MULTI-MEDIA SOLUTIONS FOR AIRCRAFT RECOGNITION TRAINING IN THE ROYAL AIR FORCE

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ABSTRACT

In the last few years there has been an ever increasing use of Computer Based Training (CBT) and Technology Enhanced Training (TET) throughout the British Armed Forces. A notable exception to this trend is the field of Aircraft Recognition; where training is still predominantly carried out by acknowledged recognition expert(s) using a mix of photographs, slideshows and briefings. These methods are costly, time consuming and involve minimal student interaction. Opportunities for self study and assessment are limited by the distribution of expensive, recognition specific, journals and magazines which, although they contain excellent source material, have limited training benefit.

This paper covers the design and implementation of the Aircraft Recognition Trainer for the UK Tri-Service Recognition Committee. It examines the decision to develop a dedicated solution rather than purchase an existing off-the-shelf package, together with the reasons behind the decision to use an in-house resource such as the Department of Technology Enhanced Training (DTET) at the RAF Training Development and Support Unit (TDSU) in preference to a commercial developer. It includes the Human Factors, Psychology and Human Computer Interaction (HCI) aspects considered during the evolution of the user interface and highlights the importance of subject matter experts having continued input to the ongoing design of a CBT package. It also covers the opportunities offered / difficulties encountered during the incorporation of new technologies such as Fractal compression, 3D modelling software and 32 bit operating systems.

ABOUT THE AUTHORS

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INTRODUCTION

The speed and manoeuvrability of modern fighter aircraft is such that the decision to fire must often be made in a split second; the difference between destroying a friend or foe depending on an individual's ability to determine the target's identity from the briefest of glimpses. The problem of correctly identifying an aircraft is exacerbated by the fact modern aircraft designs are becoming increasingly similar. Just as ordinary members of the public have increasing difficulty differentiating between today's computer designed automobiles, members of the military have similar problems differentiating between 'look alike' aircraft types.

The need for good recognition skills is readily apparent. Yet as lessons from the Gulf War and recent United Nations policing actions show, mistakes are still made and friendly aircraft are damaged or destroyed due to their incorrect identification. Part of the problem is that although the skill of Aircraft Recognition is vital, acquiring it is often a tedious and sporadic process; the training methods used, little changed from those of the 1940s and '50s. Group slide presentations of the latest imagery are held infrequently and individuals are expected to hone their recognition skills by perusing through a variety of photos in aircraft magazines and journals. Unfortunately, the images shown in magazines such as "Flight International", "Flight" and "Jane's - All the world's Aircraft" are simply too good. Such sources are invaluable for identifying distinctive aircraft features and performance data, but of much less use in training people to identify aircraft in combat situations.

Sources of suitable imagery are limited to a few dedicated recognition journals and manuals or the previously mentioned slide presentations. Yet each journal or magazine will typically contain images of only a few aircraft types, and in some cases only a single aircraft type will be covered. The ability to self-test is limited and, as with all magazine tests, it will remain the same over time. The opportunity to view similar aircraft types 'side by side' is almost non-existent and limited to a few aspects if covered at all. Perhaps more important is the fact that perusing these magazines is often tedious and time consuming, and often seen as a necessary evil rather than something to look forward to.

In contrast, a CD-ROM based multi-media solution offers (potentially) a much more flexible approach to the problem of recognition training. Recent developments in hardware and software allow thousands of photographic quality images to be stored on a single CD-ROM alongside 3-D computer models and/or video clips. These can be retrieved on demand, and displayed at sufficiently high resolution on even an entry level multi-media PC. The almost infinite malleability of software allows the stored data to be presented and viewed in a wide variety of disparate ways to the extent that decisions about what not to include become as important as those on what to include.

This paper examines the critical decisions involved with the design of a Computer Based Training (CBT) based Aircraft Recognition Trainer. It examines the reasons behind the UK Tri-service Recognition Committee's decision to commission a dedicated solution rather than adopt one of the existing packages in use with other NATO countries, together with the decision to develop the package using RAF resources in preference to a commercial developer. It will highlight the benefits (and frustrations) of subject matter experts (SMEs) having continued input to the design of the package throughout its evolution and will cover the Human Factors, Psychology and Human Computer Interaction (HCI) aspects behind key decisions. Finally, the effects of incorporating new technologies such as Fractal compression, 3D modelling software and a 32 bit operating system such as Microsoft Windows 95™ will also be examined.

