operationally following their experimental phase.

SSD is working closely with the Office of Research and Applications (ORA) and a contractor to develop more datasets that can be delivered by ArcIMS. Not only has fire data been successfully used by the public using ArcIMS, SAB is using the data as well. SSD volcano and snow products have also been added to new map services.

The Satellite Analysis Branch (SAB) of SSD has expressed an interest in applications of GIS as a tool for the production of hazard related products. The SAB currently uses fire and smoke detection data in a GIS format in their image analysis for the fire and smoke hazard mapping system. Development of a centralized workstation with GIS software and pertinent data streams to that workstation to enhance the image analysts' hazard mapping effort is under way. Training will also be included in this effort for the SAB analysts. The workstation will be used to introduce the SAB analysts to GIS as well as used as a GIS tool for their fire, tropical, heavy precipitation, snow and ice and volcanic ash hazard mapping products.

The SSD GDT has successfully transformed image production for the OSEI team from an in-house designed software package which produced non-georeferenced images, to commercial-off-the-shelf (COTS) software producing geolocated images with the ability to overlay data in a GIS compatible format for both internal and external use. The GIS Team will continue to support GIS efforts for the OSEI team and other teams throughout SSD.

Collaboration with the Office of Research and Applications (ORA), Ocean Science Team is underway to provide GOES East and West, and GOES SST images in GeoTiFF for their research. The SSD GDT is also working on conversion of RADARSAT images.

The SSD GDT has met with the National Ice Center to discuss and compare GIS development efforts on ice mapping and to provide assistance with obtaining snow and ice maps from the IMS system for comparison with operational ice charting.

The SSD GDT has completed work on a direct connection between the spatially enabled database located in the SSD and the National Geophysical Data Center (NGDC) geospatial database for the purpose of making our data available to more users and for entering our data in the Comprehensive Large Array-data Stewardship System (CLASS). The geospatial database in SSD is mirrored at NGDC. Data from the Hazard Mapping System fire and smoke detection and Wildfire Automated Biomass Burning Algorithm (WF-ABBA) fire detection products are produced and sent to geospatial databases in the SSD and the NGDC. More data in a GIS format will be made available for the NGDC geospatial database and CLASS archive. The link between the databases is near real-time. NGDC has provided expertise in developing geospatial databases to SSD.

7. SYSTEM ARCHITECTURE

The existing system includes an Oracle 9i database on Spyder-II (Linux) which is spatially enabled with ArcSDE (ESRI Spatial Data Engine), GIS development (ARCGIS1) on a Dell 4400 (Windows), and (ARCGIS2) for intranet mapping services, with a GIS web map service interface (SSDGIS1) on a Dell 4600. Construction of a backup system (SSDGIS2) is necessary to ensure data continuity. (Figure 1). Shifting the system architecture to Linux operating systems will be a goal for the internet mapping services.

8. DATA FLOW

The data conversion is an automated process and stored temporarily (no longer than 4 days) in a geospatial database. Data would be queried through the web map interface using ArcIMS. The ArcSDE (spatial data engine) searches the database and serves the data with associated metadata, to the ArcIMS map service for online viewing and the data can be downloaded from a secure FTP site. There are freely available third party applications which will enable basic viewing and analysis of GIS data.

9. PRODUCTS AVAILABLE

Through centralization of GIS development in SSD, GIS data production, including geospatial database and metadata development can be completed with cost savings.

The SSD GDT converted various image file formats into GeoTiFFs (georeferenced Tag Image

File Format) and image derived products into shape files. GeoTiFFs are georeferenced images which are compatible with common graphics and GIS software. The image files are small and have the header information embedded within the image, instead of provided in a separate header file. Shape files have associated database and spatial index files, which can be read in GIS software, or they can easily be converted to other file formats, such as a basic ASCII file.

10. CONVERTED DATASETS

GOES East and West
GOES SST
CoastWatch GOES SST
OSEI RGB images (GeoTiFF)
Global Vegetative Index
AVHRR (LAC, GAC and HRPT)
MODIS
NWS Family of Services
Any McIDAS area file
Any ASCII text file
TRaP

11. CURRENT USERS

Current users are those now using the GeoTiFF images, shape files and ASCII text files from the HMS via the SSD fire web page:

- NOAA users, including NESDIS/ORA and NWS/OST - for forecasting applications, air quality applications, and research and development.
- National Weather Service, Office of Science and Technology recently requested GOES East images in GeoTiFF for a hurricane forecasting intranet map service.
- Office of Research and Applications, Ocean Science and Land Science teams.
- Satellite Services Division, Satellite Analysis Branch.
- Space Science and Engineering Center (SSEC) - for research and development.
- U.S. Environmental Protection Agency - for air quality monitoring.
- U.S. Forest Service - for air quality monitoring.
- State fire management agencies in Florida, Oklahoma, Missouri - for fire and smoke management.
- GEOMAC users (US Geological Survey, Bureau of Land Management, NPS Fire Management Program Center, National Interagency Fire Center, National Weather Service, Bureau of Indian Affairs, US Fish and Wildlife Service) - for fire and smoke management.
- Several educational institutions and private businesses - for miscellaneous applications.

