ASPECTS OF AMIGAS II DESIGN AND IMPLEMENTATION

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1. INTRODUCTION

AMIGAS II (Advanced Meteorological Image and Graphics Analysis System) is a hardware/software system that provides the operational meteorologist with extensive capabilities for the ingest, management, and display of meteorological data. The first operational installation of AMIGAS II (or simply AMIGAS) occurred in September 1988. Development of AMIGAS has continued over the past 16 months with enhancements in the following areas: First, there are new additions to the standard set of AMIGAS meteorological applications such as grid data support and bulletin data support. These additions are in the current AMIGAS release. Second, we are "opening" the AMIGAS architecture, allowing users to add value to products through graphical editing and through incorporation of their own user-written applications into AMIGAS products. These capabilities will be included in the next general release.

2. AMIGAS STRUCTURE

AMIGAS uses a paradigm in which individual meteorological displays, called components, are grouped together along with a common projection into a slide (Figure 1). Slides can exist by themselves, or be further grouped into carousels.

A *component* definition is simply a collection of parameters which define the content of a display. For example, the definition of an upper air analysis component includes date/time group, the meteorological parameter to be analyzed, vertical level, gridlength, and contour interval, among others. A *slide* is a collection of components which are to be displayed together using a common *projection*. A *carousel* is simply a collection of slides. The carousel's slides may differ only by time, in which case the carousel can be used to show a time sequence. The slides of a carousel can also be arbitrarily grouped, such as one might assemble for a shift change briefing.

To support the definitions of components, projections, slides, and carousels, AMIGAS provides a Request Interface. The Request Interface has

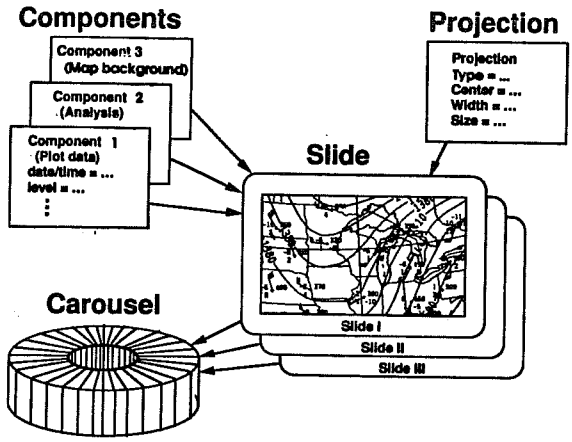

Fig. 1. The AMIGAS product paradigm; slides consist of components sharing the same projection.

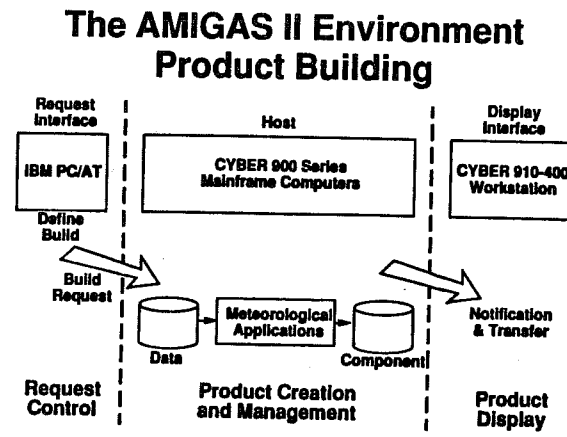

Fig. 2. The AMIGAS II environment, showing hardware and major software elements. A "build" process is shown.

a modern object-oriented user interface that uses windows, dialog boxes, pull-down menus, and a mouse.

The actual creation of viewable graphic components is referred to as a "build" (FIgure 2), which is the creation and dissemination of an instance of the product. In this process, a "build request" is sent to the host, which executes the meteorological applications that retrieve the data and create the graphical output. (AMIGAS also has a scheduler, which can initiate builds according to the time of day.) As each component is completed it is sent to each of its destinations, where it can be displayed.

For display of slides and carousels, AMIGAS provides the user with a modern, object-oriented Display Interface. Besides displaying products, the Display Interface lets the user interact with them, down to the component level. The user can interact with products and components in many ways. For example, the user can change colors, de-clutter plotted data, change lookup tables for images, zoom and pan products, view multiple products at one time, and step through carousels. Most importantly, the user can modify (add value to) products with the AMIGAS Graphical Editor.