BACKGROUND

In 1994 Flight Lieutenant Moss was investigating the possible development of a software tool to aid the process of aircraft recognition; this was being done as his MSc project and at the time it was not envisaged that such a package would be implemented as an accepted training strategy. However, there was a need to improve the current training received, primarily by aircrew, in aircraft recognition. This was highlighted by tragic examples, such as the misidentification of UN Blackhawks, which resulted in friendly aircraft being targeted and shot down in error.

In 1995 the package was used as part of the demonstration suite for a technology update briefing and was seen by the Chairman of the Recognition Committee. It was at this point that formal definition of the training need was made by the sponsor and the investigations taking place to solve the problem of aircraft recognition. The need revolved around the simple premise that aircrew must feel comfortable in their ability to distinguish varying aircraft types from differing perspectives in varying weather conditions with a high degree of accuracy. Unfortunately, the primary method being used was not providing enough information or practice and did not instil confidence into either the aircrew or their Commanders. The reasons for this are many and varied and fall outside the scope of this paper, except to state that a high priority training need had been identified and a possible solution now needed to be investigated.

The way ahead appeared to be the use of a multimedia training package and it was the demonstration of the MSc project that suggested the medium to the Recognition Committee. The Committee had basically three development options and the problem of maintenance to consider:

Purchase Existing Software

Advantages. The Committee started with the assumption that commercial off-the-shelf (COTS) CBT would be probably the cheapest and quickest solution; it would be tested and proven and likely to run on standard hardware components. In addition, the RAF would be able to evaluate the product before committing to a full purchase.

Disadvantages. There was a limited amount of COTS subject matter available, aircraft recognition software was not seen as a high volume product by production houses. What was available was based on content, style, order and depth of teaching which had been decided by a third party and which could not be easily amended without incurring additional cost.

Typical Costs. Costs varied enormously depending upon the medium used. Investigations revealed that the packages available were expensive, in the region of $150 000 to buy into the project, plus individual licences at $3 000 to $15 000 per copy. Since it was estimated that the RAF would require some 100 copies, total quoted costs of $1 500 000 - $3 000 000 were not unusual.

Specifically Tailored (Bespoke) Commercial Courseware

Advantages. There are many advantages to bespoke production, the most significant being that the RAF should receive courseware which meets its specific training need, in this case Aircraft Recognition.

Disadvantages.

a. Costs. The bespoke courseware was an expensive option, particularly since the only definite sales for the company would be to the RAF; however, some companies were willing to reduce initial costs in the hope of recouping revenue through long-term maintenance. There was also additional costs associated with RAF involvement in the analysis, specification, design and testing of the courseware, as well as the provision of SMEs during development.

b. Specification. There have been costly examples in the past where, for a number of reasons, courseware did not meet users' expectations. Experience shows that, unlike buying a piece of equipment, it is very difficult to specify precisely what is required of the CBT at the start of a project. To ensure that the RAF obtained its exact requirement a detailed specification would be necessary, this would take time and increase the cost of the software.

c. Timescale. The timescale for bespoke production would be long; however, in this case the Committee needed a solution in place within 18 months. Considering the problems of bespoke contracts this did not seem possible.

d. Typical Costs. The following costs are given purely as a guide and are based on informal discussions with a number of CBT providers; however, the RAF recognised that there would be many factors which affect the overall costs of services.

Structure	Content	Cost
Linear, or simple branching from high-level menus.	Simple text and line-drawn graphics.	$7.5k+
Increased interactivity with limited branching as a result of student actions or test results.	Simple graphics but with context-sensitive help, hot-words, hot-spots.	$15k+
	Complex 2-D or 3-D drawings, simple animation, some still photos.	$15k+
	Simple 3-D animation, short video and/or sound clips.	$20k+
	High proportion of software-only video and sound	$30k+
Fully interactive: move forward, backward & repeat; user control of action sequences.	Complex 3-D animation.	$30k+
	High quality video and sound.	$40k+
Freeplay.	PC-based virtual reality/simulation	$40k+

Fig 1. Typical Courseware Costs Per Hour

In-House Development

There are many examples of bespoke courseware in the RAF which fully satisfy its users' needs. Regrettably, there are also examples where this has not been the case, for reasons which are many and varied. These failures, coupled with the cost of bespoke courseware, have been used to argue in favour of in-house development.

