DESIGNING THE VISUAL IDENTIFICATION TRAINING SOLUTION

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ABSTRACT

On 14, April 1994, a tragic and avoidable accident occurred over the skies of Northern Iraq when two US Army helicopters were mistakenly shot down by two US Air Force F-15s and twenty-six persons were killed. Reports from the investigation indicate that a number of factors contributed to the accidental shootdown. Most prominent among these factors was the visual mis-identification of the Black Hawk helicopters. Visual identification training programs in the Air Force and across the Department of Defense had changed little from their inception a half century earlier and needed overhaul to avoid the symptomatic repetition of incidents such as that of the Black Hawk shootdown. This paper outlines the successful approach taken to insure the swift, appropriate, instructional and software design, development, implementation and evaluation of the needed training intervention titled Joint Visual Identification (JVID) training system.

BACKGROUND (STATEMENT OF THE PROBLEM)

The tragedy over Iraq was an avoidable accident. The two US Army UH-60 Black Hawk Helicopters shot down were mistakenly identified as Iraqi Hind Helicopters at a distance of approximately one-half mile. The failure to accurately identify these helicopters however, viewed in historical context provides a perspective that is needed to understand the fundamental nature of this training problem.

Historical Perspective:

The tactical skill of visual recognition is historically required by military fighting units. From the ancient Roman legions to the Chinese armies and later the British regiments on the ground, flags and other visual cues were used by both the fighting forces and their leadership to manage and provide strategic defense, assessment and information. With the arrival of new technologies for warfare came the need to standardize the methods by which to identify friendly forces and equipment. The arrival of aircraft necessitated distinguishing marks. These marks took the form of paint schemes, fuselage markings and tail insignia or the “Fin Flash.” Yet, even with these distinguishing marks, improperly trained forces have failed to properly identify or discriminate between friend and foe with devastating results. For example, poorly trained Polish defense forces shot down one out of three of their own aircraft in the first world war. British confusion between similar aircraft (the British Spitfire and the German Me-109) resulted in nearly half of Spitfire losses attributed to friendly fire. In almost every military campaign in which aircraft have been used as weapon systems, mis-identification has resulted in the lose of both lives and equipment.

As in the past, the United States Army UH-60 Black Hawk helicopters that were shot down in April of 1994, was a symptom of poor training. Reports from the investigation into this accident indicate that a number of factors may have contributed to the confusion surrounding the mis-identification. Ultimately, however, the erroneous visual identification by the two F-15 pilots—the last and most critical safeguard—failed. Unfortunately as indicated above, this kind of mis-identification is not an isolated anomaly in areas of conflict even today. Two separate mis-identified incidents early in 1996, Japanese fighter jets were downed. As in the past, without the stress of air warfare, mis-identification incidents and accidents occur several times a year. During wartime such cases increase dramatically. Fortunately few in recent years have resulted in the loss of life.

Current Training Methodologies

At the time of the Black Hawk shootdown aircraft visual training materials consisted entirely of 35 mm slides, photo’s, and overhead slides of aircraft, video clips of aircraft flying at varied altitudes, aspects, and flight profiles, posters highlighting visual differences, and books detailing the visual descriptions of aircraft. Other than the visual recognition training sessions the majority of training US. Air Force combat Aircrew received was passive in nature, not interactive (Berry 1996).

Until recently, our methodologies for visual identification training of Aircrew members was a relic of the 2nd World War. No substantial changes in training methodologies nor the use of advanced instructional technologies had been employed to upgrade the effectiveness of this critical aspect of Aircrew readiness. Until JVID was employed the major form of visual identification training for pilots and Aircrew members consists of worn slides projected on the ready room screen and questions thrown out to the assembled group for reply. Occasionally, flash cards are employed and within the last eighteen-months some rough elementary computer-based training devices have begun to emerge on the scene as supplementation.

Statement of Need

With more and more regional conflicts emerging and the precedence set for “No Fly Zones” and “Restricted Fly Areas,” the possibility of tragedy resulting from the lack of effective visual identification training grows. Visual identification training prior to 1995 was antiquated and ineffective. Although adding to the quantity of materials, subsequent training, developed outside of the methodologies described below have failed to offer substantial instructional advantage over pre 1995 materials. The need for an instructionally valid, technologically current, visual identification system was past due. Current instructional design theory, software engineering, computer technology and delivery methodologies were employed within a framework promoting retention and transfer of these important skills and knowledge.

THE INSTRUCTIONAL SYSTEMS DEVELOPMENT PROCESS

Defining and Conducting the Front End Analysis (FEA)

Front End Analyses can be conducted with various focuses or priorities in mind. This Front End Analysis (FEA) was designed and administered to isolate the desired optimal skills and knowledge-based ends in a system with skills and knowledge deficiencies. The means to those ends will be taken up in the instructional design section.

Obviously only a fraction of the volumes of collected data assembled in the analysis is of specific interest here. The audience profile embodies the essence of the audience analysis. A summary will highlight other FEA findings.

Composite Profile

Two distinct populations constitute the target population (1) Fighter-pilots, and (2) Flight Squadron Intelligence Officers. The profile Pilot is an intelligent, highly motivated, type A personality. These are white males about 28 years old. There is no distinct pattern identified among other demographic data collected. There is a strong cultural factor present in the squadron pilot community that fosters both loyalty, pride and high performance. There are social pressures that inhibit any act construed as reflecting negatively on the whole group. These are healthy, fast tract, individuals dedicated to high levels of performance and honorable and intelligent behavior; yet there is an element of zealousness and courageousness that may boarder on foolhardiness in its extreme. The pilot population practices a self-disciplined and regimented lifestyle with long difficult schedules of extended duration. They are an extremely competitive group that display a marked need for control.

The Squadron Intelligence Officers gender breakdown with 60% male 40% female. They are from predominantly Caucasian ethnicity, however with strong Afro-American, and Hispanic representation. Other ethnic representation was present yet minimal. Intelligence Officers are an average of 27 years old and exhibit dedication and motivation to execute their roles to support through providing information to the pilot community. These are conservative, detail oriented people who tend to avoid risk; yet exhibit a moderately competitive determination. There is not the profound sense of collegial community and fraternity that is found in the Aircrew community.

SUMMARY OF FEA FINDINGS (TRAINING NEEDS)

Existing limitations:

- Static non-contextual images (poor quality)
- Focus on rote slide recognition
- Scant video (non-contextual & poor quality)
- Familiarity with visual resources
- Group collusion in practice and testing
- Inconsistent, infrequent & ineffective training
- Limited development dollars
- Limited government expertise (design & development)
- Dynamic content structure—Rapid change in VID needs
- Limited design and development time to meet each need

The Need (Forecast-macro)

- An effective VID training tool
- Based on sound learning principles,
- Effective computer-based instructional design, and
- Couched in a versatile, efficient, maintainable, expandable software structure
- Maintainable
- Portable
- Modifiable as world conditions change (responsive to need)
- Loads of visual & text resources to feed and expand the capability of the tool and expand the instance pool.

