

ADVANCED METEOROLOGICAL IMAGE AND GRAPHICS
ANALYSIS SYSTEM

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1.0 INTRODUCTION

Control Data is developing an operational meteorological data processing system called AMIGAS II, the Advanced Meteorological Image and Graphics Analysis System. The baseline functions of AMIGAS II are the capture, analysis, presentation, and distribution of meteorological data. AMIGAS II is an integrated hardware/software system supported by a distributed architecture that is based on Cyber 180 mainframes, graphics workstations, meteorological data receiving equipment, and the CDCNET communication system. Real-time communication processors ingest satellite, radar, and observational data and transfer the information to the mainframe for storage on system data bases. Meteorological applications analyze and process this information into alphanumeric and graphics products. The products are transmitted and stored locally on the workstations where they are transformed into viewable graphics for display and editing. The meteorologist interacts with the products at the workstation via a man-machine interface that employs multiple windows, icons, pull-down menus, and mouse-driven control. Forecasts and edited graphic products, generated on the workstation, can be transmitted back to the host for dissemination, archiving, or modifying the system data bases.

2.0 SYSTEM OVERVIEW

2.1 System Data Flow

AMIGAS II provides a platform upon which the operations of a weather service can be built. The baseline functions of AMIGAS II are the capture, analysis, presentation, and distribution of meteorological data. Real-time hardware and software subsystems ingest and preprocess satellite, radar, and observational data. The data are transferred via the CDCNET local area network (LAN) to the host system for storage on the meteorological data bases. High-level data management routines provide concise and easy access by meteorological applications to all data types. Analysis applications, initiated by a time-based scheduler or user requests, create alphanumeric, image, and graphics products. Once created, the products are automatically transmitted across the CDCNET LAN to the workstations and stored locally on disk. Display applications render the products into viewable graphics for interpretation. Meteorologists, utilizing state-of-the-art man-machine interfaces, interact with the products for purposes of editing and enhancements.

2.2 Data Acquisition

A characteristic requirement of operational meteorological systems is the ingest of a variety of data types and formats from several different sources. The AMIGAS II Data Acquisition Subsystem (DAS) has been written to accommodate this diversity and to be customized for the requirements of each particular site. Each data source has associated with it a communication method, a formatting application, and a schedule.

The communication method is dependent on the type of device that is responsible for receiving the data (satellite data receiving system, network message switching system, etc.) and its requirements for a communication medium, transmission

protocol, and device control. Device communications can occur over a variety of different communications media. Examples include serial communication lines, an Ethernet-type local area network, a high speed local network such as Control Data Loosely Coupled Network (LCN) or a higher speed Cyber channel connection.

The formatting application is responsible for any decoding of the information and placing the data on the system data bases. Through these applications, DAS controls the receipt of the proper data types (i.e., visible or infrared satellite data, radar range, upper air observations, etc.) over the correct geographic areas (i.e., satellite data sector, a particular radar installation, etc.). Placing the data in the proper files according to date and time is also a function of the DAS applications.

As viewed from the host computer, some data sources send data at an externally determined time (satellite data, observational data, etc.) and other sources are requested to send information (radar data, automated observing systems, etc.). To request data at a particular time, DAS employs a time scheduler to activate the processing necessary to receive the data. For externally timed data, analysis starts when the data reception is complete.

2.3 Data Services

Meteorological applications are built around the AMIGAS II Data Services. Data Services encompass a data management system, access methods to the data, mapping transformations, and several categories of utilities. Data Services provide three levels of support to application programs. Level I is the application access level. Level II routines provide access to the data management system. Level III routines utilize operating system features to support the data

management system.

Meteorological applications use Level I functions to retrieve, process, and write observational, geographic, image, and graphics data. Depending on the particular type of data, different access methods are used. For example, routines are supplied to search for observational data based on date and time and/or geographic location. In addition to the various access methods, any data returned to an application can be transformed to a map projection, satellite image, or radar projection if required by the calling program.

Level II provides access methods to the data management system. File and record level routines are supported for manipulating the data. These routines include creating, opening, closing and deleting data base files. Individual records can be read, written, deleted, and searched for through the Level II access methods. Concurrent access for reading and writing is allowed with locking for concurrent writes occurring at the individual record level. All data base accesses can be retained on a log file. Utilities for searching the access log file are supported for auditing purposes. Archiving data base records is facilitated by Level II dump and load routines.