The case for in-house development for this project is further strengthened when one considers that, even for a successful bespoke project, there is likely to have been considerable RAF investment in the training analysis, strategy and design processes, together with ongoing subject matter support and project liaison. It can therefore be felt that, for the sake of a little extra investment, the whole project could be undertaken in-house.

Advantages. The major advantage of in-house development is that it gives the Committee greater control over the courseware development. The work can be carried out by people who are both subject matter and 'RAF' experts; they can produce exactly what is required and can respond quickly to change requests from users, both during development and for subsequent modifications. Cost was also an advantage for what is a complex and difficult piece of software requiring a great deal of SME involvement.

Disadvantages.

a. Personnel. The recognition package involves complex media, with production drawing on SME and skills in training design, HCI design, software engineering and media production. These are all very specialised disciplines in their own right and it follows that knowledge in one or two of these areas is no guarantee of a successful project. The most pressing concern for this project was the HCI design, in terms of screen colours, content and layout, and the degree of interactivity and means by which it was to be controlled. We had to ensure that the courseware was fully acceptable and that the Department of Technology Enhanced Training (DTET) had the staff to provide high quality courseware on time and to specification.

> "It is all well and good to introduce a technology that enables the man in the street to give vent to his creative ability, but what if he does not have any?" (Barker, 1993)

b. Project Management. Development of this project on a part-time basis, a few hours per week in between other tasks, would not work. Staff will be allocated on a full-time basis and given training, objectives, deadlines and encouragement. Discipline is crucial since a balance must be achieved between delivering, on time, what is required and allowing users (often a number of different ones) or developers (whose enthusiasm will know no bounds) to keep 'moving the goalposts'. Project management is the key to the success of this project: planning, co-ordinating, communicating (upwards, downwards and across), reviewing, standardising, testing, adapting, documenting and delivering.

c. Costs. There were a number of 'up-front' costs, including the development hardware, authoring software and staff training. Staff capitation costs (not just developers but also project managers, supervisors, graphics officers, SMEs etc) had to be considered, as was the provision of target hardware to run the finished courseware and the means of maintaining that courseware.

Typical Costs. The courseware was to be developed and run on standard hardware, the majority of in-house costs was expended on staff capitation. The experienced DTET team producing 'typical' courseware with a Windows-based authoring system achieved production ratios of around 100:1 (ie 100 hours to research, design, develop, test and document each hour of courseware). This value was significantly less than those quoted by industry which were often in excess of 200:1.

Maintenance

Commercial Maintenance. If the project had been commercially sourced, a maintenance contract would have been let. This must specify an appropriate degree of support in a realistic timescale. Would the supplier merely carry out corrective maintenance (bug fixes) or would they also carry out adaptive maintenance to accommodate procedural or equipment changes? If one considers the frequency at which modifications are introduced to aircraft both old and new, adaptive maintenance would have to be carried out on any associated courseware at the same rate; changes which take 6, 12 or 18 months to implement would not suffice. Finally, the length of contract is important. One which lapses after a year is of little use, but one which supports courseware for 10 years with no provision made for hardware upgrades is likely to be equally unsatisfactory.

In-House Maintenance. In-house maintenance for this project is cheaper and more responsive.

a. In-House Courseware. Since the courseware was produced in-house, the expertise exists to maintain it, although this would become dispersed over time. Unless well-managed, there is a natural tendency for in-house developers to try and avoid the more mundane tasks associated with courseware such as documentation and data backups, the usual claim being that this would all be sorted out 'at the end'. However, by this stage the DTET staff, and their managers, tend to have their sights set on the next project. Therefore, care had to be taken to avoid the situation where a key member of staff leaves with much essential information 'in his head'.

b. Commercial Courseware. Most manufacturers would hope to profit from continued maintenance contracts and so they are likely to charge highly to release all source materials. The onus will be on the RAF to specify exactly what is required; this should include all documentation, source code, graphic files, libraries etc. Ownership of copyright should also be established since, over an extended period, the original courseware may become much improved and possibly marketable.