The Need (micro)

- function outside instructor led paradigm
- accessible outside infrequent application
- elevate quality standards in CD-based model presentation
- utilize multiple stills and dynamic representations
- elevate quality standards in video
- elevate quality standards in modeling & rendering
- incorporate instructional strategies for effective initial learning
- incorporate instructional strategies through a variety in guided practice exercises
- incorporate instructional strategies for providing natural and artificial feedback
- teach correct, efficient process for learning distinguishing features
- focus on key distinguishing features
- allow user-control over sequencing
- teach correct, efficient process for differentiating among confusing aircraft
- allow user-control over mode of operation
- intuitive user friendly interface
- allow user-control over learning pace
- facilitate elaboration model (for clothing representations in meaning)
- utilize gaming principles (motivational & challenging = intrinsically motivational)
- incorporate instructional strategies insuring valid testing
- test only what is important

STATEMENT OF INTENT

The goal of the training intervention was to form from existing theory and research the appropriate process for accurate identification. Following the ordering of such a process or identification methodology, embody that approach in an intuitive, intrinsically motivational interface with game-like interactions that solidify for the user the application of this process (skills and knowledge) and insure retention and transfer.

DEVELOPMENT

Because of the need to produce an intervention quickly yet with exceptional quality and precise instructional accuracy, a self-directed work team became the functional design and development catalyst. This unique integrated approach to instructional design and software design allowed us to organize the JVID interactive courseware with instructional integrity. A preliminary plan, provided the architecture for meeting the needs found in the FEA. From the initial design a detail design evolved. This second step in the design phase showed detailed interactions, file structures and the standard parameters that would be used. Following the detailed design a prototype demonstrated database interactivity, latency in access time, and validation of selected technologies such as MPEG 1 and Virtual Rotation.

During the preliminary design phase, different instructional and software design alternatives were studied and evaluated. The overall development process, the basic structure of the JVID courseware, its major components, interactions and interfaces were defined. The adequacy and estimated risks of the design approach were considered. Critical resources needed for the development were identified. Key technologies on which the development process was dependent were evaluated or pioneered.

The preliminary design was further refined and expanded during the detail design phase. The definition of the system and its components are expanded to the extent that the design is sufficiently complete to be implemented. A detailed, integrated instructional and software design document was generated. It describes the model of the system to be created. This document provided precise design information needed for planning, analysis, and implementation. This design document outlined a partitioning of the system into design entities, and it describes the important properties and relationships between those entities.

During the design process, Prototyping was used to create a preliminary version of part of the software; this version acted as proof of concept in demonstrating feedback, and helped us determine feasibility of some of the pioneering code that was necessary. The prototype allowed us to investigate timing and other issues in support of the development process.

Steeped in applicable research and theory design decisions were made to approach the acquisition of knowledge stage with a information rich environment where the layout of the screen provided natural guidance. Feedback and help was made available but not required. Our intention was to push the student through the taxonomic classification process and avoid the identification pitfalls that come from unstructured, undisciplined rote approaches. Because of the audience, maximum user control was always a driving factor in the design; yet there was created a natural flow through the program that would facilitate learning. Also viewed essential to the success of the instruction was the inclusion of various realistic intercept profiles based on flight simulator data generated by experienced fighter pilots against accurately simulated enemy targets. This sometimes painful process proved an essential element in valid accurate, credible simulation.

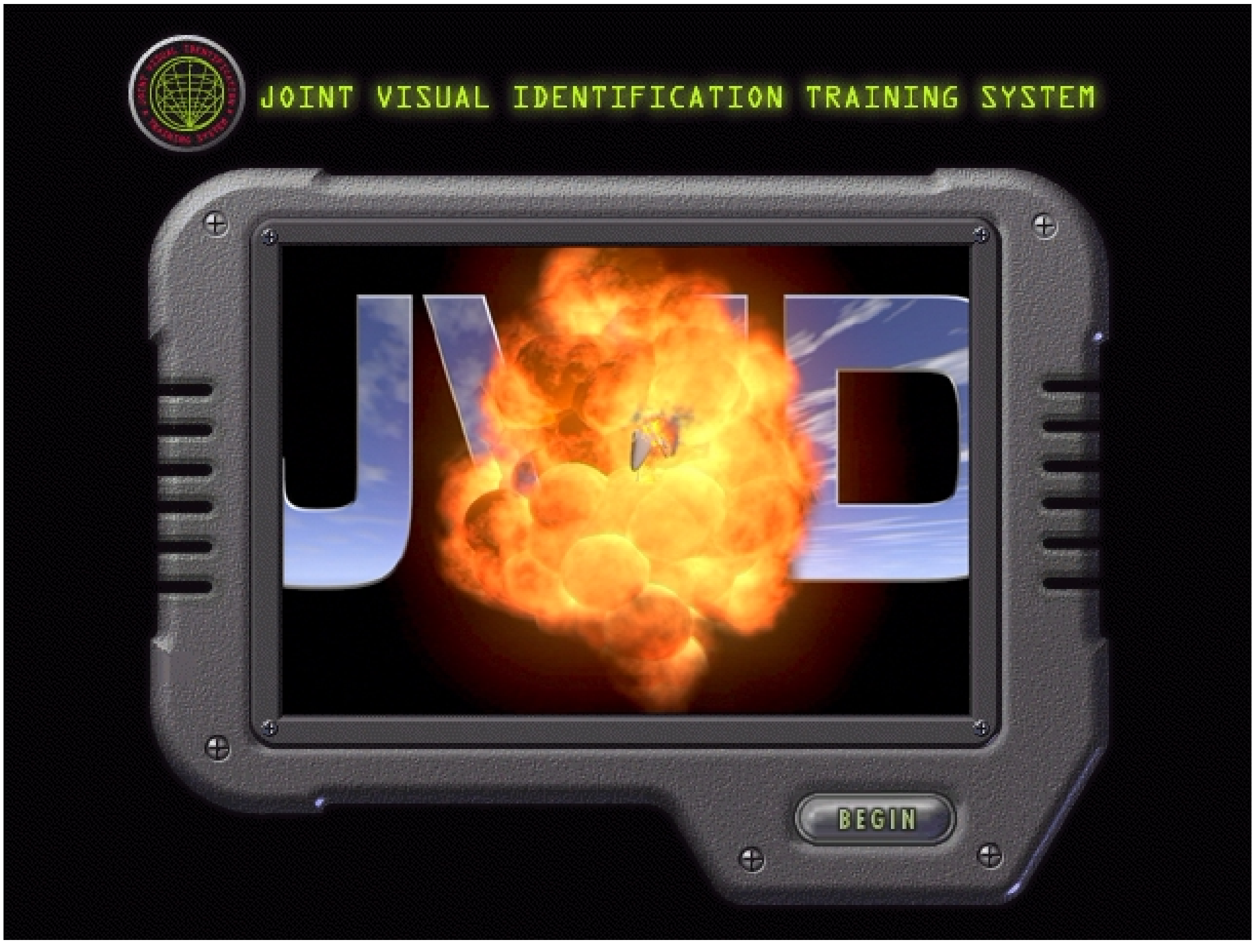

Figure 1 Initial Screen

Future constraints & considerations

Having discussed the present constraints, primarily the limitation imposed by the capacious yet limited capacity of the CD-ROM, it should be pointed out that these limitations are rapidly being removed., World leaders in laser-based media such as Phillips, Warner, Sony and others have projected release of medium capable of containing up to 10 times the present levels of data. As early as October 1996, commercial release of Digital Video Disc (DVD) with emense capacity, has been forecast. This order of magnitude gain in capacity will, in the near future, virtually eliminate the imposing constraints for this design. Entire theaters of military air and ground-based weapon systems will be housed on a single disc.

