COMPUTER BASED TRAINING
IN AIRCRAFT DESIGN EDUCATION

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Introduction
Computer Based Training

Definition:

Computer based training (CBT) is "the use of computers to provide an interactive instructional experience" in which the computer is seen "as the primary mode of instruction".

Aviation Industry CBT Committee: *Glossary of terms*
Introduction
Computer Based Training

Characteristics:

CBT is:
- interactive
- self-directed
- self-paced

CBT often includes:
- hypertext
- multimedia elements
- hypermedia

Classification:
- Student-paced CBT ("the original CBT")
- Instructor-lead CBT
Introduction

Computer Based Training

Other acronyms for CBT:

- CAI    computer assisted instruction
- CAL computer aided learning
- CBE    computer based education
- CBI    computer based instruction
- CBL    computer based learning
  
...
Introduction
Economic Problems

Costs for the development of a CBT training course (duration one hour):

- PLATO, Lilienthal Project, ... : \( \approx 25 \, 000 \, \text{US$} \)

\[ \Rightarrow \] Development costs must be distributed over a large number of students.

! Usually there is a small number of students in aircraft design.
Computer Applications in Aviation Training

Pilot Training

Training Pyramid

- **FFS** Full Flight Simulator
- **FTD** Flight Training Devices:
  - FBS Fixed Based Simulator
  - PPT Part Task Trainer
  - CSS Cockpit System Trainer
  - IFF Instrument Flight Trainer
- **CBT** Computer Based Training
Computer Applications in Aviation Training
Aviation Maintenance Training

Training Pyramid

- FFS Full Flight Simulator
- MTS Maintenance Training Simulator
- FTD Flight Training Device
- CBT Computer Based Training
Computer Applications in Aviation Training
Aviation Maintenance Training

CBT levels:

- Aircraft maintenance fundamentals
- Generic aircraft systems concepts
- Aircraft type-specific maintenance
- Troubleshooting by means of simulation-type CBT
Computer Applications in Aviation Training
Aviation Maintenance Training

Lessons learned:

- CBT does not provide a total training solution.
- Use a mix: lectures, CBT, practical training, field trips.
- Pure student-paced CBT does not work.
- Limit student-paced CBT to 3 hours per day.
- The human brain is no storage area.
- Provide easy-to-use retrieval systems.
Computer Applications in Aviation Training

Other Branches of Aviation Training

- Cabin crew training
- X-ray interpretation training
- General topic training:
  - Safety
  - Emergency
  - Security
Computer Applications in Aviation Training

CBT Developers

Dedicated CBT developers

- Vega Group PLC
- Wicat Systems Inc.

Aircraft Manufacturers

- Airbus Industrie
- FlightSafety Boeing Training International

Airlines (in cooperation with partners ↑ )
Requirements and Background: CBT in Aircraft Design Education
Requirements (problem-based learning, PBL)

- Student-paced CBT on aircraft design fundamentals
- Computing modules on
  - preliminary sizing
  - conceptual aircraft design
- Ideally: Elements of simulation-type CBT
- CBT usable via Internet ⇒
  - Web Based Training (WBT)
  - Distance Learning
- Discussion groups, E-mail support
Requirements and Background: CBT in Aircraft Design Education

Traditional Aircraft Design Computer Programs

- Advanced Aircraft Analysis (AAA)
- RDS Aircraft Design Software

PC-based Flight Simulation (Fly your aircraft!)

- X-Plane with 'planemaker'
- Aviator Visual Design Simulator (AVDS)
CBT Tools

Microsoft
- Word
- PowerPoint
- Excel

Adobe Portabel Document Format (PDF)
- Acrobat Exchange
- Acrobat Reader

HTML, JavaScript, Java

Macromedia
- Director
First Results

University of Applied Sciences, Hamburg

- Aircraft Design Education:
  - PBL, small teams, one semester
  - industry project: whole & new aircraft
  - course notes in WWW (PDF)
  - students develop their own spreadsheets
  - WWW bulletin board, E-mail support, discussion group

- Experimental CBT development
  - HTML, JavaScript, Java
  - Multimedia: HTML with video
First Results

University of Applied Sciences, Hamburg
Screen shot from CBT/WBT module on preliminary sizing

Results: Matching Chart

The following results were saved:

<table>
<thead>
<tr>
<th>Requirement 1: Landing field length</th>
<th>Requirement 2: Takeoff field length</th>
<th>Requirement 3: Second segment climb</th>
<th>Requirement 4: Missed approach climb</th>
</tr>
</thead>
<tbody>
<tr>
<td>520 kg/m²</td>
<td>0.000446 m/kg</td>
<td>0.25 [-]</td>
<td>0.227 [-]</td>
</tr>
</tbody>
</table>

Figure 1: Matching Chart

In the diagram above, the optimal parameters respectively the matching point can be determined as follows:
1. - the thrust to weight ratio should be as low as possible,
2. - the wing loading should be as high as possible without any increase of the thrust to weight ratio.

Some more details:
- the point has to be above (and on the left) of all coloured curves in the matching chart,
- hatching indicates inadmissible side of curves.
First Results

Technical University of Berlin
Screen shot from Excel program on sizing of the engines for take-off and cruise
Conclusions

CBT in aircraft design education:
- potential to improve teaching & learning situation
- danger: pitfalls (see experience from maintenance training)
- far too expensive

Recommendations

CBT designed in internationally combined effort
- course modules linked in open architecture on WWW