Having considered all of the above points the decision to produce the package in-house by DTET was taken. It should be stated that the three major reasons for this were; cost, SME involvement and continuing maintenance. It should be noted that the discussion above did not mention evaluation of similar products which was undertaken by the Recognition Committee and DTET to ensure that a reasonably priced package, which met all of the training objectives could not be provided by commercial sources; no such package was found. DTET was tasked, therefore, to produce a multimedia aircraft recognition package for Tri-service use within a timescale of 18 months. This initial tasking has been expanded to cover ships, submarines and armoured fighting vehicles as additional modules over the following 3 years.

PROJECT DEVELOPMENT

Specification & Module Design

It is an underlying theme of this paper that the final format of the Aircraft Recognition Trainer evolved through a series of meetings between the project manager and the SMEs appointed by the Recognition Committee. The final format of the project was markedly different from the initial outline specification; new features were added and existing elements substantially modified or even removed. Some of the changes were made to incorporate new software tools as they became available, but most were made as a result of comments made by the SMEs or visiting personnel from front-line units. This flexibility was only possible due to the decision to develop the package using RAF resources, which allowed for easy (and often informal) communication between the project team, appointed SMEs and intended users. Eventually, the decision to 'freeze' the specification for each module had to be made in order to allow the code to be produced and optimised but, by leaving the decision to freeze the specification until as late as possible, we were able to incorporate as many of the wishes of the SMEs and intended users as possible.

This approach is in marked contrast to the way a commercial development must be undertaken. Contractors typically conduct a series of management level consultations to identify objectives and agree a project specification, then develop systems to meet the contractors view of how these objectives should be carried out. Although these systems meet the agreed specifications, they are often overly complicated with interfaces more suited to the designer than the actual final users. By making the latest prototype available to the many visitors to the TDSU, we were constantly provided with the feedback (both good and bad) that helped fine tune the final specification for each module and hopefully avoid these problems.

Once the specification for each module had been finalised the project manager and programmers for that module met to consider how best to meet the requirements of that particular module. Typically 2 or more partially implemented solutions were produced over a 2 - 3 week period and the programmers were encouraged to attempt their own solutions in addition to those suggested by the project manager's initial design. At the end of this period the project manager and appointed SME for that module reviewed these prototypes and agreed a final design. In most cases this final design was little changed from that originally suggested by the project manager, but there were several notable instances were the initial design was modified to incorporate ideas from the various prototypes. Involving the programmers in this way also produced other, more intangible benefits; the programmers developed a proprietary interest in the project and this in turn produced a noticeable increase in the freeflow of ideas and rate of software production.

Human Factors and HCI Considerations

From the outset of the project one of the primary aims was to make the package as useful as possible to both those undergoing recognition training (Novice users) and those conducting that training (Expert users). Designing an interface to accommodate both of these requirements was once again an evolutionary process and proved as time consuming as the actual coding of the underlying search algorithms and database structures. Changes to the Interface layout suggested by SMEs or project members were only implemented after careful consideration of the basic tenants of Human Factors and HCI research, combined with the lessons learned by DTET during past CBT production/evaluation. One of the roles of DTET is to evaluate commercial packages and assess their potential usefulness to the RAF. Experience has taught us that the usefulness of a particular piece of CBT is a combination of 3 factors. These are :

- Functionality. What a system can actually do i.e. its technical power.
- Usability. How easily the functionality can be utilised by users.
- Learnability. How long it takes a user to achieve an ease of use with the package and an understanding of its working.

For expert users functionality is more important than learnability, whilst for novice or casual users, learnability and usability are more important than functionality. Achieving the correct balance between these factors is a notoriously difficult process. Many apparent functionality problems ("It won't do X") are in fact problems of usability or learnability: the system can in fact do X, it is just that the users cannot find out how to do it (learnability), or cannot understand how to do it (usability).

Understanding how people 'think' is also a vital part of the HCI design process; it is important to know not only what information to display, but also how to display it so that it is most perceptible/comprehensible to the user. The fields of Human Factors and HCI depend upon a conceptualised view of humanity that attempts to isolate the factors that govern human perception of a computer program and their behaviour towards that product. Human Factors research often asserts that the vagaries in human perception and behaviour result from a combination of 5 critical factors. These are :

1. Mankind has limited information processing capabilities.

2. Human behaviour is heavily influenced by past experiences which cause 'False Hypotheses' to be drawn. These hypotheses are often based on an interpretation of what is expected, or what ought to be happening, rather than what is actually happening.