Following the initial Fighter VID training disc, follow-on development will utilize the shell-based VID engine. The second phase of he development will include the Bomber, Cargo and Helicopters and will be released prior to the end of 1996. Future editions will increase from 6 different realistically rendered, high resolution fly-bys, per aircraft to twenty or more. Viewing length may also based from the prescribed 5 seconds to as much as 20 seconds per encounter. The VID tools capability to present and test in two levels will be made operational with a second level of resource files. Additional video, still and dynamic fly-bys will be easily added. With the space constraint removed all aircraft for all theaters could then be placed on one CD-ROM allowing seamless movement from air-class, theater and activity. The instructional design with its modular structure and the accommodating software design combine to operationalize a most powerful and versatile teaching/learning tool that should accommodate a level of effective learning well into the future; indeed, that is the purpose of the design. The key to effective training in visual identification for military personnel will be realized by fueling the JVID engines with a constant flow of new, unfamiliar, realistic instances of the encounters and images to be identified. This fueling is made possible by further advancing and accelerating the development of resource files to feed the engines. Repetition and practice with the JVID tool, over time, will foster and insure a level of visual identification skills and knowledge beyond any level of competence realized in the past or present.

Initial Screen and Log-on

Purpose

To provide an aesthetic, tailored, motivational "teaser" screen promoting both the features and the challenge of the software.

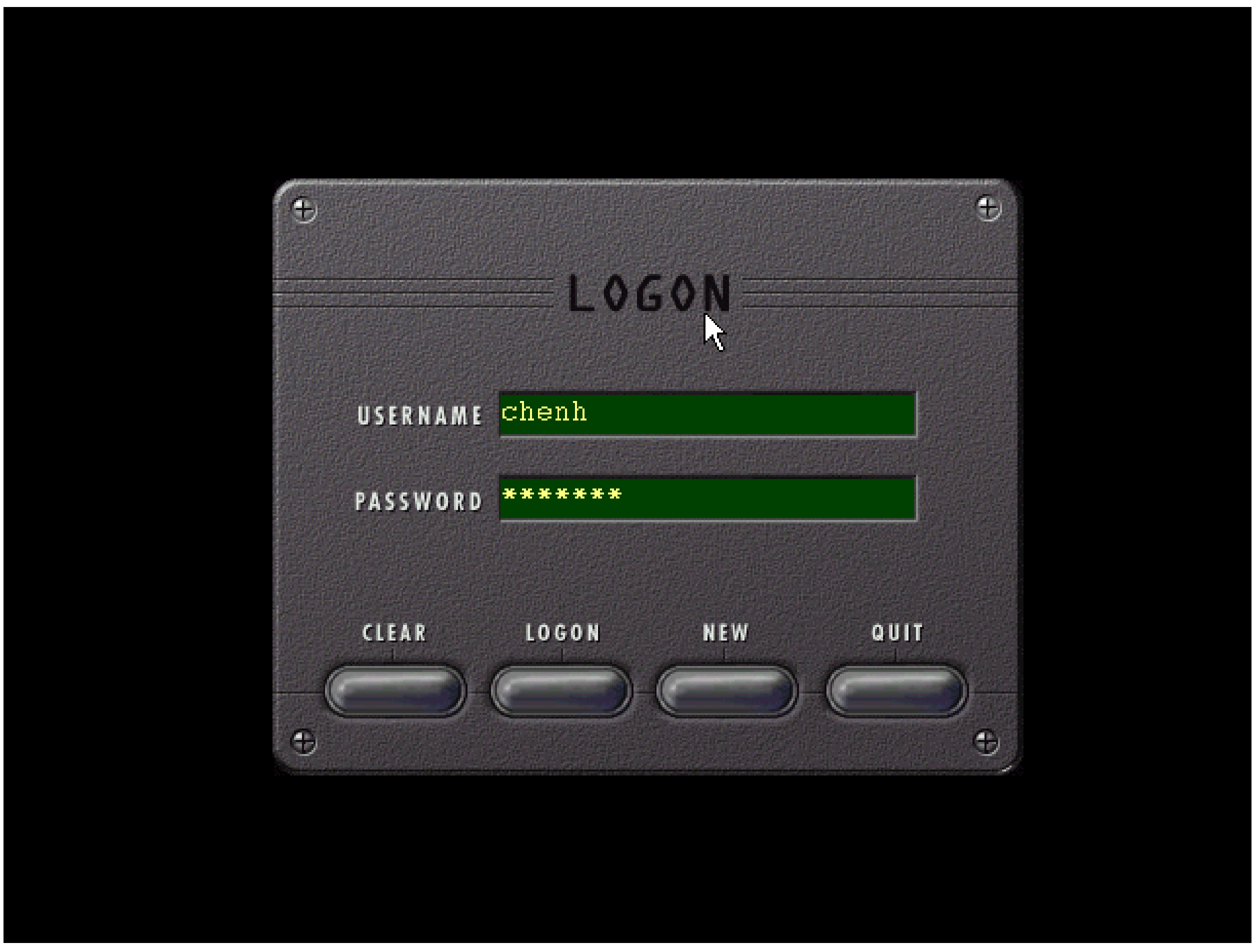

Figure 2 Log-on Screen

Operation

The initial encounter screen provides several seconds of inviting high quality animation-based MPEG video featuring aircraft encounters coupled with high tempo music and special effects. This screen will feature looping options for continuous play at the administrators prerogative. Suppressing the "Begin" button will cause the system to advance to the Introduction screen.

Application

The analysis work conducted by AETC TRSS has revealed that most Aircrew will not be mandated to practice on the VID system; however, to become proficient in the identification process, just as in other skills, requires hours of practice. The intent of this brief screen is to provide impetus or incentive to engage Aircrew in the challenge of the program.