3. EXTERNAL GRID ANALYSIS

The standard set of AMIGAS meteorological applications (Table 1) produce the kinds of components that an operational meteorologist typically uses.

Upper Air Horizontal Analyses	Distance Cross Sections
Surface Horizontal Analyses	Time Cross Sections
External Grid Analyses	Upper Air Data Lists
Upper Air Plot Data	Surface Data Lists
Surface Plot Data	Bulletin Text Lists
Satellite Imagery	Skew-T, Log-P Diagrams
Remapped Satellite Imagery	Stuve Diagrams
Conventional Radar Imagery	Vertical-Parameter Diagrams
Doppler Radar Imagery	Parameter-Time Diagrams
Radar Mosaics	Map Backgrounds

Table 1. Meteorological applications in AMIGAS

One of the new features in the current AMIGAS release allows the user to contour grids which have been generated outside of AMIGAS. This capability is enabled by the Grid Data Services (GDS), which manages the database of gridded meteorological data, and provides many utilities which make those grids usable by programs. The identification of a grid within the GDS is modelled after the Product Description Block and Grid Description Block of the WMO FM 92-VIII Ext. GRIB data transmission format.

External Grid Analysis components can coexist in the same slide with other horizontally-projected components (e.g. plotted data, map backgrounds, AMIGAS analyses). The GDS utilities permit the remapping and/or combining of grids to any of the AMIGAS projections.

4. THE OPENING OF THE AMIGAS ARCHITECTURE

It has been clear since its inception that AMIGAS would need to evolve toward a system which would support users' capability to enhance AMIGAS products, thereby adding value to them. These capabilities will be added in the next general release of software. Functionality will be in two major areas: a graphical editor and support of user-written components.

4.1 The Graphical Editor

The Graphical Editor will be used either to *create* a component which is logically a clean "sheet of acetate" upon which the user can draw, or to edit an existing graphical component. A slide can have any number of such "graphical editor" components. Figure 3 is an example of a component created with the AMIGAS Graphical Editor; it overlays three other standard AMIGAS components (a plot, an analysis, and a map background).

In using the Graphical Editor, the user first selects a tool that he or she wants to use. The tools consist of curves, fronts, regions, lines, polygons, symbols, and text. Within each of these tools, there is a