3. Human performance is influenced by adverse physical, physiological and psychological influences. A person suffering from illness or undue stress will react differently than when he/she is feeling calm, fit and well.

4. People are change detectors - acclimatising to constancy and becoming confused by inconsistency.

5. Most psychological processes are critically affected by the value of the 'stimulus' affecting them. People make more progress in tasks that are perceived as important, challenging or interesting (i.e. valuable), than they do in tasks that are perceived as dull, routine or boring. They are also much more likely to remember facts learned whilst undertaking tasks that were perceived as 'valuable' or enjoyable.

In situations that depend upon Human ⇒ Human, or Human ⇒ Computer interaction, a further consideration becomes important - Communication. The way in which interaction/communication takes place directly affects how the situation is perceived, and therefore indirectly affects stress levels and the level of enjoyment. People can have problems communicating even when they are both using their prime method of communication - speech. The opportunity for communication problems and confusion between humans and computers is far greater, especially where the user has to come to terms with an interface that uses a keyboard or mouse for input.

In designing the interfaces for the various modules of the Aircraft Recognition project we attempted to incorporate as many of these factors as possible. A consistent 'look & feel' policy was adopted throughout the whole project; commonly used commands were located in similar menu structures and similar control icons were located in the same area of the screen throughout the various modules. The need for cognitive effort was reduced by making the interface as user-friendly and transparent as possible and ensuring that all commonly used procedures could be accessed by a single menu-selection or by 'clicking' over an icon with a mouse driven pointer. Text input from the keyboard was deliberately limited to giving names to saved files and typing in the answers during tests. The majority of commands provide immediate feedback and allow the user to quickly remove accidental or inappropriate selections thereby increasing the learnability of the package and helping to reduce user stress. Maximum use of visual stimuli such as photographic imagery and computer generated graphics was used throughout the package and elements from computer games were incorporated where possible in an attempt to increase the enjoyability and interest of the package as a whole, whilst further reducing stress levels.

By ensuring that commonly used procedures can be easily combined to achieve a wide range of effects the usability of the project as a whole was increased. HCI researchers have often noted that users of well designed Graphical User Interface (GUI) packages can make 'leaps of faith' that allow them to undertake actions they have not yet 'learned', whereas users of traditional DOS / UNIX packages must learn the specific sequence of steps to undertake the equivalent actions. This ability of users to make leaps of faith with well designed GUI packages, was thankfully demonstrated during the project's testing phase, when users familiar with the "Create Slideshow" module quickly worked out the necessary actions needed in the "Test Creation" module without recourse to the instructor or user guide.

The final Human Factors considered were those that govern the effectiveness of human memory retention and retrieval. Human memory appears to be divided into two distinct areas, Short Term and Long Term Memory. Understanding the factors that can maximise the transfer of information into long term memory (and maximise later recall) are obviously important to any project that aims to impart knowledge for later retrieval. Although there are many theories regarding the factors affecting transfer of information into and out of the brain there are 3 facts that hold particular relevance to a project such as the Aircraft Recognition Trainer. These are:

1. If a person is actively concentrating, or engaged in an activity he considers challenging or enjoyable then they are more likely to remember details of that event. Similarly, a more detailed 'search' through long term memory occurs when the person is actively concentrating on finding a solution.

2. Contrasting objects to highlight their differences helps a person to categorise those objects and aids both information retention and later recall.

3. Long term memory is more prone to lapses if the information has not been accessed (recalled) for a long period of time. Conversely, commonly held facts are more easily recalled, hence the need for practice and/or refresher training.

Maintaining a high level of user attention is therefore vital. A person may be able to initially force himself to 'pay attention' to a task he considers important, but he will not be able to maintain that high attention level unless the activity is interesting. This is one of the reasons why personnel find it difficult to 'remember' details of aircraft after studying recognition manuals and magazines for prolonged periods of time; such sources provide no feedback and so their attention level drops (they become bored) and they find it increasingly difficult to concentrate. In designing the Aircraft Recognition Trainer, careful attention was given to the importance of good and timely feedback as a means of maintaining user attention and interest. The self-teach and testing modules were deliberately designed to incorporate elements from computer games to help enhance the enjoyability of the package and so maintain user attention. The 'View Aircraft' module intended for self-study / practice provides the opportunity to view similar aircraft at the touch of a button and provides 3D rotating models in addition to normal photographs and outline schematics. Similarly, the 'Test' module offers users the ability to sit through randomly generated tests that allow the user to learn from any 'wrong' answers by comparing the two aircraft side by side.