Introduction

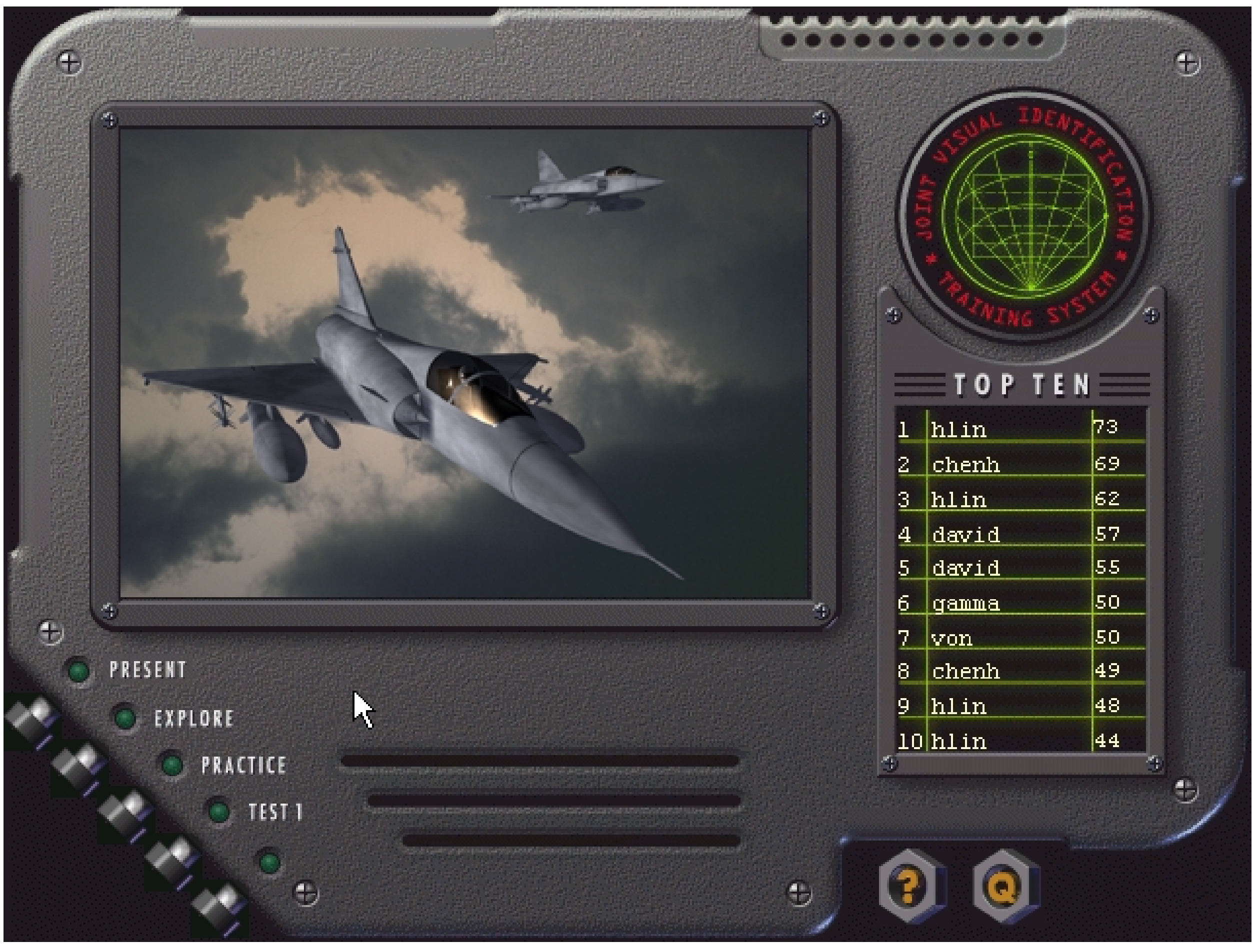

Figure 3 Introduction Screen

Purpose

The Introduction screen represents the main menu navigational interface screen. The purpose of this screen is to continue the invitation begun in the initial screen to participate in the identification exercises and provide the interface to navigate into any mode of operation.

Operation

When idle the dynamic display window to the right will continuously play randomly selected fly-bys from the database. The window to the left will feature the Aircrew members ranking, names or pseudonyms, and their scores from best score down ten ranking positions. The top three ranked user's records will be highlighted. The icon block at the base of screen will feature navigational tools. Each of the mode icons will advance the user to the designated screen and will remain highlighted, suppressed, or otherwise marked to indicate the location of the user at all times. Reference Figure 3 (Logic & Data flow). A "Quit" or "Exit" button will allow the user to terminate the program.

Application

Aircrew will use this interface as the base screen from which interactive interchanges with the various modes of the system will spring.

Present

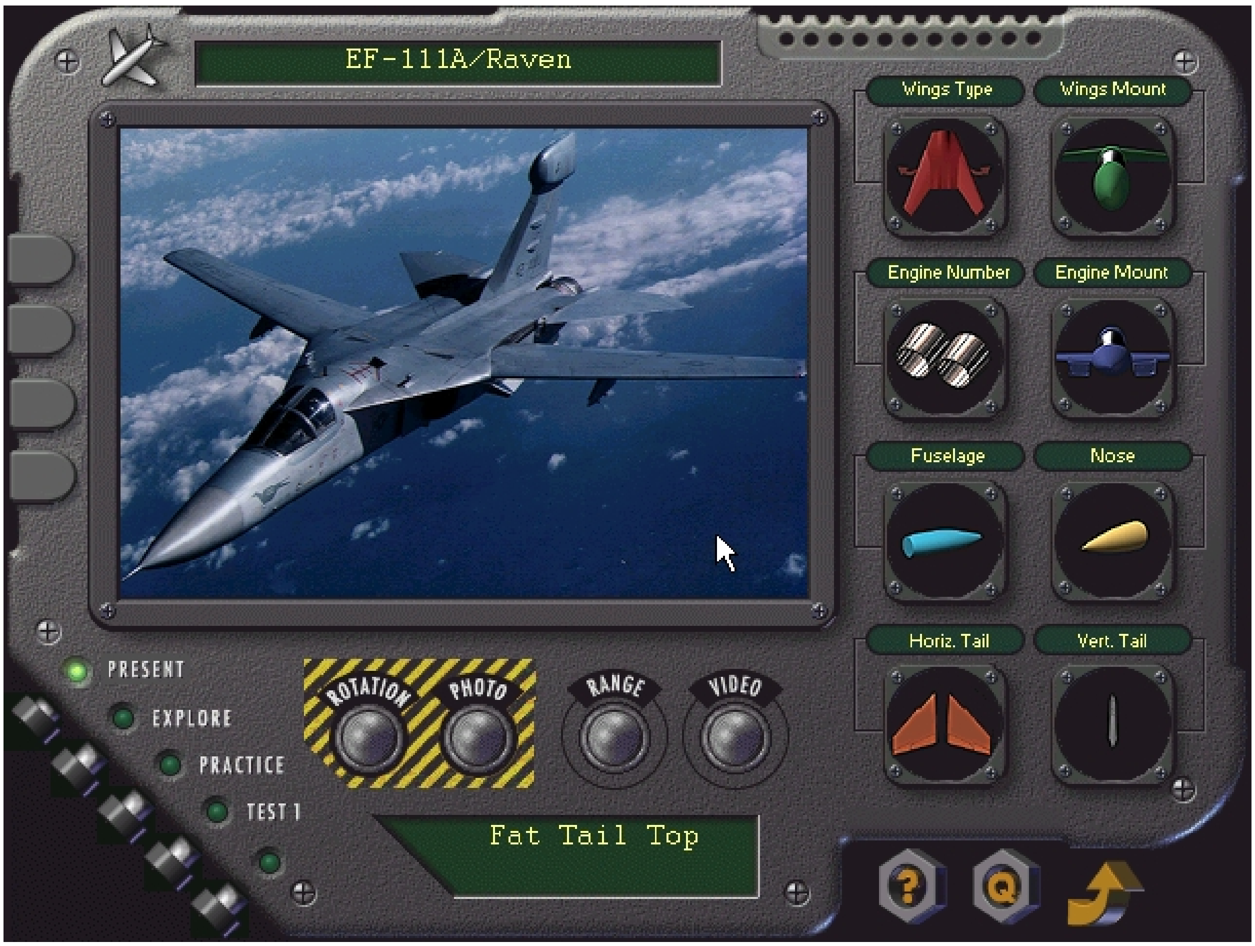

Figure 4 Example of Presentation Mode Interface Screen

Purpose

The present mode offers an information rich environment for the Aircrew member to interact with (1) a dynamic video-based encounter (2) the ranging fly-by depicting the designated aircraft from 500 feet to 3 miles, (3) Virtual Reality rotational view of the designated aircraft, (4) Six highlighted still images depicting each of the WEFT features. When the video or ranging modes are selected the video controller appears and the 352 * 240 window covers the theaters. After the video clip or the ranging view is complete, the last frame will hold until either options on the controller are executed or the Rotational VR view or still image view are selected at which point the video controller is removed. The "Ace" window displays the single salient feature or mnemonic operational phrase key in the recognition/identification tasking.

