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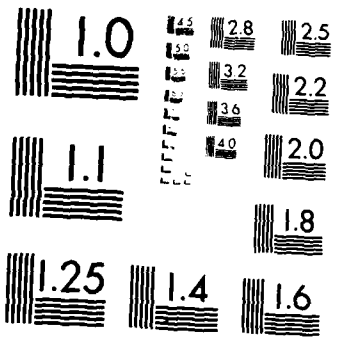

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AIR FORCE HUMAN RESOURCES LABORATORY

ATMC, THE MULTI-MEDIA TELECONFERENCING SYSTEM

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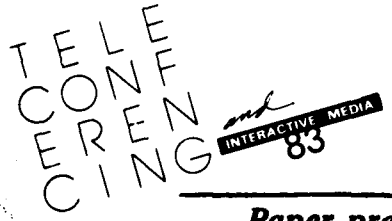

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ATMC, THE MULTI-MEDIA TELECONFERENCING SYSTEM

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ABSTRACT

The ATMC (Advanced Technology - Multi-media Communications), teleconferencing system being developed by the University of Dayton Research Institute (UDRI) under the sponsorship of the U.S. Air Force Human Resources Laboratory, is designed to provide quality real-time teleconferencing over the switched telephone network. Color Business Graphics, Freeze Frame Video, Cursor Pointing, Electronic Handwriting, and Data Communications are integrated into a single highly modularized system to provide superior quality presentation support.

Full color charts and other presentation materials are prepared electronically without use of photographic media. Local conferences are conducted using CRT monitors and/or large screen video projectors to display the material. Addition of data communications enables the charts to be rapidly transmitted to other ATMC sites, and then the same electronic ATMC presentation equipment used for local conferences is used to support real-time teleconferencing.

ATMC has several advantages over other teleconferencing systems: 1) By using the public switched network, ATMC avoids the high costs and operational restrictions characteristic of full motion video systems. 2) By providing each of the most popular forms of audio-graphic support in a single system, ATMC adapts to a wide variety of changing user habits and needs. 3) Because ATMC provides high quality local presentation graphics support, a system can be justified independent of teleconferencing needs. Migration to ATMC teleconferencing becomes a natural extension of established user habits.

ATMC systems promise to have a similar impact on presentation graphics and teleconferencing as word processors have had on typing and electronic mail.

ATMC TELECONFERENCING CONCEPT OVERVIEW

The ATMC teleconferencing concept combines quality presentation graphics with quality audio to yield a conferencing system useful for both local and geographically distributed conferences. ATMC presentation graphics encompass most of the popular forms of visual and printed aids used in corporate conferences, formal presentations, or classroom instruction:

1. Business graphics
2. Images (freeze frame, optionally combined with graphics)
3. Handwriting (electronic overwrite of above)
4. Pointing (electronic visual pointing)
5. Printed page information.

The first four aids, displayable on a TV monitor or large screen video projector, are illustrated in Figure 1.

A high speed color computer business graphics subsystem capable of producing professional quality high resolution graphics is integrated into ATMC. Next is an imaging subsystem capable of grabbing single frame images as well as supporting electronic handwriting and certain forms of illustrated graphics. Pointing, implemented as a visual cursor, is provided to complete the list of ATMC video aids. Printed page information printed on a system printer is provided as an alternative to freeze frame or FAX transmission for document distribution.

ATMC teleconferencing requires each site to be equipped with an ATMC system. A point-to-point configuration is illustrated in Figure 2.