Technical Issues

At the time of the projects inception (June 1995) the idea of using a CD-ROM based package, running on a standard desktop PC, for a military training requirement such as Aircraft Recognition was almost unheard of. Training systems tended to be based on high price Sun Spark or Silicon Graphics mini-computers with desktop computers relegated to more mundane applications such as word-processing or spreadsheets. This was in part due to the fact that the majority of these desktops tended to be older 286 and 386 based machines and even the high end 486 systems coming into service did not really have the multi-media capabilities that would be required for graphically intensive subjects such as Aircraft Recognition. Several members of the Recognition Committee were openly sceptical about DTET's assurances that Pentium™ computers and the latest computer graphics technologies offered, for the first time, the potential for such a package to be developed. As many of these assurances were based around DTET's access to various developers beta-code, it proved almost impossible to completely allay this scepticism as there was almost no material available to actually demonstrate to the committee. Eventually, DTET was commissioned to produce a Recognition Trainer for RAF and Royal Navy use; the British Army chose to continue development of a less technically capable recognition aid, based around existing technologies and using a civilian contractor.

The overriding technical requirement for the project was that once completed, the package must be able to run fully on a standard multi-media PC costing ≈ $1500 at the time of distribution (January 1997). Analysis of the trends in computer prices indicated that this would probably equate to a machine costing ≈ $4000 in January 1995. It was therefore decided that the package would be targeted at requiring a Pentium 90 or 100MHz computer with 16MB of RAM and a CD-ROM drive. Once the baseline specification for the target machine had been established the choice of which programming languages, graphics packages and operating system to use had to be made. This required careful consideration of the technical aspects of both existing software and that we knew to be ready for imminent release.

As a Microsoft Beta-test site, DTET was also evaluating both Windows 95 and Visual Basic 4 (VB4). Although both products were still in beta format (and thereby crashed with alarming frequency) we were convinced that Windows 95, as a true 32-bit operating system, offered much greater potential for graphics than the existing Windows for Workgroups. We were also convinced that by January 1997, Windows 95 would be the default operating system bundled with new Pentium computers. The decision was therefore made to develop the project for Windows 95. Although this decision proved ultimately correct, it will be seen that it caused several difficulties in the early stages of the project.

Once the decision to use Windows 95 had been made, we began to look at the various graphic formats available to store and display the various aircraft imagery. After careful consideration of the various formats the decision was made to use the proprietary Iterated Systems Fractal format to store still imagery; although other formats offered superior compression ratios, Fractal compression was unique in offering the ability to enlarge any area of an image with virtually no loss of quality. At this stage we also discounted the use of video clips in the project as we felt that the large file sizes of MPEG would either require that we limit the number of aircraft types covered, or release a package that would require the user to constantly swap CD-ROMs. Instead we opted to produce 3D models of aircraft using some of the latest 3D rendering packages such as 3D-Studio and Lightwave 3D. This immediately reduced the storage requirements of the project by an order of magnitude (10s Mbytes instead of 100s Mbytes) but also provided several other benefits. The 3D models of aircraft could be rotated around all axes and therefore allow a user to choose to view the model from any profile. More importantly by ensuring that all the models followed the same pattern of rotation users would be able to compare different aircraft side-by-side from any possible angle. This flexibility would simply not have been possible using video footage, regardless of the available storage space. The downside for this increased flexibility was that producing computer models of sufficient quality would effectively double the number of man years needed to complete the project.

The choice of programming languages also caused several problems. Originally, it was planned to use VB4 to develop the interface and then optimise speed critical areas by re-writing them in C++. Initially, this caused several problems as the existing 16-bit playback utilities caused several conflicts when attempting to run under Windows 95 and VB4. This forced us to write several early modules completely in C++, which made developing the interface much harder and greatly increased initial development times. Paradoxically, these early difficulties actually resulted in a much faster development time for the project as a whole. This was because the C++ experience gained in developing the earlier modules allowed the programmers to complete the final code optimisation phase in a much shorter time period than originally envisaged.

