CGMS XXXIII NOAA-WP-20
Prepared by NOAA
Agenda Item: IV/2
To be discussed in WG IV

# Update on the NOAA Alternative Dissemination Methods (ADM) System

The NOAA Alternative Dissemination Methods (ADM) System is an on-going development of a communications system for the dissemination of environmental satellite data from NOAA, EUMETSAT, JMA, and research satellites. The current development of the NOAA ADM is based on a two year ADM Study conducted by NESDIS. ADM will function as a supplement to Direct Readout broadcast systems from environmental satellites. The ADM can be accomplished via Digital Video Broadcasting-Satellite (DVB-S), Landline, and/or Internet infrastructures, depending on the connectivity available to the user. In this development phase of the NOAA ADM, the primary concern of NESDIS is to demonstrate the viability of the ADM System. The ADM System viability has been demonstrated by the successful construction of an ADM User Terminal (currently receiving satellite data at 10.23 Mbps), architectural descriptions for the software in the ADM User Terminal, the development of the ADM Center, and an end-to-end computer simulation of the ADM System to include Data Sources, Data Processing, and Data Dissemination. Currently, the ADM frame structures, interfaces and performance criteria are still under investigation by the NESDIS ADM Team.

# Update on the NOAA Alternative Dissemination Methods (ADM) System

## 1 Introduction

As future environmental satellites improve their capabilities, they will produce far more data than the current satellite series. Each constellation will require its own unique field terminal to acquire its transmission. In the future, an environmental user must decide whether a single satellite series is sufficient to meet its mission needs or purchase additional field terminals to get the other data. In anticipation of this, NESDIS commissioned a study in 2003 to investigate how Alternative Dissemination Methods (ADM) can aid in this future data dissemination and data reception. The NOAA ADM Study contributed papers to CGMS XXXI and CGMS XXXII discussing the development of the NOAA ADM system.

In 2005, the NOAA ADM Study progressed into the NOAA ADM Development. The purpose of the current NOAA ADM Development is to prove the viability of the ADM System described in the ADM Study, and to provide specific descriptions of what the ADM System should consist.

The 2003-2004 NESDIS ADM Study determined that the following 3 dissemination methods should be pursued by the ADM System: Commercial Satellite Communications, the Internet, and dedicated fiber optic lines.

