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MONOLITHIC INTERFACE MODEL ICARUS CONTROLLER (MIMIC)

Synectics Corporation

Matthew Pasick and Randal K. More

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Air Force Materiel Command
Rome, New York

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APPROVED:

ALEX F. SISTI
Project Engineer

FOR THE COMMANDER:

JOSEPH CAMERA
Technical Director
Intelligence & Reconnaissance Directorate

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Matthew Pasick and Randal K. More

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Synectics Corporation
111 East Chestnut Street
Rome NY 13440

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Rome Laboratory/IRAE
32 Hangar Rd
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13. ABSTRACT (Maximum 200 words)

This effort focuses on an innovative approach to the collection, integration, and presentation of multimedia data for the operation of ICARUS systems. In addition, it provides highly integrated multimedia presentations of other programs that are dynamically tailorable for the attending audiences' technical level.

An advanced concept model management and human interface shell environment was developed, which surrounds the many components of the existing ICARUS facility. MIMIC represents a state-of-the-art multimedia authoring, composition, and presentation platform that has been augmented with system administration and network control functionality.

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1.0 INTRODUCTION

This document is the Final Technical Report (CDRL A008) for contract number F30602-94-C-0102 , entitled Monolithic Interface Model ICARUS Controller (MIMIC). The MIMIC effort was a twelve month effort, which ran from 27 June 1994 through 27 June 1995. Synectics Corporation was the sole contractor for the entire effort.

The MIMIC project is a unique blend of a centralized system administration and control system, and a custom-developed multimedia presentation and authoring tool. Although it was built specifically for the target environment (the ICARUS laboratory) its design and implementation are such that it can be used as-is for any number of diverse control, presentation, training, or other activities.

1.1 MULTIMEDIA OVERVIEW

Multimedia presentation and authoring systems are one of the most rapidly expanding areas of information processing and presentation. Multimedia, as its name implies, refers to the presentation of video, audio, static images, graphs, charts, words, and other data containing elements in a controlled mix.

Multimedia technology allows the presentation of these information forms in a highly interactive fashion. The user controls the information presented and the pace and order of that presentation (within the parameters of the presentation system's programming).

1.1.1 TRADITIONAL MULTIMEDIA AUTHORING

The process of assembling multimedia information into a complete presentation is known as "authoring". All of the individual elements are assembled by the author and converted to the form expected by the presentation tool being used. The author then generates a complex set of rules, known as a "script" to control the presentation and interaction possible for the assembled information.

Multimedia authoring has two major drawbacks for the casual user. First, the process of converting information (most of which probably already exists in one form or another) into the format which can be presented by any particular presentation system is very labor intensive and time consuming. Second, the scripting languages used by most authoring systems are very complex and difficult to learn.

1.1.2 MIMIC MULTIMEDIA AUTHORING

This effort focused upon an innovative approach to collection, integration and presentation of multimedia. In addition it provided an ability to combine traditional multimedia

scripts with the execution of local and remote processes. This allows for multimedia based interfacing with, and operation of, ICARUS (and indeed with any internal or external systems). As a bonus it provides the foundation for providing a highly integrated multimedia presentation of other Rome Laboratory programs. All of these presentations are dynamically tailorable for the attending audience's technical level.

MIMIC represents a state-of-the-art multimedia authoring, composition, and presentation platform which has been augmented with system administration and network control functionality. It is characterized by several unique features including:

- *Use of existing materials.* Unlike other authoring systems, the MIMIC is able to use existing presentation materials in their original form(s). It is not necessary to convert data into a proprietary internal format. For example, if a user has an existing PowerPoint™ presentation concerning a project, that presentation may be included as a single MIMIC item. This leads to rapid and convenient materials base accumulation.

- *"Automatic" script generation.* The MIMIC does indeed have a rich and complete scripting environment. In addition the MIMIC includes a unique automatic script generation capability. As shall be seen later, a user need only select the material to be presented, click a simple button, and the script to present that material is written automatically. As a result, even the novice user can make professional presentations with only modest instruction.

- *Interpretive execution.* Most authoring systems are compilation oriented. In order to view or change a script it must be compiled and then executed by a separate engine. The MIMIC can execute any script, or part of a script, at any time. This allows for a convenient trial and execution development technique which is very helpful to the occasional author (the target users of this system).

