CGMS 34 NOAA-WP-22
Prepared by NOAA
Agenda Item IV/2
Discussed in WG IV

2006 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. NOAA is now in the second year of the development phase of ADM, and has the following prototypes available for demonstration: ADM User Terminal (currently receiving satellite data at 10.23 Mbps), ADM Control Center Software, and ADM Network Management Center (IP Encapsulator, Modulator, …). Further development of prototypes is proceeding. One demonstration of the ADM User Terminal has been given. Two demonstrations of the ADM Control Center Software have been given. The possibility of a satellite demonstration of ADM is being considered. NOAA ADM applications to and support of the GEO-NETCast global disaster relief network are being investigated. A Systems Requirements Document, Statement of Work, and Costing have been completed by the NESDIS ADM Team in order to support NOAA decision making as to how best the NOAA ADM can support GEO-NETCast or other projects.

2006 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 environmental satellite constellation will require the user to employ a field terminal receiver unique to that particular environmental satellite constellation. In the future, an environmental data user must decide whether a single environmental satellite constellation is sufficient to meet mission needs, or whether to purchase additional field terminals to get data from other environmental satellite constellations. 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 reception. The NOAA ADM Study contributed papers to CGMS XXXI, CGMS XXXII, and CGMS XXXIII, discussing the development of the NOAA ADM system.

In 2005, the NOAA ADM Study progressed into the NOAA ADM Development, which is currently continuing in 2006. The purpose of the current NOAA ADM Development is to stage demonstrations of the NOAA ADM prototypes that have been developed, in order to inform NOAA management of NOAA ADM capabilities, and apply NOAA ADM architectures to the GEO-NETCast project.

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.