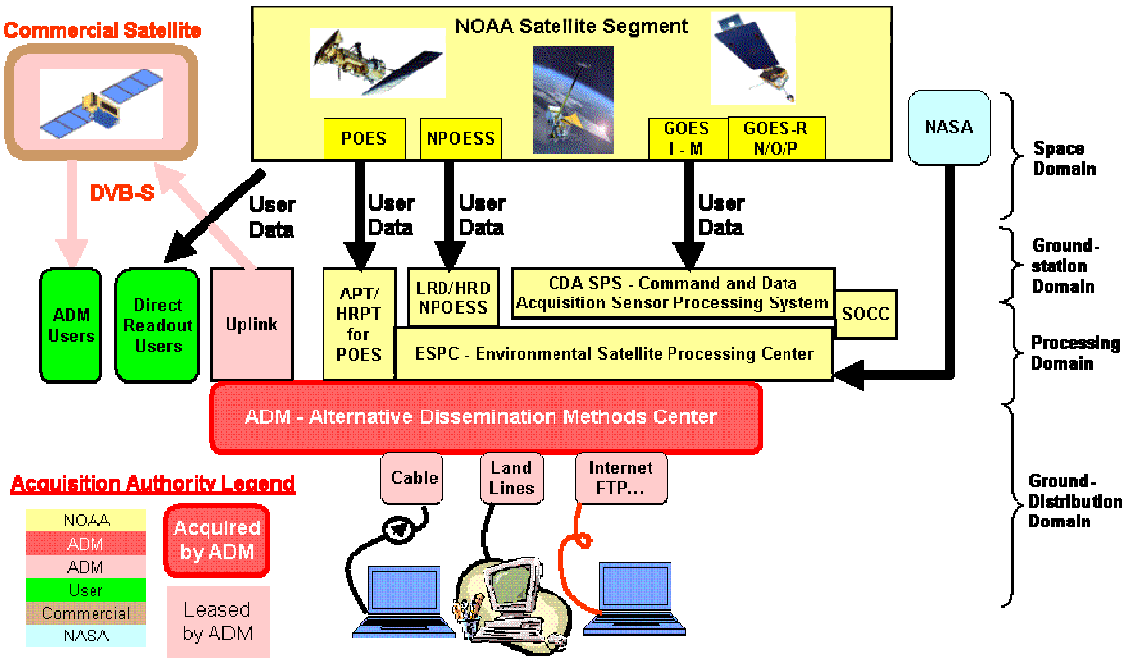


Figure 1-1: Systems Interface Description of ADM

# 2 ADM System Viability

There are 3 functional components to the ADM System: Data Collection, Data Processing, and Data Dissemination. In order to show that the ADM System is viable, NOAA must demonstrate a plan by which all three functional parts of the ADM can be implemented. Proof that the ADM System is viable is currently being accomplished by prototype construction, software architecture descriptions, and simulation.

## 2.1 ADM Data Collection

The main source of data for the ADM Center will be the NESDIS Environmental Satellite Processing Center (ESPC), located in Suitland, MD. The ADM Center will receive Level 1B (calibrated, and with LAT/LONG information), GOES VARiable (GVAR), NPOESS EDRs, and NASA research data,. Other types of meteorological and oceanic information data will also be received (this is a topic currently under investigation). The main operation executed by ADM on ESPC data will be "prioritization." The available "bandwidth" or "capacity" of the ADM dissemination function is limited, so that not all data received from the ESPC can be broadcast. The ADM Center will create algorithms for the selection and prioritization of received ESPC data, in order to form the broadcast data stream of ADM. The ADM System also has the responsibility of collecting HRPT data from selected HRPT terminals.

## 2.2 ADM Data Processing

Architectural descriptions of the software that will be contained in the ADM Center are currently being written.

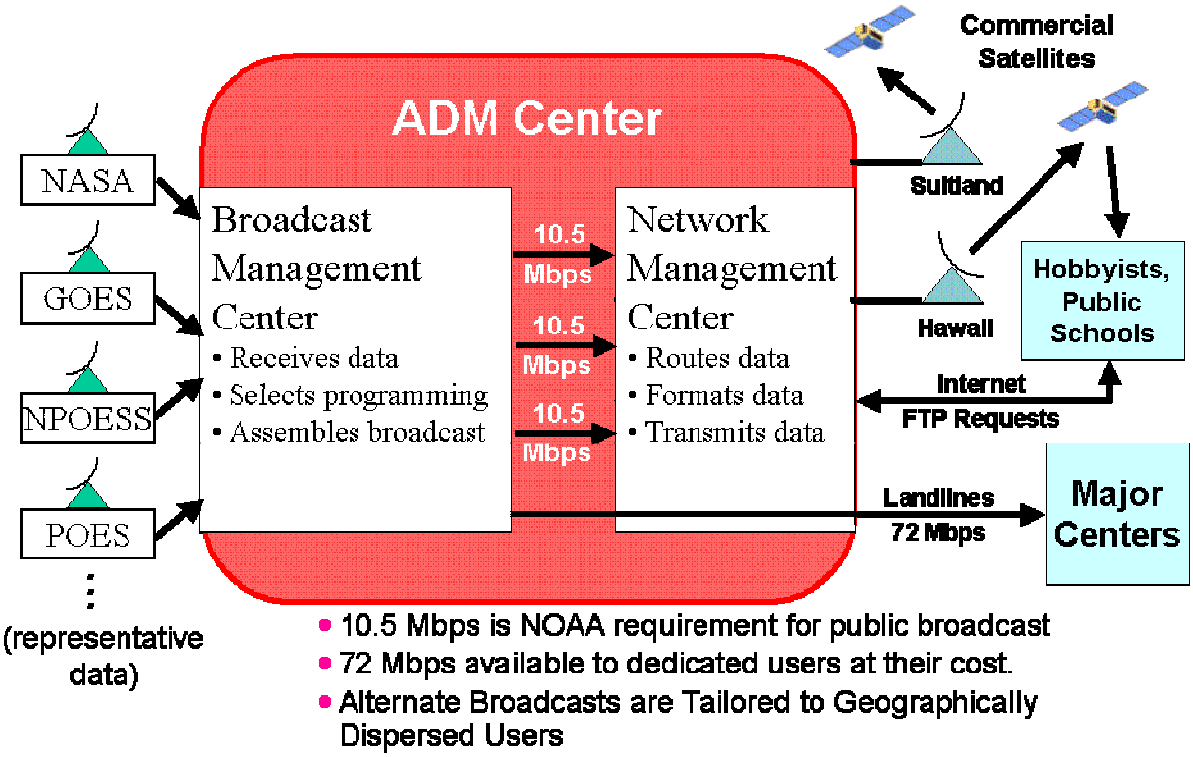


Figure 2-1: Systems Communication Description of ADM

The software of the ADM Center is being designed at an architectural level. The ADM Center will be located in Suitland, MD, and will be at the core of the three ADM functions: Data Collection, Data Processing, and Data Dissemination.