2.0 THE MIMIC MULTIMEDIA SUBSYSTEM

The Multimedia Authoring and Presentation component is based on a unique combination of off-the-shelf and custom software and hardware products (detailed later in this report). These components have been combined to allow the seamless integration of video, audio, and imagery captured from ICARUS system operation to build a fully hyperlinked presentation that is fully portable.

In addition to providing for demonstration and presentation activities to be performed on the MIMIC hardware, the MIMIC includes a media authoring capability. This authoring is designed with an extremely shallow learning curve so that even the novice MIMIC users are able to record and distribute both passive (video tapes) and active (multimedia disk) materials. This allows for the cost effective presentation of ICARUS and Rome Laboratory systems to persons at remote locations at extremely low cost, and with high quality and interest levels.

As an example of the type of presentations possible with the MIMIC system, a presenter could give an overview of Rome Laboratory and its mission, then proceed to a slide which shows IRA's mission and current efforts as a series of quad charts. Any program in which an audience member showed interest could be instantly accessed at a more detailed level through a downward hyperlink. Technical details, personnel, funding information, even a demo (live or recorded) could be shown. Related efforts, technology transfer activities, etc. could all be explored at will based on questions or interest from the audience. Since any level of detail on any project can be accessed instantly, but only when asked for, the presentation takes on a life of its own and audience interest is kept high. In addition the presenter always has prepared materials for any question that is likely to arise. Even if an unrelated question is asked a keyword search facility allows the information to be accessed. Thumb-marking allows the point at which the presenter diverged from the normal slides to be marked for instant return and resumption of the presentation when the audience questions had been addressed.

2.1 THE AUTHORING ENVIRONMENT

The MIMIC Authoring system components are roughly divided in three categories: Collection, Integration, and Presentation.

2.1.1 COLLECTION OF COMPONENTS:

The collection of "raw" data can be gathered by one or many people in the following forms:

- Video: A video camera for recording spokespersons and scenes (e.g., labs, buildings, interviews, etc.), and a frame grabber board with buffering.
- Graphics: Graphics files in a large number of formats are supported. This will allow existing graphics, pictures, scanned images, and a host of other items to be used.
- Audio: Live and recorded audio may be digitized and combined with other sources and added into the final product.
- Synthesized Audio: The MIMIC accepts MIDI and other forms of command inputs to the system's synthesizer subsystem.
- Scanner: To convert photos or text into high resolution file format from the MIMIC workstation.
- Text: Textual information may be imported or generated and included in a number of formats.

2.1.2 INTEGRATION

During the integration phase, the components are linked together using the authoring and scripting capabilities of the MIMIC. In the MIMIC system this phase is accomplished almost entirely by a simple "point and click" system. This makes MIMIC ideal for novice or occasional users.

For additional information regarding collecting, editing, and customizing data for use in the Authoring system, refer to the volume of the MIMIC documentation set entitled, "Collecting Multimedia Components".

2.1.3 PRESENTATION

The MIMIC is an ideal system for presentations. Through its use of both local NTSC video output, high resolution VGA output, and the integrated projector, the MIMIC can provide the basis for presentations to an audience of almost any size.

The MIMIC was constructed with an infrared remote controller to run the presentation from anywhere in the conference area. In addition the immediate hyperjump facility allows for viewers' questions to be answered immediately, and then allows the presenter to return to the original topic.

2.2 AUTHORING

Authoring is the primary tool used to construct and develop scripts with the edited and integrated materials collected into the MIMIC multimedia presentation environment. The Authoring system allows the user to integrate captured live and still video, audio, graphics files, text files, and other sources. The author can then build hyperlinks among the clips and frames to allow navigation through them, and to be played in multipath fashion. Finally the author constructs scripts to be played out to a distribution media recorder or to a display device.

The MIMIC system is unique in that the authoring system has the built-in ability to allow the publishing of machine readable media to be distributed to owners of compatible equipment. On other systems the production of such tailored output and the generation of a CD ROM is a multidiscipline process that requires the use of a number of programs.