Operation

The present mode provides tools and methods for acquiring most of the required information needed to accurately visually identify aircraft. The design features user control features allowing flexibility and elaboration to facilitate diverse learning styles and acquisition strategies. Upon entering this mode the user may select an aircraft from the comprehensive listing pop-up menuing controller. The selected aircraft resource files are then loaded. The still photographic image is featured in the 240*240 window and all option buttons are active. After the user has completed review and study for the selected aircraft another aircraft may be selected and the process repeated. Reviews are not regulated in any way by the system. The user may repeat or skip any review or study option as desired. There are no time limits imposed.

Using the Ace Key

The Ace descriptors will provide a concise epigrammatic phrase, analogy, single distinguishing feature or mnemonic. This key phrase will be captured from extant resources or will be generated with target audience participation. The effectiveness of this feature will depend on the information provided by government sources.

Application

The present mode is used to progressively engage the user in learning the WEFT features which define each airframe. The Ace statements give Aircrew members insightful nuggets of information describing the aircraft under consideration through mnemonics, analogy or other descriptive phrasing.

Explore

Purpose

The Explore mode is the primary mode for comparison of potentially confusing aircraft. This screen features WEFT comparison features for both selected aircraft. The intelligent design prescreens the comparison aircraft so that is can be selected from the pool of potentially confounding similar featured aircraft. Highlighted WEFT features are depicted from rendered still images and are accessible through hyper-linked text. Fundamental critical measurements are provided for orientation and perspective.

Operation

The WEFT window immediately below the dynamic window features the WEFT-based comparisons item-by-item where the black text describes the common characteristics and the red text highlights differences. Slightly separated from the other text appears a test block that toggles between the dimension statements for each of the aircraft and the "Ace" statement describing the single most salient feature typically in the form of a mnemonic. The Ace button is the toggling switch.

The rotate button toggles a user from the Scale back to virtual rotation. Scale depicts each weapon system in proportional view within the class of weapon systems.

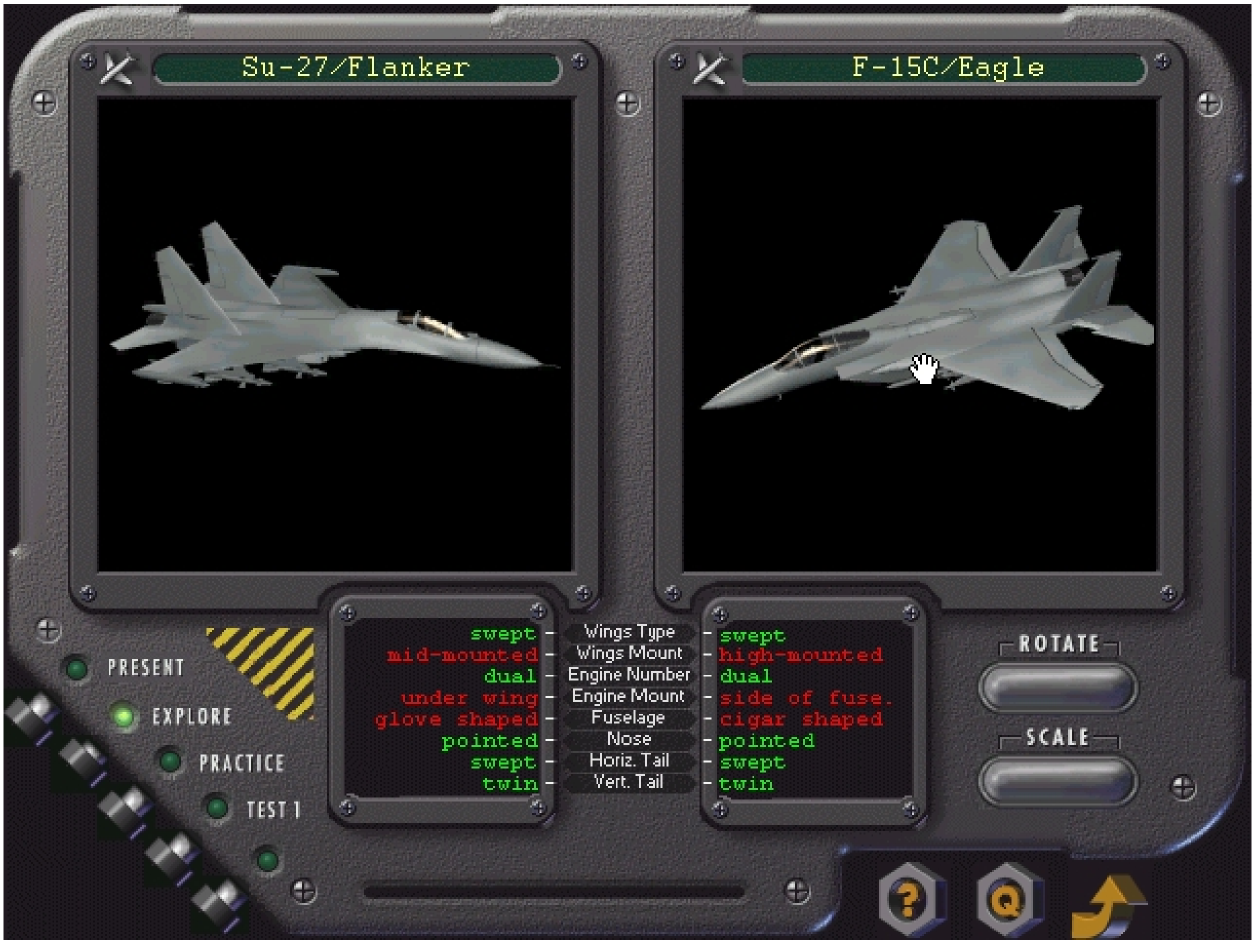

Figure 5 Example of Explore Mode Interface Screen

Application

Aircrew members will use this screen in conjunction with the Presentation screen to familiarize themselves with the distinguishing features of the various confusing aircraft—feature by feature—using the WEFT taxonomic model.

Practice

Purpose

The purpose of the Practice mode is to interactively simulate the testing environment without the pressure to perform. In this mode students may evaluate themselves without the obligation of recorded scoring. Corrective natural and artificial feedback is provided and a high level of user control is available.

Operation

Upon entering the Practice screen a student is prompted by the flashing fly-by aircraft icon. Suppression of this icon initiates a randomly selected 5 second fly-by in the upper-left window. Upon completion of the fly-by the student will select from the WEFT iconic menus the appropriate descriptive designators. Following the selection of WEFT features the user will select from the list of potential aircraft that aircraft thought to have been depicted in the fly-by. When the step above have been completed, the Score button will flash indicating evaluation can now be accomplished. If the student chooses to revise any selection prior to suppressing the Score button user control will allow it. Feedback is richly descriptive and representational. Representational feedback such as WEFT descriptors are depicted in the Practice-Feedback mode window. Textual feedback is also provided in the Feedback mode window. Feedback is by page with each page representing the data for an aircraft item. No scoring is provided within the Practice mode. The restart button zeros out the feedback and restarts a practice session. With the restart button users may choose to take one or many practice encounters and receive feedback on small or larger blocks. The Feedback Mode window will page through the evaluations screens using a next or previous buttoning system.

The process of selecting an aircraft from within the Present Mode is accomplished initially from a comprehensive menu of available aircraft. Icon buttons depict the class and mode of selection. Selecting one of these buttons reveals a set of iconic feature representations that are selectable option. In practice mode the objective is to practice the proper taxonomic classification process by viewing a realistic fly-by then identifying the distinguishing features and finally the weapon system. These features have been designed to implement research finding and instructional design theory for the effective acquisition, application and retention of these skills. The guiding principle was to “keep the interactions as graphical orientated as possible.” Whenever possible the utilization of iconic representation has been incorporated in the menuing and interactions.