Level III serves as the interface to the operating system dependent portions of the data management system. These routines isolate the rest of the Data Services from dependencies on particular hardware and software systems. The purpose of Level III routines is to optimize the implementation of read and write methods for the various data sets.

2.4 Application Processing

The complete execution of a meteorological application involves three steps: 1) satisfying the values for controlling parameters, 2) analyzing or processing the desired data set, and 3) viewing the output. Within AMIGAS II, these steps are performed by the Request Interface, Meteorological Applications, and Display Services, respectively.

2.4.1 Request Interface

The Request Interface is the man-machine interface for creating product definitions. This interface employs various mouse-driven facilities, such as pull-down menus, push buttons, list boxes, and dialog boxes, to present application parameter values. As a matter of design philosophy, keyboard input of values is avoided wherever possible to reduce the chance for errors. By selecting and specifying parameter values, the user creates product definitions which are saved on a data base. The product definition data base maintains custom product definitions for individual users and shared definitions for use by an entire site.

For organizational purposes, products are described as slides and carousels. The basic element of a slide is a component which represents a particular processed data set. Examples of a component are a satellite image, a map background, a contour analysis, a station model plot, etc. One or more components are combined to form a slide. By definition, all components within a slide must share the same horizontal (i.e., map, image, etc.) or the same vertical (i.e., cross section, Stuve, etc.) projection. The slide provides a concise method for combining overlays of several different types of data and insures that the combination is geographically accurate.

Slides can be conveniently assembled into a single group called a carousel. An animation loop is constructed by placing slides with the same content from different times into a carousel. Weather briefings are formed by combining slides of dissimilar content from the same time into a carousel.

2.4.2 Meteorological Applications

A product, as defined by a slide, is created by executing one or several AMIGAS II Meteorological Applications. Applications are initiated directly by the user or by a system scheduler and execute asynchronously. Each application is passed values of controlling parameters by the Request Interface. The results of executing a meteorological application are a component file, the execution status of the application, and any informative messages. Upon completion, the component file is routed automatically to the workstations and retained on the mainframe for archive purposes and plot creation.

AMIGAS II provides eight basic types of applications: lists, plots, analyses, images, maps, vertical parameter plots, parameter/time plots, and vertical cross sections. These applications form a base set which can be substituted for and added to by customer written applications. The Data Services provide the applications with access to satellite and radar imagery, surface and upper air observational data, and geographic and geopolitical data. The applications process this data and create, using routines supplied by the Data Services, a component file.

The component files are created in one of several formats, graphics metafiles, image data files, alphanumeric data files, and files which combine graphics and alphanumeric data. Each type of component has associated with it a display method and

certain interactive functions.

2.4.3 Display Services

AMIGAS II has been designed to emphasize output to graphics workstations. The Display Services provide the means for constructing graphical output from component files, viewing it on the display screen, and interacting with the data for purposes of enhancement and editing. Output for plotters is formatted specifically from the workstation-oriented files by a Display Services program.

The Display Services provide a multiple window environment for displaying slides and carousels which contain various combinations of image, graphics, and alphanumeric data. The user is free to select any number of windows and position them any place on the display screen. Interactive functions are controlled through mouse-driven facilities which include icons, pull-down menus, and dialog boxes.

Information contained in each particular type of file is consistent with the amount of interaction that is performed through the Display Services. Highly interactive display applications require a greater knowledge of the values and the type of information (i.e., station plot, contour, etc.) being displayed. Station model plots, for example, allow the user to select which weather parameters to display and the placement of that data within the station model itself. Functions which can be performed on all products include panning, zooming, scrolling, and window resizing. Through this tailored approach to displaying and interacting with component files, a unique balance between flexibility and responsiveness is achieved.

3.0 Summary

AMIGAS II is a platform of meteorological data processing capabilities which can integrate multiple types of data, analyze the data, and create products in response to meteorologists' requests. Utilizing state-of-the-art user interfaces and distributed processing, AMIGAS II provides meteorologists with the most responsive system possible. The system serves as a baseline capability to be expanded and adapted for specific customer implementations. To minimize the impact of integration with existing operational systems, customer applications are readily included within the AMIGAS II system. Because of its modular architecture and platform design, AMIGAS II will remain a viable product into the 1990's.