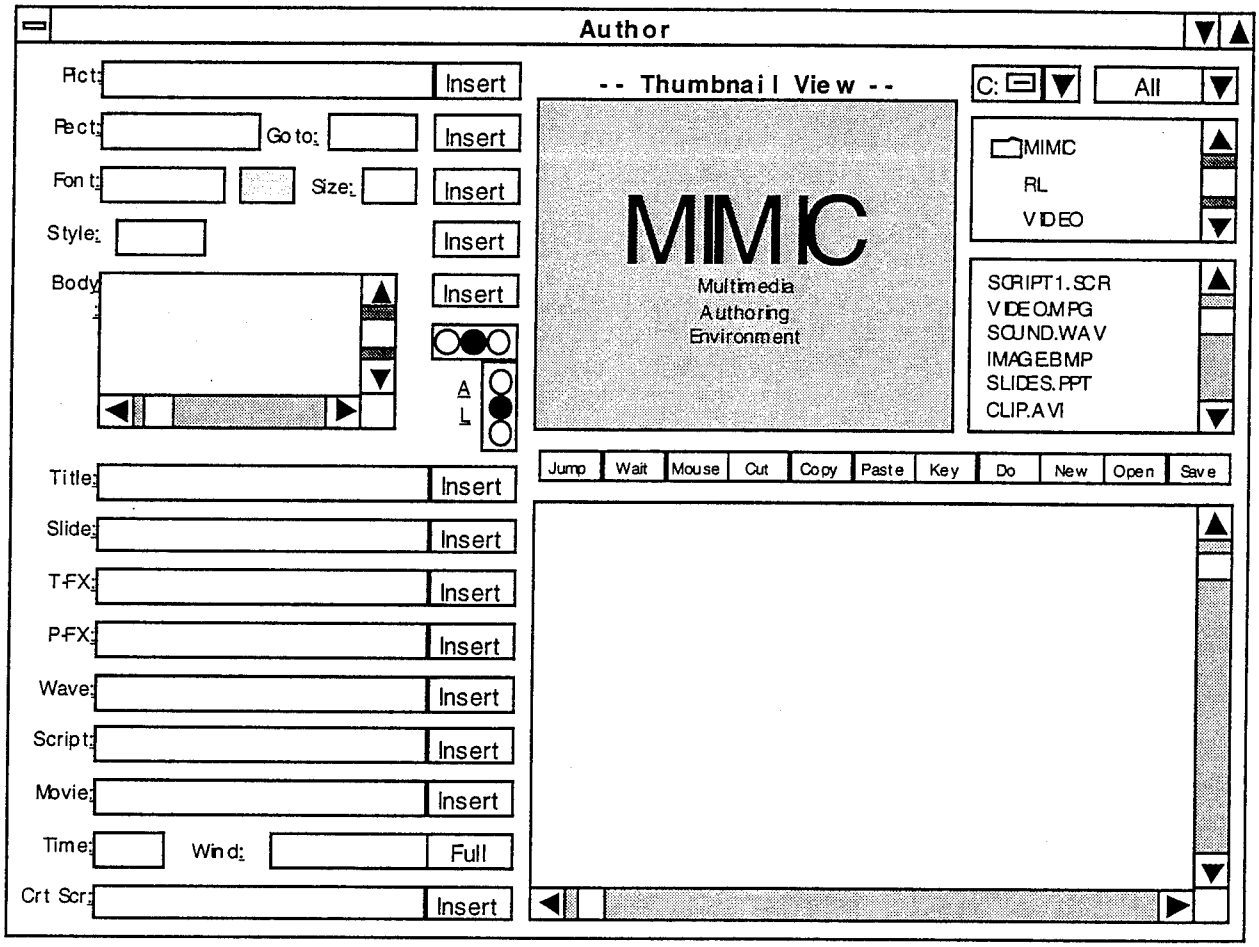
2.2.1 THE AUTHORING WINDOW

The *Authoring Window* is the heart of the MIMIC multimedia subsystem. It is initiated from the Program Manager in Windows. The Authoring Window uses the entire display area. It can, however, be moved, resized, etc. like any other Windows application. It is suggested that it remain in full screen mode, and opened and closed as necessary to use other applications. Most

of the authoring commands are processed via the mouse by selecting the various components from this window, along with some keyed entry by the user.