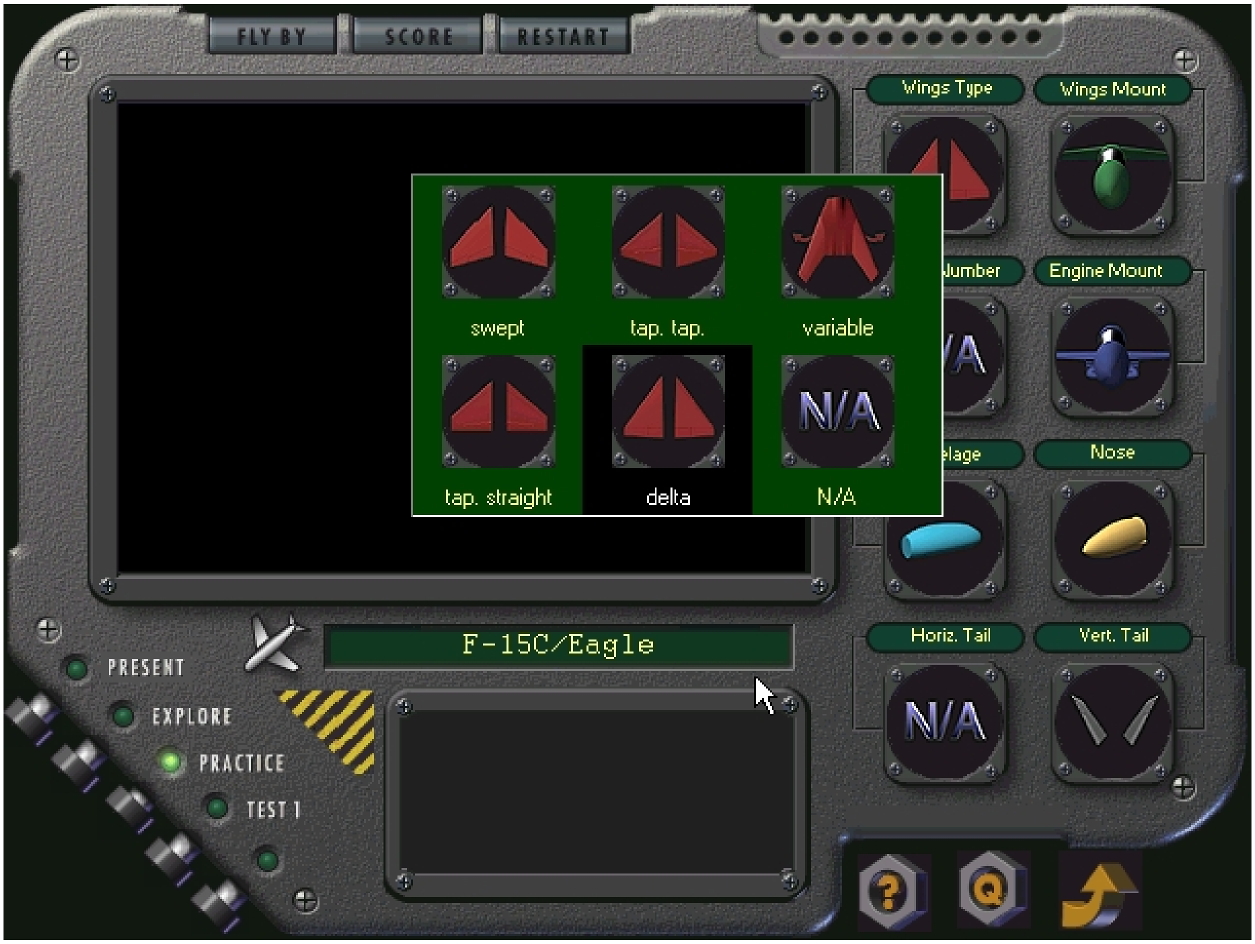

Figure 6 Example of Practice Mode Interface Screen

Selecting a WEFT Descriptor

As stated above each of the menuing options have been constructed using iconic representations. Because of the focus on visual identification rather than declarative or textual recognition and mental processing, all representations within technological and functional constraints, need to focus on performance or procedural knowledge acquisition, retention and application thus the need for and use of iconic menus.

Designating Wings			
(1) Position	N/A	(2) Mount	N/A
	Delta		Low mounted
	Swept back		Mid Mounted
	Swept forward		High Mounted
	Large stubbed		rear of fuselage

Table 1 Selecting WEFT (Wings)

Designating Engines			
(1) Number	N/A	(2) Intakes	N/A
	Dual		under slung
	Single		Top mounted
			Side mounted
			housing on top

Table 2 Selecting WEFT (Engines)