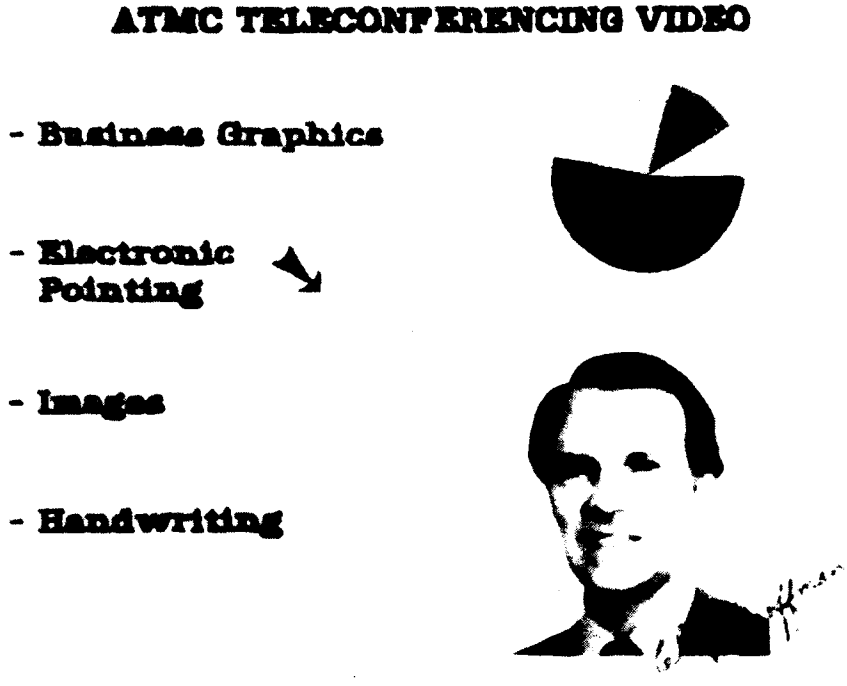


Figure 1. An ATMC Prepared Chart Showing ATMC Video Aids.

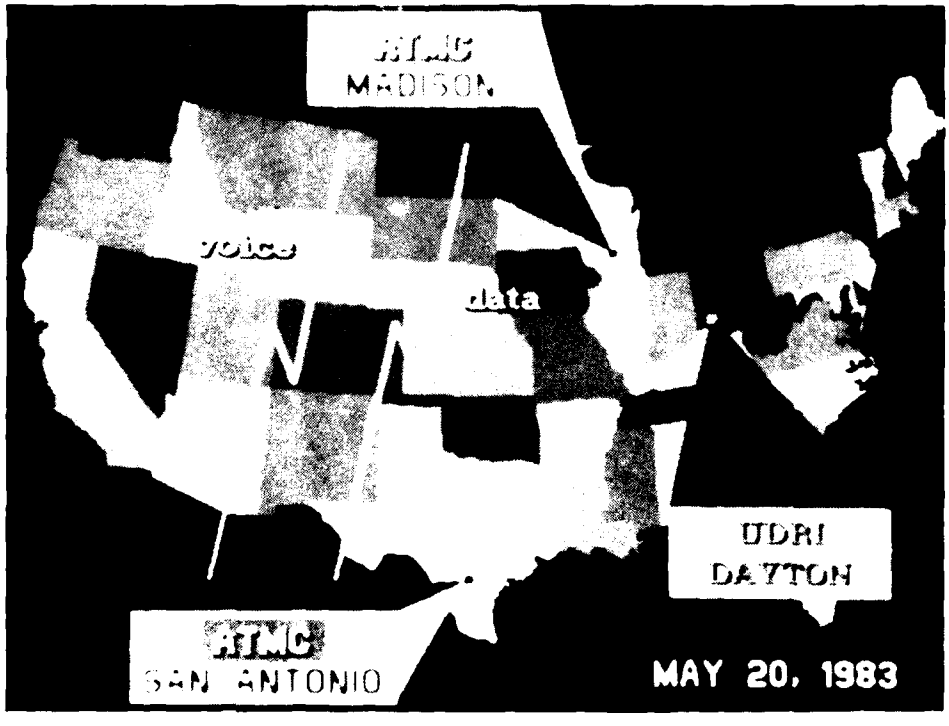


Figure 2. Configuration Used for ATMC Teleconferencing Demonstration at TELECONFERENCING AND INTERACTIVE MEDIA '83 Conference. UDRI Participated in the Audio Portion via a Bridge Located in San Antonio.