The Authoring work presents all of the tools required for a multimedia authoring session on one screen. It provides access to: File Management tools, a Thumbnail View area, the Script Editing Window, and a Special Work Area.

EXHIBIT 1. THE AUTHORING WINDOW



Beginning at the upper-right portion of the Authoring Window environment is the *File Management Area.* In the MIMIC system the user simply selects the object he wishes to view (image, PowerPoint™ presentation, video clip, etc.) using this area. The selected element will be displayed in the thumbnail area at the top center of the screen, and the command to play that element will be generated at the left-hand side of the screen, ready for automatic insertion into the script with a single click of the Insert button! This simple process may be repeated for each element to make a presentation with NO PROGRAMMING!

For more advanced users the *Script Editing Window* is located in the lower right portion of the Authoring Window. In this area the more advanced creating and editing of scripts takes place. The user is able to insert from the Authoring Window, or manually key, scripting

language into the current script. The area has two (2) scroll bars—horizontal and vertical—that are activated by the use of the mouse. In order to use the scroll bars, the user can either click and hold the status bar or click on the desired direction arrow.

The MIMIC even helps advanced users with the scripting process with the *Menu Bar* located in the center of the Authoring Window. This bar may be used in the advanced script Authoring process to automate the creation of the following functions: Jump, Wait, Mouse, Cut, Copy, Paste, Key, Do (it), New, Open, and Save.

EXHIBIT 2. MENU BAR

Jump	Wait	Mouse	Cut	Copy	Paste	Key	Do	New	Open	Save

To make presentations more visually interesting the MIMIC contains an advanced *Script Effects Work Area* which is located on the left portion of the Authoring Window. This area has components that will allow the user to insert formatted overlay text and various special effects into the current script being authored in the Script Editing Window. The Script Effects Work Area has the following functions: Pict(ure), Rect(angle) & goto, Font, Color, Size, Style, 3-D Style, Body, Al(ignment), Title, Slide, T(ext)-FX, P(icture)-FX, Wave, Script, Movie, Time & Wind(ow), and Crt(current) Scr(ipt). Most of the script effects are processed via the mouse by selecting various components from this and initiated Windows, along with some keyed entry by the user.

The special effects and styles are far too extensive to go into here, but as an example, the 3-D text style box has a number of property settings. These property options include:

- *Raised with Light Shading* - Text appears raised off the screen.
- *Raised with Heavy Shading* - Text appears more raised.
- *Inset with Light Shading* - Text appears inset on the screen.
- *Inset with Heavy Shading* - Text appears more inset.
- *Drop Shadow* - Text has a single drop shadow.
- *Block Shadow* - Text has a solid block shadow.
- *Outline Block* - Text has a single pixel outline with a solid block shadow.

Similarly the Special Effect Selection Window allows the choice of over 100 individual, and 3;000 combinations of special transitions and effects. These are all detailed in the MIMIC User's Manual. The tools also allow the selection of the Effect Speed, the Effect Grain, and provide for a preview slide which gives the user a "live" look at how the effect will look, its speed, and granularity.

To preview the selected effect in the Effect Selection Window, the user simply clicks once on the Show button located in the center of the window. The effect can be viewed in the Preview Slide. To modify the selected effect, the user can change the numerical value(s) in the Effect Speed box and/or the Effect Grain box by activating the cursor within the desired box and

keying in the value. When the effect is finally acceptable, the user simply clicks once on the OK button to insert the effect into the Effects bar in the Script Effects Work Area.

The *Wave* bar is used to select, listen to, resample, and insert a sound wave file into a working script. The sound waves used in MIMIC scripts must end in **.WAV**. The user selects a sound file from the File Management Area which is then displayed in the Wave bar. To sample the sound wave, the user simply clicks once on the word "Wave" located at the beginning of the Wave bar.

2.3 MIMIC ADVANCED SCRIPTING LANGUAGE

In addition to the simple "point and click" authoring approach, the MIMIC contains a complete and robust *Scripting Language* . This language may be used in the Authoring process by more advanced users, or to construct the control processes that form the other part of the MIMIC's functionality. The scripting language consists of easy-to-learn, use, and understand commands and symbols that can be inserted directly into the working script using the mouse, or keyed in by the user in the Script Editing Window. These commands and symbols are the building blocks for all of the presentation scripts that will be written by the user to be utilized by the MIMIC system. Most of the scripting language can be inserted into the working script via the Menu Bar or Insert keys in the Authoring Window, as described in the previous chapter. The syntax, descriptions, and functions of the commands and symbols are explained next.