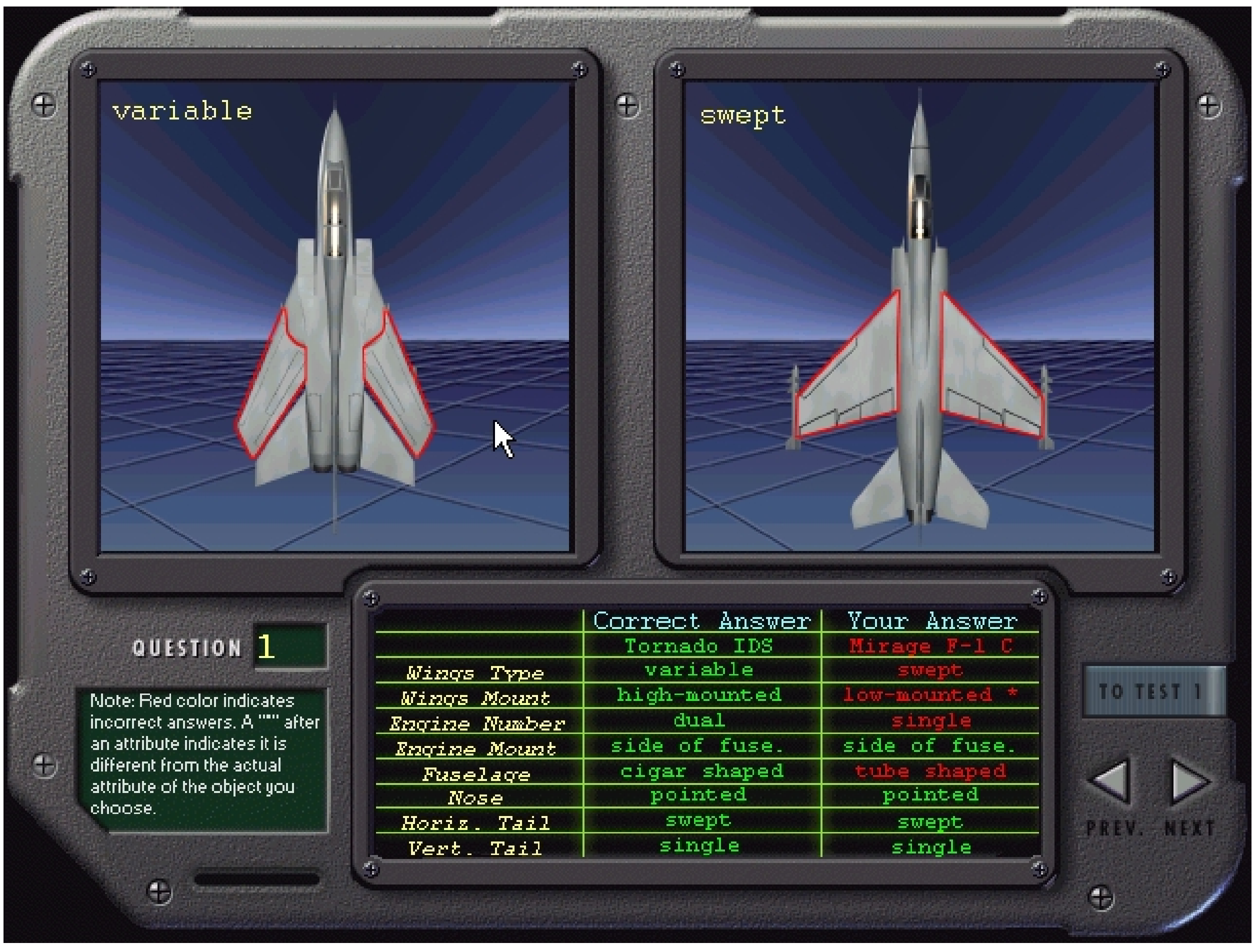

Figure 7 Example of Practice Feedback Interface Screen

Designating Fuselage	Designating Tail
N/A	N/A
boxy	single
two-seater	twin
cigar-shaped	canted outward
straight	perpendicular
drooping	canted inward
large chin-faring	

Table 3 Selecting WEFT (Fuselage and Tail)

Application

Aircrew members will use this mode to prepare for the testing modes. Both testing modes parallel the format of the practice mode with notable exceptions (1) no feedback is provided in testing mode, (2) level 2 testing does not require WEFT.

Testing Modes 1

Purpose

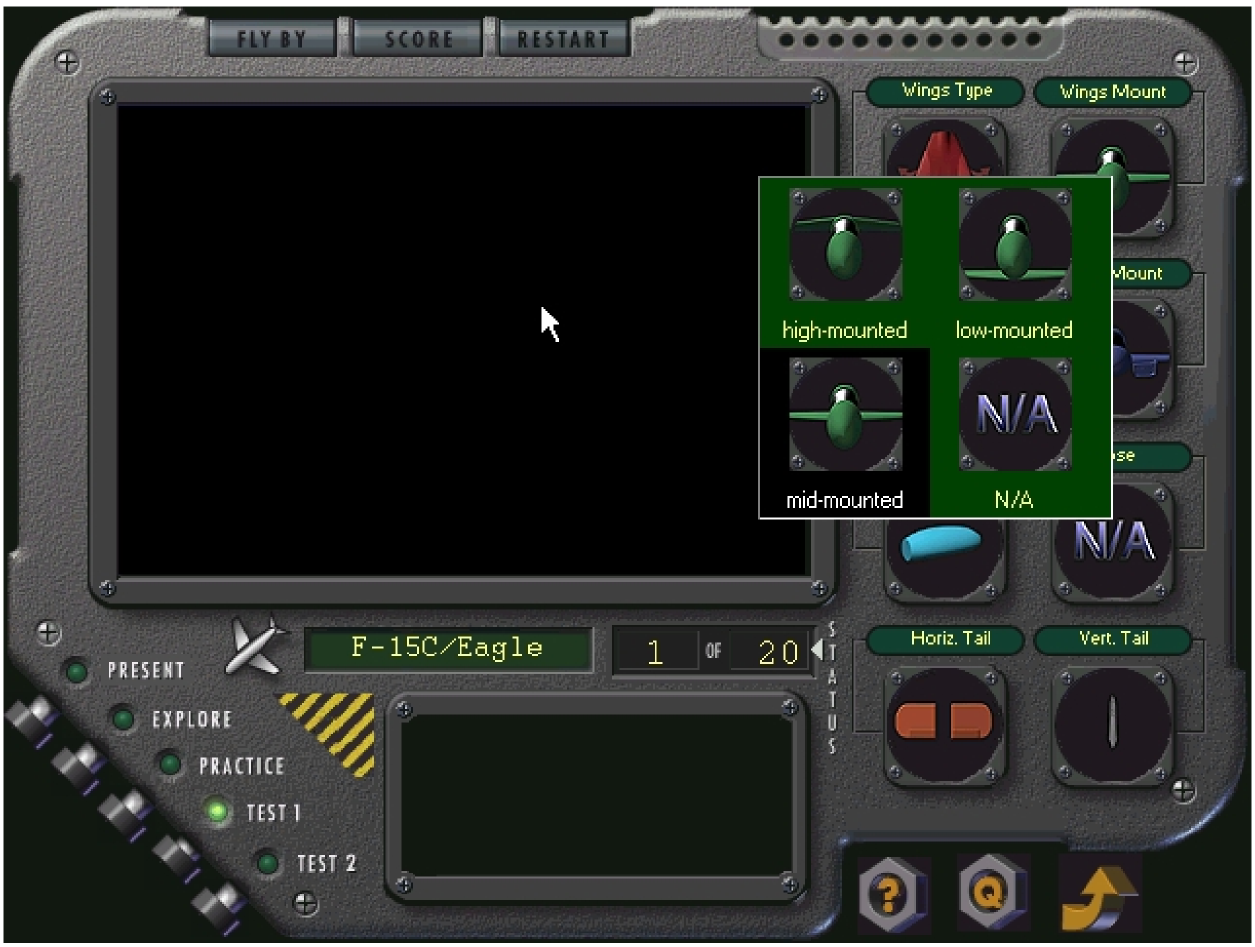

Figure 8 Example of Test Mode 1 Interface Screen

Test mode 1 parallels the features and functions provided and described in the Practice mode. In the Test mode only the feedback options are not present and scoring is active.

Operation

A user initiates action again by suppressing the flashing fly-by button. A fly-by occurs and the user is left to identify the distinguishing features under the WEFT icon menus. WEFT features are graded on a weighted basis with approximately 65% of the score for each airframe coming from the WEFT and the remaining 35% provided by selecting the aircraft. Obviously in this mode no perfect score is possible without both the effective accurate WEFT designations and selection of the correct airframe.

Testing Sets

Under either of the testing modes a default of 20 randomly selected fly-by will be presented and may be logged into the record of high scores. The scoring is calculated by giving ten points for each successful identified WEFT feature for a total of forty (40) points and fifty (50) points for correctly identifying the aircraft, for a total of 130 points per item or 2600 points for the set. When the evaluation screen appears the user has the option to record or discard the score.

Application

Upon entering the Test mode 1 the student suppresses the fly-by button and begins the test. The user then selects the appropriate WEFT designators and the aircraft thought to be the aircraft in question. Evaluation occurs and the system resets for the next item.

Testing Modes 2

Purpose

In the Test mode 2 testing occurs as standards were prescribed in the previous testing mode; however no WEFT selection is required. In addition here each testing set is timed to insure that both speed and accuracy are evaluated.

Operation

Major testing features remain the same between testing modes. Exceptions here include the conspicuous lack of the WEFT descriptors and the equally conspicuous presence of timing. Each item will be provided with a set amount of time allowable for response—high scores are those scores accomplished in the minimum amount of time factored by the accuracy of the identification.

Application

Upon entering the Test mode 2 the student suppresses the Start button and begins the test. The user then selects the aircraft from the drop-down menu, thought to be the aircraft in question. Evaluation occurs and the system resets for the next item. Twenty items are standard. Basic feedback, including the number correctly taken and those missed will be provided following the completion of the set. Recording the score is optional.

