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DEVELOPMENT OF A PROTOTYPE INTERACTIVE LEARNING  
SYSTEM USING MULTI-MEDIA TECHNOLOGY  
FOR MISSION INDEPENDENT TRAINING PROGRAM

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## INTRODUCTION

The Spacelab Mission Independent Training Program provides an overview of payload operations. Most of the training material is currently presented in workbook form with some lecture sessions to supplement selected topics. The goal of this project was to develop a prototype interactive learning system for one of the Mission Independent Training topics to demonstrate how the learning process can be improved by incorporating multi-media technology into an interactive system. This report documents the development process and some of the problems encountered during the analysis, design, and production phases of this system.

## OBJECTIVES OF THE SYSTEM

The following objectives were identified:

1. Present the course material in an a manner that maintains the interest of the student. Using an interactive system will keep the student involved in the learning process and emphasizing visual and audio presentation of the course topics should keep his attention.
2. Provide consistent training from learner to learner. Using an interactive learning system, the course material will be presented in the same manner and at the same level of detail each time a student takes the course. The result should be more consistent training.
3. Make the training accessible. It is planned to make the system available on a network where any Mac computer can have access to the system.
4. Assess the student's comprehension of the course material. The system will have a testing capability and will provide immediate feedback as to whether or not the student answered a question correctly. At the end of the course, the system will provide a summary of how the student performed on the test and some suggested prescriptive measures that the student can take to correct the deficiencies.
5. Make the process of learning more effective. Incorporating multi-media effects, such as animation, graphics, narratives, sound effects, and video segments, will make the presentation more interesting and should help maintain the attention of the student. It should also some personality into the system as it interacts with the student.

## INSTRUCTIONAL SYSTEM DEVELOPMENT PHASES

The development of this prototype system went through an Analysis Phase, a Design Phase, and a Production Phase. The following paragraphs describe the activities performed in each development phase.

### ANALYSIS PHASE ACTIVITIES

The first activity in the Analysis Phase was to define the training requirements. These were divided into identifying the training tasks that any interactive learning system would perform and identifying the topics that would be covered by this particular system.

Four training tasks were identified. The system needs to provide direct instruction. The traditional educational approach (Teach it, Test it, Assess it, Re-teach it) was adopted as the presentation method for this interactive system. Another requirement that was identified is to keep the student involved in the learning system and to provide positive feedback. To keep the student's attention, the course material needs to emphasize the visual and audio presentation of the course material and limit the amount of text material that the student needs to read.

The second training task involves the assessment of the student's comprehension of the course material. The system needs to provide immediate feedback after each test question and provide a summary of the student's performance with some prescriptive actions for the student to take following the completion of the course.

The third training task should give the student a view of the course content. The student should be able to see all of the topics contained in the course. As the student progresses through the courses, the student should be able to see the topics already covered, the current topic, and remaining topics to be covered. This gives the student a view of where he has been and where he needs to go to complete the course. This type of information gives the student a feel for what is required to complete the course.

The fourth training task is the capability to backtrack or go back to topics already covered by the student. As a student progresses through a course, many times it is necessary to return to a topic to get a better understanding of the material.

The second part of defining the system requirements involved selecting a topic from the Mission Independent Training Program. The subject selected was the Command and

Data Management System (CDMS) Overview course. This topic is covered in two workbooks containing approximately 300 pages of information. To determine course content, interviews with two subject matter experts -- one who had written the CDMS Overview Workbooks and the other an instructor with knowledge of the CDMS subject. It was decided that the orientation of the course needed to reflect the interests and needs of Principal Investigators and Cadre members. The course topics that were identified include identification of CDMS components and their functions, review the flow of command transactions, review the flow of experiment data, and a "What happens when a CDMS device fails?".

Once the system requirements were defined, the next step involved assembling reference materials related to the CDMS subject. There were volumes of information available, in addition to pictures, diagrams, video presentations, that were obtained. The method of organizing, selecting the best materials to use, etc. was the use of a storyboard.