Because high quality audio teleconferencing poses technical problems not directly related to ATMC presentation graphics, ATMC teleconferencing audio is handled separately from the data network. Both the voice and the data network are implemented using equipment from telephone companies and other suppliers in a manner similar to methods usually used with commercial freeze frame equipment, electronic blackboards, etc. Eventually both data and voice will be integrated into a communications system which will appear to be a single network to users.

HUMAN FACTORS CONSIDERATION

Only two predominant human factor considerations are presented. The first we call "responsiveness," the second we call "user friendliness."

By "responsiveness" we mean the ability of the system to respond to the command of the user. For example, we found that anything longer than about one second to locate and display a presentation chart appears sluggish to a user and that significantly greater acceptance is achieved if the average access and display time is less than 1/3 second. Whenever possible, users must perceive of everything as happening in real-time.

"User friendliness" is a broad term which simply interpreted means that each user, whether graphics designer, programmer, or conferee must be presented with an interface requiring minimal training to perform tasks. The interface must be readily adaptable to accommodate increased user knowledge and user demand for more capabilities.

Services offered by ATMC are new to most users, and, if the average user is presented with too many options at one time, he can easily be overwhelmed. For this reason all services are introduced at an elementary level and only after the need for more services is apparent, are new services introduced.

DESIGN OBJECTIVES

Design objectives frequently emerge from experience or from ingenious hindsight. The ATMC objectives which have been with us from the onset and which continue to be our major guidelines are:

1. Systems Concept. In contrast to many systems which focus on a narrow segment of the corporate communications problem, ATMC was to address a much broader span of communication needs. ATMC was not to be a terminal concept, a media concept, nor was it to be simply a teleconferencing concept. It was to employ a total systems concept encompassing friendly communications needs and user friendly interfaces whether strictly local or geographically dispersed. All ATMC systems are to be communications compatible with each other within limits of user selected options/modules.

2. Switched Network Operation. The primary incentives behind this objective were low operating costs and the need for interactive teleconferencing between ATMC sites. The existing telephone network offers cost effective world-wide communications today, independent of future technologies. If ATMC could be made to operate effectively over the existing network, any improvements to the network will improve ATMC still more. Examples are enhancements to the switched network which offer greater bandwidth or improved reliability.

3. Improved Local Support, then Migration to Teleconferencing. If a system responds first to existing user needs with improved services and products, system acceptance is greatly enhanced. Although teleconferencing is the ultimate user service objective, ATMC is to first provide users with improved local conference services. Then after winning user confidence, the move to the teleconferencing environment can occur with minimal change in user habits.

ATMC SYSTEM DESIGN AND OPERATION

Within system design objectives, ATMC systems can be configured in many ways. Figure 3 illustrates the Multipurpose System as implemented by UDRI to provide all ATMC services. Other compatible configurations can be implemented strictly to support teleconferencing, others to prepare graphic media, etc.

This multipurpose system is explained with emphasis on how each component/subsystem responds to the total conference communications environment.

ATMC Controller

The ATMC controller is housed in a cabinet measuring approximately 19" W x 14" H x 22" D. A general purpose microcomputer controls all system functions, including presentation graphics preparation, teleconferencing, and hard copy media production. The presentation graphics subsystem shares the high speed computer data bus which enables data to pass