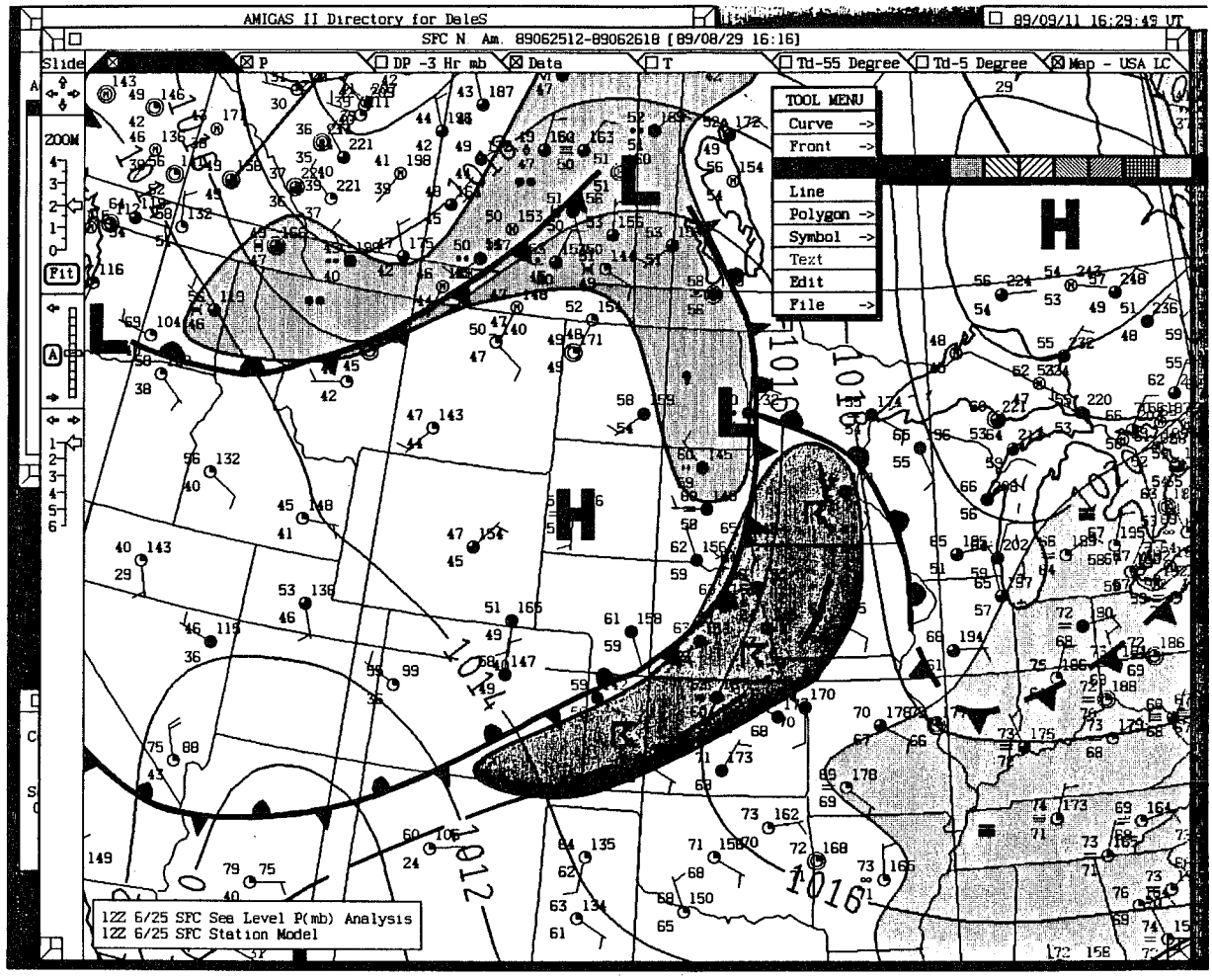

Fig. 3. Example of an AMIGAS graphically edited product. The "Region" tool menu is currently being accessed.

capability of changing color, thickness, and style. For example, after choosing the front tool, the user can select the frontal style (cold, warm, stationary, occluded, etc.), and can also select a thicker or thinner frontal representation. When drawing fronts, curves, and regions, the user uses the mouse to lay down "control points." As he or she does this, a continuously differentiable curve is drawn through the control points. In this way the user is given continuous feedback regarding the drawing of the object.

The Graphical Editor also has an Edit capability. Upon choosing the "Edit tool," control points for every object are shown. The user chooses an object by selecting one of its control points, after which operations like moving, reshaping, or deleting may be done.

Importantly, the user always edits a copy of the component, thus having the option of preserving the original. AMIGAS provides a mechanism for saving

a graphically-edited component as part of the product. The changed product is identified as an edited product, and its non-ambiguity is guaranteed. That edited product is managed by the system just as any other product is. Typically there is a necessity to distribute an edited product to other destinations. To accomplish this, the Display Interface has a capability to reroute the product to the host for either 1) automatic redistribution to the original set of destinations for that product, or 2) for optional future redistribution.

4.4 Support of user-written applications

The second major way in which AMIGAS now accommodates user value is by allowing users to incorporate their own applications into the AMIGAS framework. That is, the program's output may be viewed as a component of an AMIGAS slide. Optionally, it may coexist within that slide with other user-written components or with standard AMIGAS components (a user component and a map background would be a common example of this combination).

The user-written program may call AMIGAS-provided functions to read data from the AMIGAS database, to perform (lat,lon) to (x,y) conversions, to query the Geopolitical Reference Database regarding observation station attributes, to convert units, and to perform many other utility functions.

One of the output formats for a user-written component is a CGM. AMIGAS itself contains functions which provide most of the capabilities of the CGM standard, and those functions can certainly be used by a user when writing a program. Alternatively, users may wish to use other packages which support the CGM standard, e.g. MAGICS. We envision that AMIGAS will support this concept, providing the other package creates output in the correct AMIGAS-supported CGM (character-encoded) form.

6. CONCLUDING REMARKS

We have discussed the "open-system" features of AMIGAS, including the Graphical Editor and support of user-written components. Future development will expand AMIGAS users' ability to tailor their environment, say in terms of user-editable fonts, frontal styles, etc. We also recognize a requirement for an editing mode wherein users edit the *data* rather than the graphics. In general, the future of AMIGAS will see an increase in interactivity with the data at the workstation.