The scripting language commands used in the Authoring Tool are: ACTIVATE, BULLET, EFFECT, FONT, GOTO, MOUSE, MPEG, PATH, PAUSE, PICTURE, PLAY, QUIT, RETURN, SCRIPT, SOUND, STYLE, TITLE, and WAIT. The following gives a brief overview of each command. For a complete review please refer to the MIMIC Software User's Manual / Design Document.

- The ACTIVATE command is the final step of a Mouse block. It allows the user to sensitize a portion of the screen so that clicking on it causes an activity to occur.
- The BULLET command places a bullet of text on the given on the currently displayed image.
- The EFFECT command executes the desired picture or text special effect chosen by the user (fade, wipe, barn-door, etc.).
- The FONT command sets the selected font type, point size, and color as entered by the user.
- The GOTO command executes a branch of control to a specified label within the current script.
- The MOUSE command begins a mouse block process. It allows the user to sensitize a portion of the screen so that clicking on it causes an activity to occur.

- The MPEG command executes and plays the movie file. The MPEG command line contains the MPEG command, the filename, the duration of the movie and the size and location on the screen of the window in which the movie will play.

- The PATH statement is similar to the DOS "path" command and is used to set a default path for the present script. The commands that are used in conjunction with the PATH statement are: MPEG, PICTURE, SCRIPT, and SOUND.

- The PAUSE command is used to pause the executing script for a set period of time.

- The PICTURE command will display a picture file. The PICTURE command can display any of the commonly found image types. This means that the user is not required to manipulate images into special formats as is required with other multimedia packages.

- The PLAY command is used to play a cued sound file in the script.

- The QUIT command terminates MIMIC.

- The RETURN command is used to return to the previous script.

- The SCRIPT command executes another script as a subroutine to the current script. When that script is RETURNed from execution resumes at the calling location of the parent script.

- The SOUND command cues (loads) a sound file.

- The STYLE command sets the user selected styles for the text or title in a given frame of the script.

- The TITLE command places title text in the title area on the given picture in the script.

- The WAIT command stops the executing script and "waits" for user action.

3.0 OVERVIEW OF MIMIC TASKS

The MIMIC task objectives were to research and develop an effective advanced multimedia based workstation and software suite. To accomplish these goals the MIMIC team performed the following:

- SYSTEM DESIGN - A high level design was completed. This design was based upon a melding of user requirements, system goals, and the current state-of-the-art. A mapping of the identified required functionality to COTS products was performed, and designs provided for all functions not covered by COTS elements.

- SELECTION, CONFIGURATION, AND ACQUISITION of hardware and software products. A recommended components list was generated, based on the system requirements and Government approval.

- INTEGRATION of all software and hardware elements acquired in the Selection and Acquisition task, and installed in the ICARUS Facility.

- DESKTOP SYSTEM IMPLEMENTATION of the control and administration system, allowing access to all ICARUS projects from the MIMIC workstation.

- MULTIMEDIA SYSTEM IMPLEMENTATION of a multimedia engine with its hyperlink capability, including extensive source importation, editing, and authoring tools required for presentation construction.

- DEMONSTRATION - Activities that verify the control and administration functions, multimedia, and hyperlink authoring and presentation systems.

- TRAINING - Activities provided for selected Government personnel, to include a set of comprehensive training materials for both the control and presentation systems.

Each of these tasks is outlined in more detail in the sections below.

3.1 SYSTEM DESIGN

The objective of this task was to create a detailed design of a system to meet the ambitious goals of the MIMIC project. Where possible a mapping of the required functionality to COTS products was accomplished. In those cases where functionality or ease and consistency of use dictated, the MIMIC team completed designs for all functions not covered by COTS elements.

In instances where more than one COTS element can be found, all that applied were listed, ranked, and evaluated. This list was used as the basis for generating the product selection. This design portion was used as a road map for the implementation of all software components. The design and fabrication of the MIMIC system allows for the execution and utilization of numerous heterogeneous systems from a centralized, standardized interface.

