Course Development: Maintenance of Composite Aircraft Structures

Process, Progress and Results

Charles Seaton – Principal Investigator, Edmonds Community College
This course...

- Provides an overview of the issues involved in composites’ maintenance and repair, beginning with a common level of knowledge of composite materials terminologies and concepts.
- Is not intended to provide training that qualifies students as composite repair practitioners.
Primary Deliverables

- Terminal Course Objectives (TCO) + Course Abstract
- Modules
- Safety Messages

- TCOs, Content, Assessments
- Progress – Focus on process

FAA guidelines (precursor to policy) on training needs:

*Critical Composite Maintenance & Repair Issues*
Curriculum Development: Composite Materials Maintenance and Repair

Edmonds Community College

Cooperative Agreement Begins
August 2004

Develop Terminal Course Objectives (TCOs)

Workshop November 2004 (Seattle)
50+ World Experts

Global Teleconference April 2005

Expand Scope as a result of industry input

Develop Content

‘Populate’ TCOs with written content
April – Sept 2005

Course Enhancements
- Testimonials
- Videos
- Lab Instructions

Framework, Content and Enhancements

Chicago

60+ World Experts Consider:
- Consistency between Content and TCOs
- Proper Emphasis
- Modified Curriculum
Curriculum Development

Critical Elements

- Framework defined by Terminal Course Objectives (TCOs)
- Content to populate TCOs
- Assessment

Deliverables: Publish TCOs, Content and curriculum enhancements by EOY 2005 – Phase I

- Deliverables (2006): Develop course and assessments – Phase II
Curriculum Development
Collaboration of Industry & Academia & Government

- Workshops during curriculum development
  - FAA/Industry/Academia Workshop in Seattle, WA (November/December 2004) *Establish course framework by identifying terminal course objectives (TCOs)*
  - Tele-conference (April 2005) - ~10 participants
  - FAA Workshop (Chicago - Sept 2005) *Evaluate content relative to course framework as defined by TCOs*

- Results
  - 2004 workshop – 450 skills identified; 60+ TCOs; 11 major areas (‘modules’)
  - Workshop report posted on AMTAS web-site for review: Jan 05
  - Workshop attendees invited to evaluate progress and provide suggestions via teleconference: April 28, 2005
  - Increase in scope, resulting in prerequisite course plus additional content detail and tools
  - Major Achievement: Consensus on course expectations
  - 2005 workshop – Considerable feedback on content and TCOs currently being integrated into curriculum
Original Statement of Work

TCO Development

Nov/Dec '04 Workshop

Organize Course Modules

Jan to Apr '05

Repair Course Development

Apr to Jul '05
Lecture/PowerPoint
‘BlackBoard’ or equiv.

Lab - Regional

Context – Web Based
Revised Statement of Work

TCO Development
Nov/Dec '04 Workshop

Organize Course Modules
Jan to Apr '05

Prerequisite Development – Web Based

Repair Course Development
Apr to Dec '05
Lecture/PowrPoint Streaming Video Testimonials Safety Messages 'Black Board' or equivalent

Lab - Regional

Lab - Regional

Content - Classroom

Content – Web Based

2006
Curriculum Development

2005 Chicago Workshop

- Modules: Grouped into Key Subject areas and provided to small teams for preliminary assessment before workshop
  - Published on website for participant viewing
  - Focus: Define issues based on content
- Objective: 2005/2006: Publish course content and other teaching tools in ‘public domain’
  - Terminal Course Objectives (TCOs), categorized by modules
  - Written content, corresponding to TCOs
  - Testimonials and Videos
  - Laboratory instructions
Modules

TCO A Module - Understand Basics of Composite Materials Technology
TCO B Module - Understand the Basics of Composite Materials Maintenance and Repair
TCO J Module - Understand other Critical Elements of Composite Maintenance and Repair
TCO C Module – Understand Roles and Responsibilities
TCO D Module – Recognize Composite Damage Types and Sources
TCO E Module – Identify and Describe Information Contained in Documentation
TCO F Module – Describe Composite Laminate Fabrication and Bonded Repair Methods
TCO G Module – Perform a Bonded Composite Repair
TCO H Module – Describe Composite Damage and Repair Inspection Procedures
TCO I Module – Describe Composite Laminate Bolted Assembly and Repair Methods, and Perform and Inspect a Bolted Composite Repair
TCO K Module – Case Team Studies
## Elements of Curriculum
### Relationship to Course Design