The storyboard technique allows a person to visualize how best to present the available materials. Under the CDMS topics, all information including text, diagrams, pictures, and any other relevant information were assembled. This involved cutting and pasting. The materials under each topic were then condensed and it was fairly easy to identify the diagrams and other visual materials that best described the CDMS topic. The storyboard helped define a functional path for presenting the material and develop information to be used for scripting the presentation of the material. This concluded the Analysis Phase.

### DESIGN PHASE

Some method for organizing the CDMS topics and information identified during the Analysis Phase was needed. The system needs to be designed around some structure. The structure selected was a hierarchy of nodes, where each node represents a CDMS topic. It was fairly easy to transition from the storyboard to the hierarchical organization. Each node was assigned a topic name along with the related information that was made up of text information and graphics. Based on the information, nodes were added to the hierarchy to better define sub-topic under the major CDMS topics. Folders were used to represent the nodes in the hierarchy, which kept all the information related to a sub-topic together.

From the information available in each of the sub-topic folders (or nodes in the hierarchy), the program specifications were developed. These specifications include screen formats, scripts for narrations, test questions and prescriptive instructions, menus, and diagrams.

## PRODUCTION PHASE

This phase consists of developing the system, verifying the system, and validating the system. The first step involved selecting the software to develop the learning system. The first consideration was to re-use some of the software developed as part of the MacCIC system. It still would involve developing a SuperCard User Interface, developing a Nexpert Object rule base, developing some multi-media interfaces, and developing a link between the SuperCard interface and the Nexpert Object rule base. This was viewed as too involved an approach for a 10 week project. Also, because of Nexpert Object licensing costs, this approach was viewed as not being cost effective for the CDMS Overview prototype system. It was decided to review other software available in the Lab.

The second alternative considered was MacVideo Interactive authoring system. It supports multi-media functions including the playing of video clips. After selecting this software and working with it for about a week, it was found to be not usable in its current version. The version available in the Lab is a beta test version, which means that the system was released so that software bugs can be identified and corrected. The current version had enough bugs that the software was deemed unusable for the CDMS Overview Prototype system.

A third alternative was an authoring system called LessonCard. The CDMS Overview prototype system was programmed using LessonCard. The result was an interactive learning system with a point and click user interface that generally satisfies the system requirements and meets the objectives defined for the system. However, this was accomplished with limited multi-media capabilities. LessonCard supports HyperCard Graphics which does not include color. Therefore, the capability of displaying color photographs was lost. Video is supported by LessonCard, but only when played from a videodisc player to a television monitor. This capability was also lost. The CDMS prototype system is able to display black and white diagrams and play narrations. While these are limited capabilities, the CDMS system is still effective.

The verification of the CDMS prototype system was done by one of the subject matter experts interviewed early in the system development. He reviewed the system two different times. He concluded that the course content was correct and that the proper level of detail was presented. He made some suggestions on how to present some material and these suggestions are being incorporated in to the system.

The system is currently being validated. Other Branch members are reviewing the system and their comments and suggestions are being reviewed.

#### SUMMARY

The CDMS Overview prototype system is limited in multimedia capabilities, but it met its objectives. Some of the limitations may be overcome when a new version of LessonCard is released in the Fall. It demonstrates the effectiveness of an interactive learning system that involves the student in the learning process and emphasizes the visual and audio presentation of the course topics. It was also completed within a ten week window, even with the difficulties and lost time when using the Mac Video Interactive software.

However, a problem does exist with the LessonCard version of the CDMS Overview course. After including the diagrams and recording the scripts, the system grew to over 14 megabytes, and is probably too large to really be portable or accessible. This points to a major problem when attempting to use personal computer platforms for an application with even limited multimedia capabilities. The storage requirements are too large. An external storage device and a television monitor are needed to display any kind of color photographs or video clips. This is probably the major shortcoming of the CDMS Overview prototype system.