12. POTENTIAL USERS

Potential users are those who have used, requested, or otherwise expressed an interest in using satellite imagery (individual channels) and derived products in GeoTiFF and other GIS-compatible formats:

- Members of the Open GIS Consortium (numerous federal agencies) - channel imagery and OSEI imagery, mostly for emergency management.
- National Weather Service - HMS imagery for AWIPS.
- SSEC - channel imagery for general use and integration with McIDAS as a decoder or ADDE server.
- Australian Bureau of Meteorology - channel imagery for general use.
- Unidata - channel imagery for general use.
- State of Alaska - OSEI imagery for fire monitoring and mitigation.
- State environmental protection agencies - channel imagery, OSEI imagery and HMS products for air quality enforcement.
- Pacific Disaster Center - OSEI imagery for assessment of impact on military operations in foreign theaters.
- Foreign governments - OSEI imagery fire mitigation efforts in Indonesia, Brazil, Mexico and Canada.
- U.S. Department of State - IMS snow maps for foreign humanitarian aid applications in Afghanistan.
- News media - OSEI imagery for use in creating graphics for breaking news and follow-up documentaries.
- Educational institutions - OSEI imagery for use in creating educational graphics.
- Private businesses - OSEI imagery for miscellaneous uses.
- Private citizens - OSEI imagery for miscellaneous uses.

Other identified potential users of GIS data not listed above are organizations which currently work with GIS or have GIS data available through internet sites. Some of these include state and local governments, schools and universities, field offices of the National Ocean Service (NOS) and National Marine Fisheries Service (NMFS), the general public and international users.

The NOS and NMFS currently use GIS in their research efforts. Researchers in the field commonly use GPS data to track marine mammals, NOAA ships, and map sites of interest, such as coral reefs or marine protected areas. Our data can be integrated in GIS software with GeoTIFF images and shape files to enhance their

research.

13. REFERENCES

The NOAA Enterprise GIS community, https://www.gis.noaa.gov

The National Weather Service has an effort underway to offer their products in a GIS format via an ArcIMS map service which is under development at http://140.90.22.241/website/uszone.

The National Weather Service, Office of Science and Technology currently has a hurricane tracking intranet map service (ArcIMS).

The National Weather Service also has a GIS Map Database located at: www.awips.noaa.gov/mapdata/newcat/

The University of Texas has a Weather and GIS website located at: www.utexas.edu/depts/grg/ustu.../fall96/condell/project/

An ArcIMS map service is available through NASA at http://datasystem.earthkam.ucsd.edu.

The National Geodetic Survey offers their data through an ArcIMS map service in GIS compatible format at http://www.ngs.noaa.gov/RSD/shoredata/NGS_Shoreline_Products.htm and select "vector shoreline data."

The Federal Emergency Mapping Agency has GIS data available at: www.gismaps.fema.gov/

The general public can view data in an ArcIMS map service easily through a web browser in PNG format, and can download ESRI ArcExplorer for free from the ESRI website. In addition, there are other programs such as GRASS and ArcGIS (ESRI).

Open GIS Consortium, Inc., http://ogc.opengis.org/cgi-bin/displayGlossary.pl, June, 1998

ESRI Library, GIS Glossary, http://www.esri.com/library/index.html., October, 2002

14. SYSTEM ARCHITECTURE

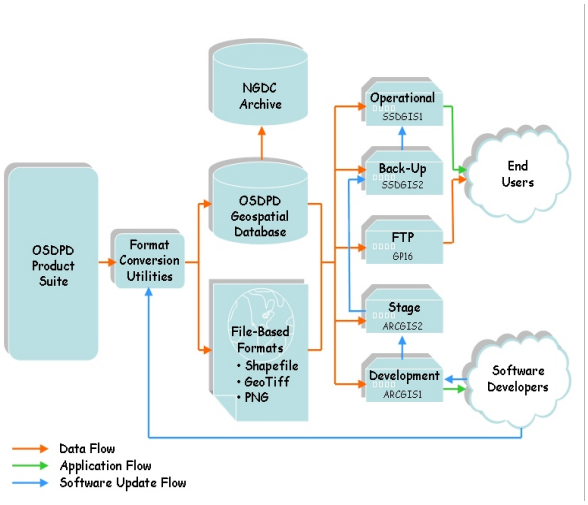

Figure 1. System Architecture for the Satellite Services Division Geographic Information System production with data conversion, file transfer protocol server, geospatial database, connection to an archive and operational, back-up and development machines.