<table>
<thead>
<tr>
<th>Elements (published)</th>
<th>Technique</th>
<th>Custom Curriculum</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCOs &amp; Content</td>
<td></td>
<td>Learning techniques</td>
</tr>
<tr>
<td>Flight Safety Messages</td>
<td>STORY BOARD</td>
<td>Modified mix of elements</td>
</tr>
<tr>
<td>Testimonials</td>
<td></td>
<td>Teaching format</td>
</tr>
<tr>
<td>Videos</td>
<td></td>
<td>Target audience characteristics</td>
</tr>
<tr>
<td>Time</td>
<td>Activity</td>
<td>Primary Mode[s]:</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Tuesday</strong></td>
<td></td>
<td>Lecture</td>
</tr>
<tr>
<td>Morning</td>
<td>8:00 to 9:50</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>9:10 to 10:10</td>
<td>Intermission</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning</td>
<td>10:10 to 12:00</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Afternoon</td>
<td>12:00 to 1:00</td>
<td>Lunch</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Intro to Composite Maintenance & Repair Timeline**
Safety Messages

1: Interlinked aspects of composite repair
2: Repair disposition
3: Repair documentation
4: Correct processing
5: In-service inspections
6: Procedures and post-repair of bonded repairs
7: Post-repair inspections
8: Bolted repairs
9: Importance of teamwork
How Session 4 Worked

45 minutes per session

Facilitates Conversation and Feedback

Module Content

Moderator

Verbal Ideas

Scribe

Captures Verbal Ideas on Screen

Feedback Collection Sheet

Suggested Resources to Enhance Content:

Feedback Slips

Participants Post Ideas throughout Conference

Break-out Group (15-25 participants)
Convey Verbal Ideas and Post Written Feedback

A Basics of Composite Materials Technology
B Basics of Composites Maintenance and Repair
C Roles and Responsibilities
D Composite Damage Types and Sources
E Information Contained in Documentation
F Laminate Fabrication and Bonded Repair
G [Lab] Perform a Bonded Composite Repair
H Composite Detection and Inspection Procedures
I [Lab] Perform a Bolted Composites Repair
J Other Critical Elements of Composite
K Case Team Studies

Name

Company

Phone

Conference

Post Written Feedback

Please indicate applicable modules

A Basics of Composite Materials Technology
B Basics of Composites Maintenance and Repair
C Roles and Responsibilities
D Composite Damage Types and Sources
E Information Contained in Documentation
F Laminate Fabrication and Bonded Repair
G [Lab] Perform a Bonded Composite Repair
H Composite Detection and Inspection Procedures
I [Lab] Perform a Bolted Composites Repair
J Other Critical Elements of Composite
K Case Team Studies

Please indicate applicable modules

Name

Company
Issues Feedback: Workshop

Session 5 (Thursday Morning): Scribe Reviewed Section 3 & 4 Inputs

Themes
TCO/Content Consistency
Content Balance
Primary Emphasis on Issues of Safety Concern
Path to Complete Review and Update the Course Standard
Workshop Results

- Building curriculum framework: TCOs
  - Refined descriptions to better reflect intent
  - Prerequisite course contrasted with repair course – clarified in small group discussions
- Providing content to support TCOs
  - ‘Tightened up’ content
Next Steps

- Integrate feedback into TCOs and Content
- Publish outcomes on websites
  - Presentations
  - TCO and Content Revisions
- Compliance Approval
Next Steps: Posting & Links of Workshop Results

Detail of Workshop: www.mpdc.biz

Overview: depts.washington.edu/amtas/

Links: www.niar.twsu.edu/newniar/
Click on this Link

Material and Process Development Center

Welcome to the MPDC

The Material Science field is always changing and innovating, and we would like to help bring you closer to that cutting edge by offering you resources and training on the latest developments. If you are involved in the field and would like to contribute anything, please contact us.

We would like to mention that we just finished a major overhaul of our website with more to be added soon. We will be cleaning up the look a bit, as well as increasing the content. Your suggestions are welcomed.

Latest News and Events

10 - 2005

2005 FAA Chicago Workshop

Here you will find notes, movies and documentation on the 2005 FAA Workshop in Chicago
Next Steps: Compliance Approval

- Purpose – Validation of Trainer process to the TCOs, content and assessment of course
- One Scenario
  - Trainer documents curriculum
  - Independent organization assesses compliance (similar to ISO 9000, for example)
Organization Roles (One Scenario)

- TCOs – Documented by CACRC
- Independent Organization assesses Compliance/Certification
- Modules/Safety Messages – FAA Technical Center Report
- Assessments – Documented by CACRC
- Training Organization develops procedures
Next Steps: Curriculum Development

- **Deliverables: Publish TCOs, Content and curriculum enhancements by EOY 2005 – Phase I**
- **Deliverables (2006): Develop course and assessments – Phase II**