### 2.3 ADM Data Dissemination

The ADM System Data Dissemination capabilities are being verified by the same methods used to verify the two other functional components of ADM (Data Collection and Data Processing). The ADM System Data Dissemination capability will be verified by hardware (ADM User Terminal Prototype Construction), software (ADM User Terminal Software Description), and ADM Simulation.

#### 2.3.1 ADM User Terminal Prototype Construction

A prototype of the ADM User Terminal has been developed. The prototype consists of an eight foot C-band Antenna, Low Noise Amplifier Block Downconverter (LNB), and receiver. The ADM User Terminal is currently receiving the 10.24 Mbps C-band broadcast from AMC-4. This broadcast utilizes the DVB-S (Digital Video Broadcast-Satellite) format, which is the data format that was chosen for ADM during its Architecture Study Phase.

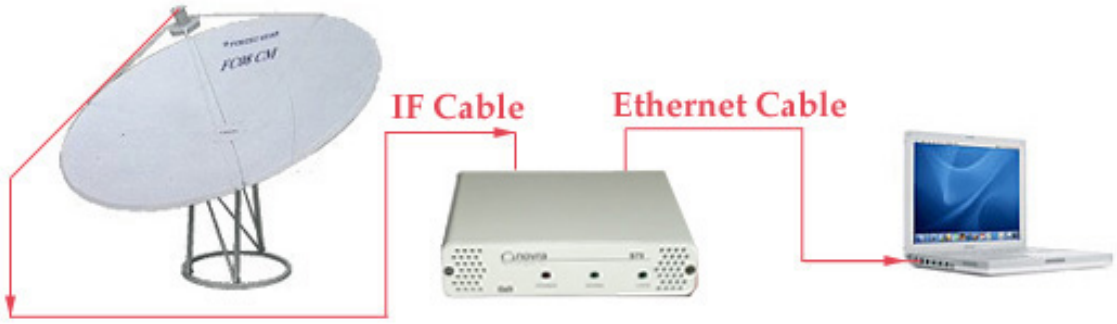


Figure 2-2: Prototype of ADM User Terminal

Now that the hardware portion of the ADM User Terminal Prototype has been finished, investigations are now commencing on the software suite that will be most appropriate to the ADM User Terminal.

### 2.3.2 ADM User Terminal Software Description

Architectural descriptions of the software that will be contained in the ADM User Terminal are currently being written. Software for the user terminal will be modular and flexible. The ADM Center and the ADM User Terminal will use the DVB-S protocol. The DVB-S protocol encapsulates IP traffic, which will enable the ADM Center to have a broad range of data products available. The ADM User Terminal will have the capability of receiving the DVB-S signal and restoring the received broadcast data to the form of its original data set.

Transmitted content will change over time as needs change and new data products are developed. Therefore, it is important that the software of the user terminal adapt to those changes without requiring software upgrades.

The major functions to be performed by the user terminal are:

- *Transmission handling*. The user will comply with the protocol established by the ADM Center and handle error conditions.
- *Scheduling.* The user decides when to listen for broadcasts and what data is to be saved locally.
- *Data management.* The user terminal provides a framework for saving data products, retrieving them and managing a local retention policy.
- *Data Processing.* The user terminal allows the user to install software to process data products.

The above software functions will be implemented in a modular fashion that permits module replacement without affecting other modules. The transmission handler should not need to know the particular formats of the data products. It should be concerned with receiving a product according to the transmission protocol and passing it to the data management module. The data processing modules need not know the details of transmission protocols but should only make requests of the data management module. The user of the terminal will have the ability to deploy whatever software they require to process the data products.