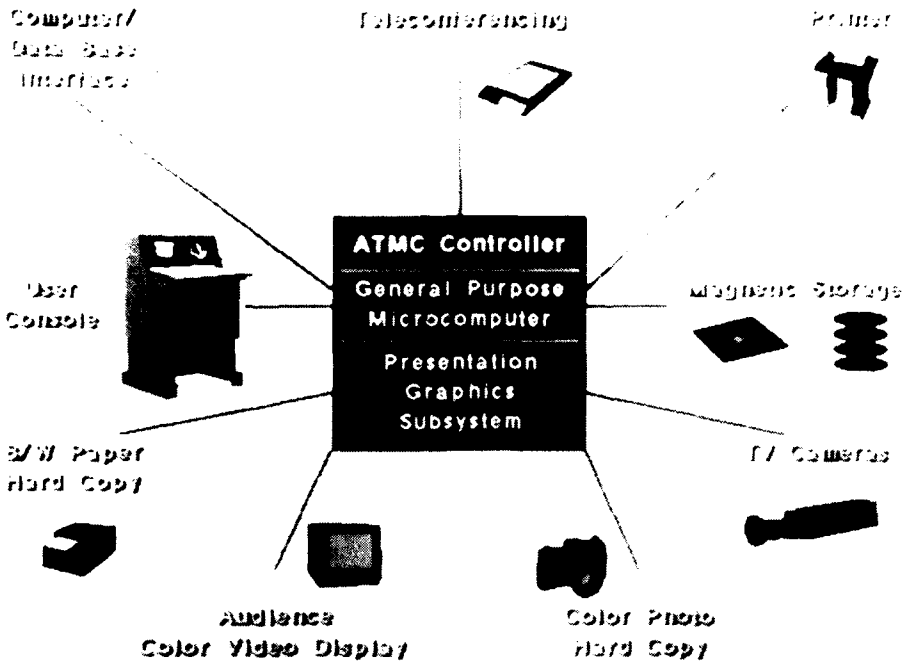


Figure 3. ATMC Multipurpose System. Each System Element Plays an Important Role in the ATMC Concept.

freely to/from main memory and the magnetic disk peripherals. The system is self-contained inasmuch as all software needed for color graphics slide preparation, freeze frame imaging, handwriting, data communications, etc. is stored on magnetic disk and is accessed by the microcomputer as needed for specific tasks. There is no dependence on a larger central computer.

For a teleconference, slide presentation material is preferably sent ahead of time to other sites via the teleconferencing data interface* and placed on magnetic disk. Last minute changes, including insertions and deletions are transmitted just prior to the teleconference, depending on the extent of the changes. During the teleconference, presentation graphic slide material is taken from disk and displayed as needed. Only simple commands, cursor movement, handwriting, and other extemporaneous information (e.g., impromptu freeze frame images) is transmitted during a teleconference.**

User Console

The prototype user console illustrated in Figure 4 was designed and fabricated by UDRI for multiple uses. In its raised stand-up position, it is used for formal large group presentations and conferences. In its lowered position it is used either for media development or for small group conferences/teleconferences. Because of the versatility of the console, it will only be described in relation to how it is used during a teleconference.

*Other data networks or public mail of diskettes can also be used.

**Background communications will enable presentation material to be transmitted during conference dead time. In a normally structured teleconference, natural pauses will enable presentation material to arrive at remote sites by the time it is needed.