An in depth study and review of the current and planned ICARUS systems and programs was performed, as well as a requirements analysis for the MIMIC system, as part of this first technical phase. The study and review concentrated on the following areas:

- The I/O requirements for each system. Interest was paid to the type of display, resolution required, display drivers required (MOTIF, X-term, Character Based [telnet], etc.). Palette requirements and the need for special I/O capabilities (sound, video, scanner, SCSI CD-ROM, pointing devices, etc.) were also addressed.

- The suitability of each system for live demonstrations was evaluated for the presentation system purposes.

- The physical interconnection specifications and transport layers the "nuts and bolts," required to attach, start and execute on all hosts were evaluated.

3.2 PRODUCT ACQUISITION AND INTEGRATION

The components were acquired and integrated on the target desktop platform. In many cases the MIMIC represents the melding of components which have not previously resided in a monolithic system. Typically the gathering, editing, authoring, presentation, and production systems used in multimedia authoring are separate and distinct. The integration phase of the MIMIC development required considerable effort because of this, but resulted in a "one seat" system that provides convenient and integrated access to the entire multimedia process.

3.3 SYSTEM ADMINISTRATION IMPLEMENTATION

In the discussion of the multimedia authoring and related systems resident in the MIMIC it is sometimes forgotten that the MIMIC system also contains a complete control and administration system for the execution and control of ICARUS elements.

The MIMIC contains a complete X-Windows terminal emulation system which has an integrated script execution subsystem. This has been tightly bound to the MIMIC authoring and scripting environment so that advanced system processes can be accomplished by executing multimedia button clicks.

This facility is unique to the MIMIC and forms the basis for capturing administrator expertise and encapsulating it for use by novice operators.

3.4 MULTIMEDIA SYSTEM IMPLEMENTATION

The implementation of the MIMIC multimedia subsystem was the most software intensive portion of the effort. This task involved the use of Visual C++ and Visual BASIC as frameworks on which to hang the functional COTS software components. The MIMIC team then implemented the custom front end and scripting language which provided seamless access to these COTS components.

All of the code to read, convert, and display images; produce special effects; capture and play video and audio; and control external devices is provided by COTS components. The MIMIC controls these COTS VBX and DLL elements in such a way that the user need not be aware of which element is doing what.

This technique of insulating the user from the intricacies of the multimedia process is the greatest strength of the MIMIC system.

3.5 DEMONSTRATION

The MIMIC development process was accompanied by an ongoing demonstration task. The intent was to provide a demonstration of the authoring, administrative, and presentation capabilities of the MIMIC so that its ability to meet requirements could be assessed at each stage of development. This technique of interactive development proved to be extremely successful in producing a system that meets or exceeds all original requirements.

3.6 TRAINING

The MIMIC system is, as has been discussed, extremely easy to use. In order to demonstrate this a training program was instituted to instruct a member of the IR staff in the use of the system. This resulted in a series of scripts being produced by a non-technical user.

This process verified the MIMIC interface paradigm and allowed for the refinement of the user's manuals. This exercise was not a part of the original task, but proved to be extremely worthwhile and resulted in a far superior MIMIC product.

4.0 RESULTS

The MIMIC effort resulted in the development of an advanced concept Model Management and Human Interface "shell" environment which surrounds the many and diverse components of the existing ICARUS laboratory to provide for:

- Enhanced system administration and control.
- Homogeneous system operation.
- Highly flexible multimedia system demonstration and presentation of ICARUS-based programs.

This has been accomplished through a facility known as the Monolithic Interface Model ICARUS Controller (MIMIC).

The MIMIC system is based on a state-of-the-art multimedia authoring and composition platform which has been augmented with system administration and network control functionality.

4.1 CONTROL AND ADMINISTRATION

Control functionality is provided through the a custom virtual desktop operating in the X-Windows, Motif environment. The vehicle for this implementation is an off-the-shelf X-Windows package which has been tightly coupled with the MIMIC authoring and scripting subsystem.

Using the integral system control scripts in this system, a MIMIC user can execute and control any ICARUS subsystem through a simple "point and click" metaphor. This allows the novice user to take advantage of scripts produced by expert users and ensures that proper system protocols are observed.