# 3 ADM Simulation

In order to affirm the viability of the ADM System, a simulation is being written. All three functions of the ADM System (Data Collection, Data Processing, and Data Dissemination) are being modeled by an orbital simulator, Satellite Orbit Analysis Program (SOAP), a communications network simulator, COMmunications NETwork (COMNET), and a data dissemination simulator, Dynamic Communications Architecture Study Tool (DyCAST)). These simulation packages were selected so that data can be easily transferred from one program to another in order to implement an entire system-wide simulation.

The ADM Simulation requires top-level ADM System parameters, and all members of the NOAA ADM Team are working to generate these parameters. The ADM Simulation

mimics the performance of the proposed ADM System, thereby helping to prove the viability of the future ADM System. The ADM Simulation requires knowledge of parameters which will be used by the future ADM System. The ADM Simulation serves as a guide for the completion of the ADM Architecture by modeling the collection of data into the ADM Center, the processing and prioritization of data within the ADM Center, and the distribution of data directly to the ADM internet user as well as the distribution of data via commercial satellites to the ADM User terminal. The ADM Simulation model can be used to predict system performance over time and gain an overall assessment of the system design. This model will be used to do initial system-sizing studies, simulate the fully operational system performance, as well as support future growth studies.

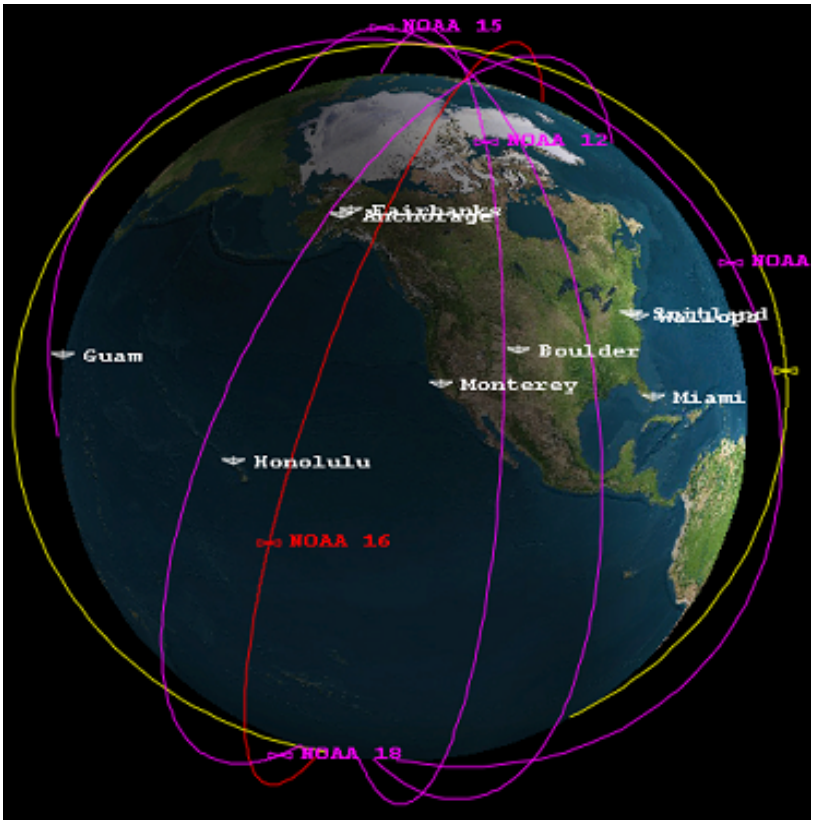


Figure 3-1: SOAP Simulation of HRPT Terminal Data Return

## 4 Conclusions

NOAA has built upon its current development of ADM architectures derived from the previous ADM Study. The ADM Development at this point has verified the viability of a low cost ADM User Terminal and begun the investigation into data formats to be pursued by both the ADM User Terminal and the ADM Center. The ADM Architectures derived in the previous 2-year study have been verified. Viability of the ADM Architectures has been verified, although the work on ADM Simulation is on-going. The pursuit of alternative methods of distribution is important as the amount of environmental data grows in the future. ADM is a system for the distribution of Near Real Time data, with a

latency of only 3 or 4 minutes or less. ADM does not support an archive of weather data. Work to develop a detailed description of the system architecture is on-going. ADM users may receive environmental data via domestic satellite (DOMSAT) if they are within the footprint of the ADM Broadcast. ADM users may, of course, use the Internet or dedicated landline if these resources are available to them.