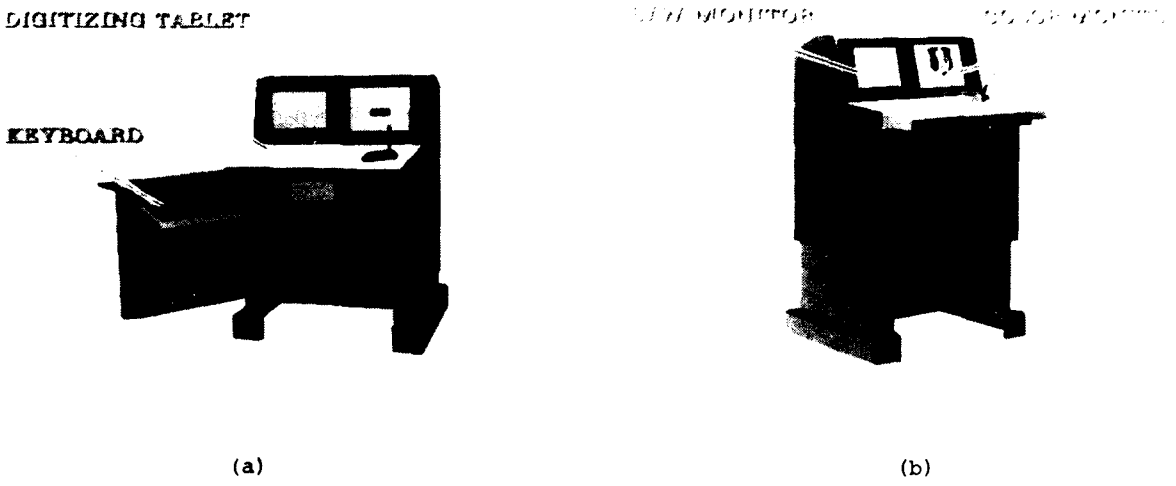


Figure 4. ATMC User Console. (a) Sitting Position. (b) Stand-up Position. The Keyboard is Normally Stored Out of Sight During a Teleconference.

The B/W monitor and the digitizing tablet are the two standard console components. The B/W monitor is an operator monitor on which all operator prompts, backup notes and backup data, help messages, screen menus, etc. are displayed. If desired, information on this monitor can be shifted to the color monitor and/or large screen video projector for audience viewing.

The total control of the system is accomplished using the digitizing tablet. Overlays such as those shown in Figure 5 are placed on the tablet and alignment points are touched with the stylus. Operating commands are then selected by touching function key areas. Cursor movement is controlled with XY key areas. The combination of digitizing tablet, overlays, and associated control software is called the "ATMC soft keyboard."

Overlays are designed to match operator needs and skills. If only a few features are needed, the overlays are made very simple. As more features are required, the overlays become more complex. For example, the overlay in Figure 5(a) provides only simple slide and cursor control. The HELP key is used to assist the operator in learning functions. If first the HELP key, and then one of the other keys are touched, an explanation of key operation is displayed on the operator monitor.

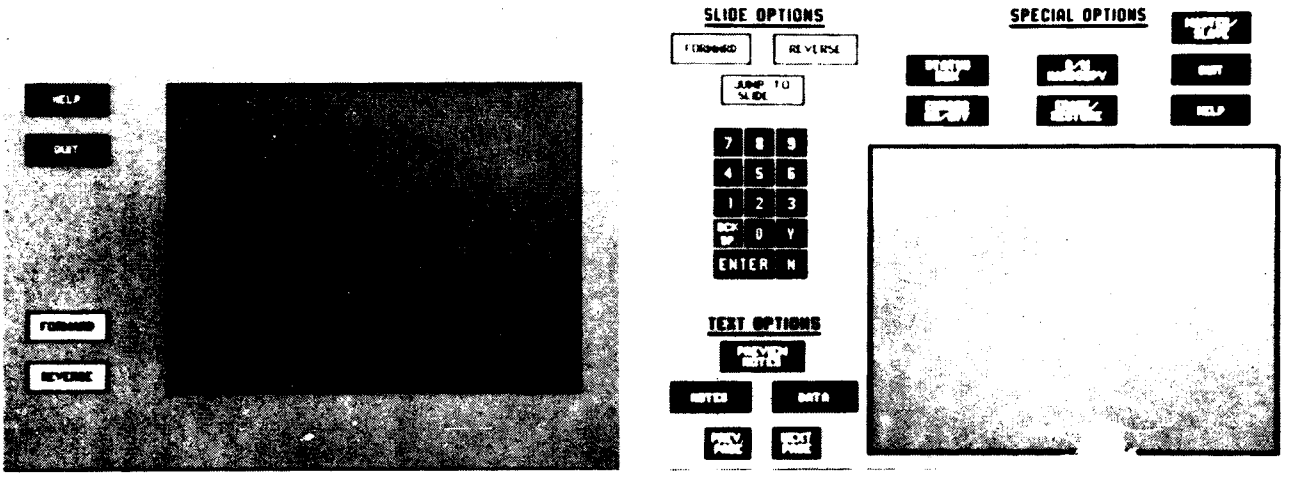
The more complex overlay in Figure 5(b) is used in an identical manner. It has keys which enable the operator to randomly jump to any slide, access notes and data, make B/W hard copies, etc. The ATMC soft keyboard, in combination with the information displayed on the B/W and color monitors, offers extensive opportunity for meeting our objectives for user friendly interfaces and also for providing additional functions as they are introduced.