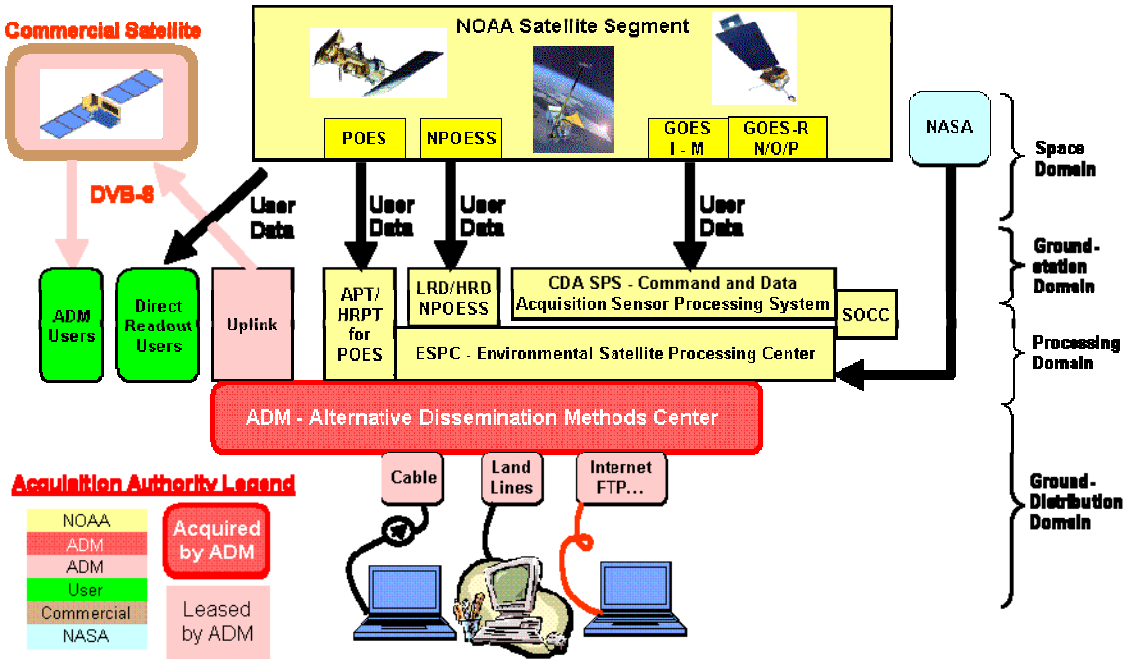

FIGURE 1-1: SYSTEMS INTERFACE DESCRIPTION OF ADM

2 NOAA ADM PROTOTYPE DEMONSTRATIONS

There are 3 functional components to the ADM System: Data Collection, Data Processing, and Data Dissemination. Data Collection consists of the fiber optic lines going into either the ESPC or ADM Center. Prototypes have been constructed by the NESDIS ADM Team for the ADM Data Processing and Data Dissemination functions. One demonstration of the ADM User Terminal has been given Two demonstrations of the ADM Control Center Software Prototype were given in 2006. An ADM Network Management Center Prototype (IP Encapsulator, Modulator, …) is operating, and its incorporation into a satellite demonstration is under consideration.

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 (Environmental Data Records), and NASA research data,. Other types of meteorological and oceanic information data will also be received (this is a topic currently under investigation). The ADM System also has the responsibility of collecting HRPT data from selected HRPT terminals.

2.2 ADM Data Processing

The main operation executed by ADM on ESPC data is “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 Control Center Software Prototype has been demonstrated twice during 2006, and has illustrated this “prioritization” or “queueing” property. The ADM Control Center Software Prototype includes screens for the ADM Administrator to enter decisions concerning the “prioritization level” assigned to incoming data. The incoming data stream is down-selected according to the entered priorities, a broadcast data stream is formed, and then the broadcast data stream is sent to the ADM Network Management Center for transmission over commercial satellite, Internet, or dedicated fiber optic cable.

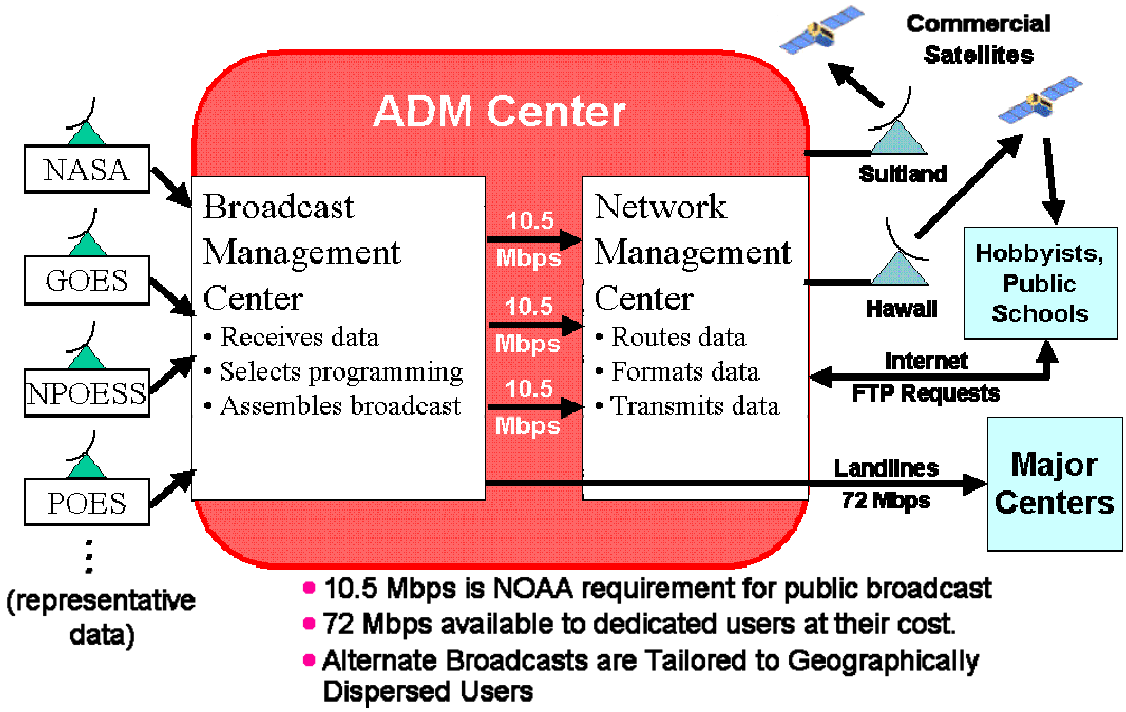

Figure 2-1: Systems Communication Description of ADM

The transmitter section of the ADM Control Center Software Prototype successively wraps the ADM data with ADM headers, IP headers, and DVB-S headers. A "de-wrapping" function is executed at the receiver section of the ADM Control Center Software Prototype.