PROJECT BREAKDOWN

The Aircraft Recognition Trainer is broken down into three discrete modules; Imagery Slideshow, View Aircraft and Testing. Two of these modules (Imagery Slideshow & Testing) are further sub-divided into 'Create' and 'Execute' modules. This was to allow those users with a responsibility to teach others, to create their own slideshow presentations and recognition tests from the information stored on the CD-ROM(s). The Aircraft Recognition Trainer is therefore broken down into the following 5 modules:

Create Slideshow. Individual aircraft types can be selected by searching the database for aircraft of a particular country (e.g. USA), aircraft role (e.g. Air Superiority) or a combination of the two (e.g. USA Air Superiority). All selection is by mouse clicks on drop down text boxes, as is the subsequent selection of a specific aircraft. Selecting an aircraft loads a series of thumbnail images into a preview viewer which displays 3 thumbnail images along with a scroll bar that allows all the thumbnails of that particular aircraft to be previewed. Clicking on one of these thumbnail images loads that image into the viewer to allow a closer examination of the image, right-clicking on the thumbnail loads it into the slideshow at the highlighted position. A thumbnail preview of the slideshow is constantly shown on the right hand side of the screen to allow it to be easily modified. An example of this is shown at Fig 2.

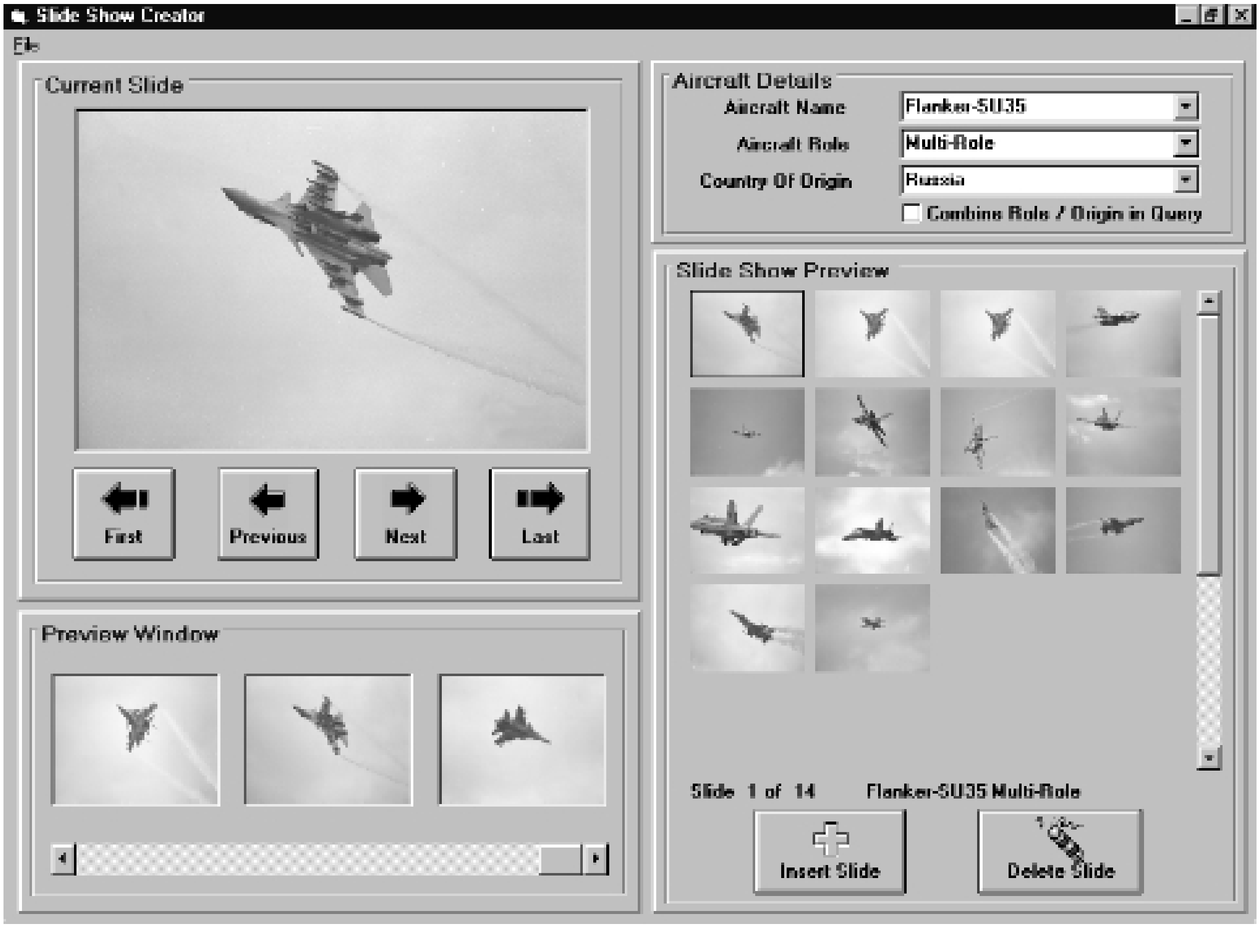

Fig 2. Screenshot of Create Slideshow Module.

- View Slideshow. This provides a full screen display of the selected slideshow with the aircraft shown. Left Clicking the mouse loads the next slide, right clicking the mouse reloads the previous slide, alternatively entering the slide number via the keyboard loads that particular slide. Moving the mouse pointer over any part of the displayed aircraft changes the pointer to a magnifying class that allows that section of the aircraft to be ‘zoomed’ by simply left clicking the mouse. A maximum of 4 zooms are currently allowed.
- Create Test. This module allows a user to create both ‘practice’ and ‘hurdle’ recognition tests. Selecting an aircraft type and image is performed using the same methods as in the create slideshow module. The question can be either Multiple choice or Text input. In both cases the user has the option of either typing in the possible answers or letting the program automatically pick from the list of similar aircraft. The user also has the option of setting the test to require individual login and score monitoring or be free input for general use, he can also set the test to allow a practice / teach attempt. Questions can either be selected to appear after a set period of time or after an answer to the current question has been input.