The integrated color monitor adds significantly to the ease of console operation. However, it is only mandatory when there is no other color display viewable from the user position. Information displayed on the color monitor is identical to that seen by conference participants at all sites.

The alphanumeric keyboard is used for system setup, but it is not normally used during a teleconference. In exceptional cases where complex operations require assistance from a programmer, the keyboard is placed along with an additional B/W monitor in a convenient conference room or support room location. Verbal contact with the keyboard operator is then used to handle the requests. An example of such keyboard use may be when it is essential to make an on-the-spot change to an important color graphic slide.

Audience Color Video Display

Good quality high resolution RGB (RS170) monitors or large screen video projectors are recommended. For very small groups, the small color monitor in the user console is adequate. For larger groups of 5 to 8 people, a 19-inch diagonal monitor serves very well.



(a) (b)

Figure 5. Examples of Tablet Overlays. (a) Simple Overlay. (b) Overlay More Functions.

Large screen video projector technology which provides affordable high resolution video images of 5 ft diagonal and larger is progressing at a very rapid pace. As these projectors become more widely available, it is anticipated that they will be preferred over standard video monitors, even for small groups. Conferees appear to prefer large screen video projection in the same way they have traditionally shown preference for large screen projection of 35 mm slides and overhead transparencies.

B/W Paper Hard Copy

The black and white video paper hard copy unit serves two major functions: 1) to provide draft copy of presentation materials, and 2) to provide on-the-spot copies of presentation materials to conferees.

Presentation materials most often originate from author notes and sketches. This input is then converted to presentation charts by an ATMC operator. Upon completion, the original sketches are returned to the author along with B/W video copies for proofreading. Corrections and changes are marked on the B/W copies before being returned for final entry. Color editing is handled at the operator console or through handwritten notes, if needed.

To illustrate the second function, imagine a teleconference where a delivery schedule is being intensely debated. Finally, all parties come to terms and electronic handwriting changes are made on the displayed schedule. Even signatures can be added to denote commitments. B/W video copies are then made of the "Decision-Time Edited" (DTE) chart and given to conferees. The DTE chart showing the "decision audit trail" has greater meeting value in most cases then an updated color graphic chart.

Color Photo Hard Copy

Users continue to demand photomedia for compatibility with existing projection equipment, publication, and versatility for travel. Many meetings simply do not allow use of anything but photo media. For these reasons ATMC provides system compatible photo hard copy.

ATMC color photo hard copy is separated into two resolution categories: the first is raster video with a resolution of 640 x 480 pixels. The second is professional quality with a pixel resolution greater than 1600 x 1200 pixels. The illustrations published in this paper are all raster video resolution. With certain allowances for Figure 1, each illustration could easily be produced in high resolution format using the same ATMC source code as was used to prepare the published illustrations.

Both resolutions can be produced on a variety of film formats, including 35 mm slides and overhead transparencies. Advantages of the raster video resolution are lower cost and more rapid turnaround. The high resolution media is more suited to graphic arts department

production. It offers advantages of greater graphic detail and smoother lines.

TV Cameras

Up to four TV cameras can be connected to the ATMC controller for input of freeze frame images. When needed, each camera is provided with a separate camera control overlay area on the soft keyboard. Only one camera can be used at a time.

Magnetic Storage

The amount of magnetic disk storage provided on an ATMC system depends greatly on anticipated use. Ten to twenty megabytes of Winchester type storage is adequate for smaller systems with limited imaging capability. With increased emphasis on freeze frame image storage, the need for disk storage, including removable cartridges, can exceed 100 megabytes.

The diskette drive is a general purpose interface device used for presentation chart storage and program loading. One diskette can easily hold several hundred color graphic charts, whereas it may only hold four or five freeze frame images, depending on image complexity. The diskette can be used as a transportable media between ATMC sites.