4.2 PRESENTATION

The Presentation component is based on a number of off-the-shelf and custom multimedia products combined so as to allow the seamless integration of video, audio, and imagery captured from ICARUS system operation, and any number of other sources, to build a fully hyperlinked presentation that is fully portable.

In addition to providing for demonstration and presentation activities to be performed on the MIMIC hardware, the MIMIC includes a media generation capability. MIMIC users are able to record and distribute both passive (video tapes) and active (multimedia disk) materials. This allows for the cost effective presentation of ICARUS and Rome Laboratory systems to persons at remote locations at extremely low cost and with high quality and interest levels.

4.3 EXISTING MATERIALS

To provide an example of the type of presentations possible with the MIMIC system, the MIMIC team produced a complete series of interlinked multimedia presentations. Using these materials a presenter can give an overview of Rome Lab and its mission, IR's mission, and detailed examinations of all current efforts.

Any program in which an audience member showed interest can be instantly accessed at a more detailed level through a downward hyperlink. Technical details, personnel, funding information, and even a demo (live or recorded) can be shown.

Related efforts, technology transfer activities, etc. can all be explored at will based on questions or interest from the audience. Since any level of detail on any project can be accessed instantly, but only when requested, the presentation takes on a life of its own and audience interest is kept high. In addition the presenter always has prepared materials for any question that is likely to arise.

Even if an unrelated question is asked, an instant jump facility allows the information to be accessed. Thumb-marking allows the point at which the presenter diverged from the normal slides to be marked for instant return and resumption of the presentation when the audience questions have been addressed.

5.0 RECOMMENDATIONS

This effort resulted in a customized blend of a centralized administration and control system, multimedia presentation systems, and an authoring system designed for the ICARUS Facility. The MIMIC system allows for novice and occasional users to construct and present highly interesting multimedia presentations.

The MIMIC can be an invaluable tool for both the distribution of information concerning Rome Laboratory, and for the collection and storage of information for internal consumption.

The execution of the MIMIC effort revealed a number of avenues toward which this technology could be expanded. These include the following.

5.1 ADDITIONAL SCRIPT AUTHORING

The MIMIC is a powerful and flexible system for disseminating information and authoring multimedia presentations using existing materials. The inclusion of additional scripts to the existing base can be accomplished through the use of materials existing in many of the directorates. A high value effort would include the authoring of scripts encompassing all of Rome Laboratory.

In addition the MIMIC is an ideal tool for the construction of educational materials. Its ability to utilize existing materials means that current documents and videos can be combined in exciting new ways to make extremely cost effective multimedia training assets.

5.2 LIVE LINKS

One of the MIMIC's most innovative features is its inclusion of "doors" which allow the scripts to execute and administer live systems connected to a network. At the present time this facility is used only in conjunction with certain systems in the ICARUS facility. The value of the MIMIC would be greatly enhanced by adding door scripts to other systems of interest.

Since the MIMIC allows the knowledge of an advanced system administrator to be captured and preserved in an easy to execute fashion, the MIMIC would be ideal for setting up a systems administration resource desk to assist novice and advanced system users.

5.3 SIMULATION MATERIALS AUTHORING

Multimedia and hyperlink concepts have high value when used for simulating user interfaces. The MIMIC can be easily used to build a replica of an interface to a system to see whether users like it. The MIMIC's ability to access live links means that these mock-ups can access real live data and systems. This ensures that the user feedback is realistic.

The MIMIC is the ideal platform for interactive interface development. Its interpretive execution and local authoring means that interactive development cycles can happen in real time.

5.4 "TAKE THE SHOW ON THE ROAD"

The MIMIC is the ideal platform for disseminating information about Rome Laboratory. The system is now sufficiently mature and populated to accomplish this goal. The next step is to take the system out to trade shows and other venues and use it for the purposes for which it was built.

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OF

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c. Provides a full range of technical support to Air Force Materiel Command product centers and other Air Force organizations;

d. Promotes transfer of technology to the private sector;

e. Maintains leading edge technological expertise in the areas of surveillance, communications, command and control, intelligence, reliability science, electro-magnetic technology, photonics, signal processing, and computational science.

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