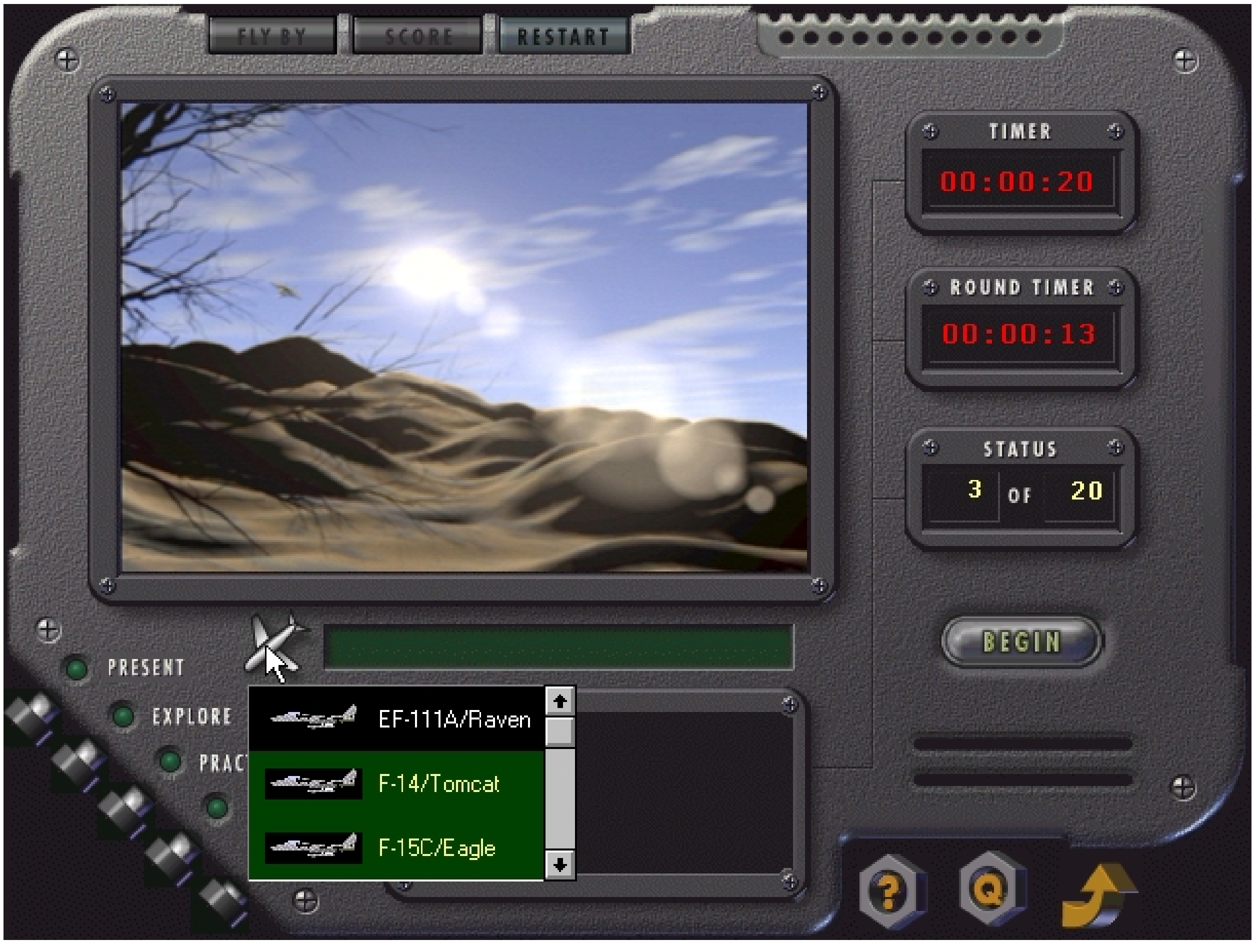

Figure 9 Example of Test Mode 2 Interface Screen

Data collection

Each user data item is stored on the delivery system's hard drive. The collection of data items is configured into the student record providing an encapsulated history of the individuals testing history.

This data history provides a vehicle for assessing information through database queries. These queries or function calls to the database will facilitate both evaluation of the JVID system as well as assessment of the individual users.

OVERVIEW OF RESEARCH DESIGN

Following the completion and various "in house" testing procedures, the JVID system was taken to the user field for trials. A random sample of the target population was selected from 4 bases. These four bases represented both AETC and ACC sites and a range of experience levels.

Air Force Base	Hill	Langley	Seymore Johnson	Tyndall
Intelligence Officers	11	8	14	5
Aircrew	10	8	5	17

OVERVIEW OF RESEARCH FINDINGS

Two instruments for acquiring data were administered. A survey with mainly demographic and opinion data and the Pre and Post-test scores. Initial analysis of the data revealed a

It was expected that among Aircrew, experience will correlate with performance in JVID scores, and indeed the research showed a significant correlation between hours of flight experience and performance on the JVID tests.

It is expected that the control group would perform superior to treatment groups in the JVID tests. Treatment groups used the same interface and most of the features of the JVID system with the absence of the Explore screen for one treatment and no WEFT tools on another. Interestingly, all groups showed a marked increase in scores from the pre-test to the post-test; however, the strongest gains were had by those persons with low initial pre-test scores. Overall, Aircrew members tended to perform slightly better on the pre-tests yet no real difference between Intelligence officers and Aircrew members could be statistically identified in looking at the post-test scores.

The intervention was shown to provide an environment that was motivational and effective in teaching visual identification skills and the prerequisite knowledge needed to perform such tasks. Both the Intelligence Officers and the Aircrew members showed marked improvement from pre-test to post-test.

Of equal interest was the results of the likert-based survey instrument. As mentioned above, some of our most pressing questions dealt with affective objectives. It was interesting to note that compared with the other computer-based visual identification training materials they had used, all of which were fielded as interim steps within the previous year, 81% stated that this program was “Much Better”, 14% stated that it was “Better”; 5%, that it was “about the same.” Not a single randomly selected Aircrew nor Intelligence officer rated this program less than equal with the competing tools. This overwhelmingly positive response was reflected in all other areas (i.e., interface, gaming features, practice, feedback and knowledge acquisition modes) of the survey as well. One hundred percent indicated that they would use this program in their spare time.

The lowest rated item was for the use of the WEFT taxonomic classification process. Here, of the target audience, 11% felt it had no effect on the effectiveness of the training; 4% felt it had a slightly negative effect and 3% a “negative contribution.” The remaining 82% determined that it made a slightly positive, or very positive contribution. Our initial interviews indicated that there would be some resistance among the Aircrew community to the WEFT process; however, it was very the use of this process was determined to be an essential element in the overall effective instructional design. The low percentage of those surveyed that felt these features and the process associated with their use had no positive effect was in itself favorably surpassing. All of our research indicates that our methodology which incorporates WEFT-based taxonomic classification, is very effective in securing these visual identification skills. Much thought, research and testing lead us to establish these techniques in the process and to provide a tool that would lead to the automaticity of such skills in the learners.

LESSON’S LEARNED

The most profound lesson learned was the validation of our systematic integrated approach in addressing and achieving optimal results. Secondary to this is the establishment of the use of Gaming in meeting certain instructional needs. The question of applying gaming features to the extent that we did was questioned by many along the way and was considered a politically liability by some and just a great risk by others.