The functioning of the entire ADM Center is described in a forty page Systems Requirements Document (SRD), authored this year by the NESDIS ADM Team. This SRD was based on the ADM Architectural Studies of 2003 and 2004. ADM Prototype construction has been based on the SRD, so that current ADM prototypes are in line with the desired capabilities as found in the ADM Studies.

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 have also been verified by demonstration. The Data Dissemination receive capability was verified by a hardware prototype (ADM User Terminal Prototype Construction) and a software prototype (ADM User Terminal Software).

2.3.1 ADM User Terminal Prototype Construction

A prototype of the ADM User Terminal has been built by the NESDIS ADM Team. The prototype consists of an eight foot C-band Antenna, Low Noise Amplifier Block

Downconverter (LNB), and receiver (demodulator). The ADM User Terminal currently receives a 10.24 Mbps C-band broadcast from the AMC-4 satellite. This broadcast utilizes the DVB-S (Digital Video Broadcast-Satellite) format, which is the data format that was chosen for ADM during the ADM Architecture Study Phase.

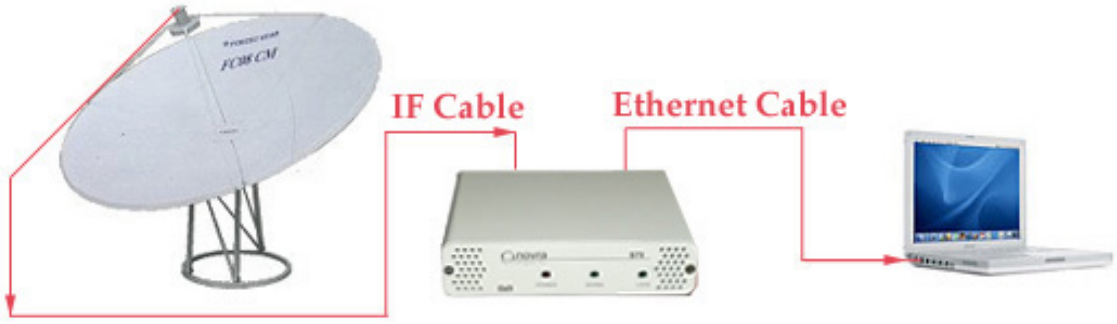

Figure 2-2: Prototype of ADM User Terminal

The ADM User Terminal Prototype includes a Graphics User Interface (GUI) for display of environmental data. The GUI is based on the "Google Earth" software, and has the capability of superimposing a weather image on the "Google Earth." The ADM User Terminal Prototype also includes a public domain (High Rate Picture Transmission) HRPT Reader, which generates various products (visible light, vegetative index, ice index, …) from a "raw" HRPT file. Each of these products can be displayed by means of the Google Earth utility.

The design of the ADM User Terminal Prototype has purposely remained "open source" or "public domain" in order to enable a low cost for the terminal ultimately available to the ADM user. Standards for construction of an ADM terminal could be published on a website to enable "home-made" versions of ADM User Terminals. Simply maintaining the "open source" nature of design standards for ADM terminals will encourage competition in the terminal vendor community, and thus lower ADM User Terminal cost.

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 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 Conclusions

NOAA has continued the development of the ADM System, based on the ADM Study of previous years. The ADM Development at this point has produced functional prototypes of the ADM User Terminal (demonstrated once), ADM Control Center Software (demonstrated twice), and ADM Network Management Center (possibly to be demonstrated over a satellite link in the future). These prototypes and demonstrations have verified the viability of a low cost ADM User Terminal. The ADM Control Center Software Prototype and the ADM Network Management Center Prototype have verified the compatibility of the Interface Standards described in the ADM Center Systems Requirements Document with commercially available hardware. The NESDIS ADM Design Team has maintained a “trace-ability” of “desired capabilities” from the ADM Study phase to the Systems Requirement Document, and then to the ADM prototypes themselves. The practicality of the ADM design as described in the SRD has been verified by the ADM prototypes. The pursuit of alternative methods of dissemination 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 4 minutes or less. ADM does not support an archive of weather data. 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.