- Run Test. This module allows the user to select any of the tests created with the create test utility. Assuming the test creator has allowed them, the user can select which mode (Practice or Test) they wish to attempt the test. In practice mode, inputting an incorrect answer causes an image of that aircraft to be displayed alongside that of the question; the program automatically makes sure that the incorrect answer’s image is that of the aircraft at the same distance, profile and angle of attack. In hurdle mode the program simply keeps track of the users score informing them at the end of the test of their overall score and a question by question breakdown of correct/incorrect answers. If the test creator wished for the user to login prior to taking the test, this information is also stored for later retrieval by the test creator.

- View Aircraft. This is the main ‘self-teach’ module. It allows a user to select a theatre of operations and then select from a list of countries operating in that theatre, which countries’ aircraft he is interested in. Once this selection has taken place the user can select a particular aircraft either by operating country or role. Selecting a particular aircraft launches a five part ‘lesson’, which allows the user to view all the stored images of the aircraft in a variety of ways including a 3D rotating model and computer generated ‘peacetime’ intercept from 1.5KM to 250m. Details such as aircraft statistics, performance data and weapon load are included along with a series of recognition/identification tips on the subject aircraft and similar aircraft. Selecting a weapon brings up the performance data for that weapon and selecting a similar aircraft loads rotating models of the 2 aircraft to allow comparison from any possible profile. An example of this is shown at Fig 3.

Fig 3. Comparing 2 Aircraft side by side.

CONCLUSION

In developing the Aircraft Recognition Trainer it has been proven that military software teams are capable of producing software that matches or surpasses the quality of that produced by commercial companies. For small specialised CBT projects such as the Aircraft Recognition Trainer the military experience of the programming team allows for a level of flexibility that civilian companies are unlikely to match. Developing the Aircraft Recognition Trainer has also demonstrated the importance of continued input from acknowledged SMEs and the critical nature of the Interface to a program’s success. It has shown that, as with most aspects of software engineering, good feedback and/or stimulating interfaces cannot easily be designed separately, or added to a system at a later date. They must be part of a carefully considered overall design strategy for the system from the outset. Asking a software engineer to make existing software user friendly or more stimulating is like asking an aircraft engineer to redesign an existing aircraft to make it more stealthy. We have learned much from this project; in essence the development has allowed the RAF to refine what was very much a theoretical CBT lifecycle. Further studies will be conducted as part of the training validation for this project, but we have no doubt that the experience gained will allow further complex projects to be undertaken in a reduced timescale.