Printer

This general purpose printer can range from an inexpensive character printer to a high speed line printer. It is used for ATMC program and presentation material preparation, general purpose record keeping, and for printing converence materials when necessary.

Teleconferencing Data Interface

This interface is used to transmit presentation graphic materials via the telephone network to other ATMC sites, and then during a teleconference, it is used for control and extemporaneous graphic information such as handwriting, freeze frame, and cursor pointing. Other uses for this interface may be to signal an exuberant talker at a distant location that you would like to interrupt. Printer data (electronic mail?) can also be passed between sites, printed, and then used during a teleconference.

Computer/Data Base Interface (Option)

In many organizations, meetings involve presentation of a great deal of data which is simply updated periodically in standard graphical format. The data frequently resides in a large central computer data base, or it may reside in a small personal computer.

To facilitate use of this data for automatic update of standard graphic charts on an ATMC system, standard data communications interfaces are provided by ATMC. In some cases, the graphic charts can be completely prepared on an external computer and then simply passed to an ATMC system via the interface (or via diskette) for teleconferencing use. Another method is to pass the raw data to the ATMC microcomputer and then reduce it to graphical form using ATMC general purpose graphics software.

In any case, the problem of interfacing to user data bases must remain a user problem. ATMC simply supplies the tools to make the interface as painless as possible.

Other Options

The system design of ATMC using a general purpose microcomputer coupled with the software written by the University of Dayton Research Institute provies the expandability required to add optional peripheral devices such as a flat bed plotter, printer plotter, 35 mm slide projectors, multiscreen capabilities, and other options as desired.

PROGRESS TO DATE

ATMC is an ambitious development undertaken and promoted by the University of Dayton Research Institute in concert with the U.S. Air Force Human Resources Laboratory. Following delivery of the first ATMC system to Brooks Air Force Base in May 1982, and then with the demonstration of ATMC teleconferencing in September 1982, interest in ATMC by the U.S. Air Force and other organizations has increased.

More test sites will be added this year which will provide valuable user feedback from operational teleconferences. Acceptance of the color graphics features so far has been very good and these features alone have generated major interest. Other ATMC features such as freeze frame and handwriting are still in the laboratory developmental phase. Few users have previous experience with communication features such as these, much less in a system where they

are all available simultaneously. Our expectations are to win user confidence with quality local presentation support and then, using this learning experience, comfortably convert users to the teleconferencing environment.

THE FUTURE

Fully interactive ATMC multipoint teleconferencing will be developed in the near future. Most Air Force commands and laboratories are geographically located at three or more locations. Whereas periodic briefings traditionally require travel to a central site, ATMC multipoint will enable these briefings to be conducted with greater ease and without requiring travel.

ATMC multiscreen capability is a straightforward outgrowth of ATMC architecture. This development which will provide control of both raster video and photo media projectors will enable strong points of both projection technologies to be utilized.

The ATMC concept, because of its emphasis on user friendly interfaces, will provide single action call establishment to remote sites. For example, once presentation material is prepared, a single touch of an overlay key will establish both voice and data channels to remote sites. Whether these two channels are physically separate or integrated in a voice/data network, the ATMC controller will insure total link integrity throughout the teleconference.

Few developments proceed with greater awareness of the need to establish interface standards than the ATMC development. The potential problems with ATMC look-alikes which are unable to exchange information in a teleconference are analogous to the codec incompatibility problems evolving in full motion video. In some cases it is a problem of establishing or forcing a standard where none exists. Increased emphasis will be given to development and dissemination of ATMC standards.

A growing information resource is developing around Videotex standards. Many organizations have already made sizable commitments to defacto graphic standards such as Tektronix Plot 10. For ATMC to achieve maximum user acceptance, friendly interfaces to standards such as these are almost certainly in ATMC's future.

If commercialized today, each ATMC system would sell for $75,000 to $150,000 depending on features. Because of recent technology improvements and greater understanding of design concepts, a price range of $50,000 to $100,000 may not be far away. ATMC prices will undoubtably follow a price reduction path similar to most other high technology products.

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