



# Course Development: Critical Composite Maintenance and Repair Issues

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# General Comments Course Caveats

*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*

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# Agenda for Course Review

- ✦ Process in creating an industry standard
- ✦ Summary of Curriculum Development
- ✦ Adapting curriculum to online training format
  - Learning Effectiveness and Tools used in online format
  - Special Areas of Focus
    - Testimonials
    - Discussion Boards
  - Student Demographics and Participation
  - Collateral Benefits
- ✦ Summary

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# Process

Curriculum Development

-Industry Standard-

Phases I, II, III

Aug 04 – Jul 07



Online Format Development

Phase IV

May 07 – Dec 07



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# Phases I – III

## Creating an Industry Standard Curriculum

Involvement: Achieve consensus with industry, academic and regulatory experts

- Series of workshops

- May 2004 FAA/NRC workshop in Wash. DC *Executive review of systematic, repair, NDI & training issues*
- November 2004 workshop to evaluate training needs
- 2005 and 2006 FAA workshops to:
  - Review progress in establishing **awareness training on critical issues**
  - Solicit feedback from industry experts



# Phases I – III

## Creating an Industry Standard Curriculum

### ☀ Process

- ☀ Define framework by identifying ‘terminal course objectives’, or TCOs
- ☀ Establish safety theme by documenting ‘safety messages’
- ☀ Develop content to populate TCOs as a tool for course developers

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# Awareness Course Content

Base Knowledge

Prerequisite: Students take assessment prior to main course

Teamwork &  
Disposition

Damage  
Detection &  
Characterization

Repair Processes

## Main Course

Understand the roles & responsibilities of key teammates

Recognize composite damage types and sources and describe composite damage and repair inspection procedures

Identify & describe information contained in documentation for approved maintenance & repair

Describe composite laminate fabrication, bonding, & bolted assembly methods and perform bonded & bolted repairs

Participate in case team studies

# Phase IV: Online Course 'Beta' 2007

Prerequisite  
(2 weeks)



Oct 1 - Oct 15

Basics of Composites'  
Technology - Online

Awareness  
Course  
(6 weeks)



Oct 16 - Nov 25

Critical Composites  
Maintenance - Online

Hands-on  
Laboratory  
(3 days)



Nov 27 - 28

Capstone (Abaris  
Training - Reno, NV)

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# Learning Effectiveness

Students learn best by:

- ✦ Being exposed to meaning before content
- ✦ Learning through self-discovery
- ✦ Repetition

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# Learning Tools

Meaning Before Content

1 Minute Testimonials

Awareness Video (Boeing/CACRC)

Web Links

Self-Discovery

Discussion Boards

Exams (2)

Repetition

Group Project

Prior Week Teaching Points

# Testimonials

(Providing meaning before content)



# Blending Testimonials and Discussion Boards

- ✦ Opening thread borrows from testimonial

- [Seaton] Doctor Armstrong was limited to approximately 1 minute in his 'testimonial', so was unable to describe all the circumstances around his repair scenario. Assume, however, that he has been complete in his description. Each of you pick one significant question to ask him regarding compliance.

- ✦ Sample Questions

- "What was the type of fiber form, fiber style, and ply lay-up originally used for the engine and for the repair?"
- "Is it acceptable per the SRM to use 2 plies of the lighter cloth in lieu of 1 ply of the heavier cloth?"
- I've either missed out on a very important part of this discussion and I'm about to ask an award-winning and the dumbest question on our discussion board but "who is Dr. Armstrong"?



# Discussion Boards

- ✦ Students learn by interacting with each other and by self-discovering Teaching Points
- ✦ Two topics per week (5 weeks)
- ✦ Facilitator – Uses questioning technique to guide students to teaching points

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# Discussion Board Example

- Thread: Are any of you aware of a situation whereby the 'approved' NDI technique seems to not represent the full extent of composites' damage even though approved procedures were followed? What was the result? (Seaton)
  - I was involved in a violation a few years ago where the OEM required a pulse echo ultrasound and the carrier did a tap test. A question that I asked the engineer who approved the tap test was: "what are your NDI qualifications to determine that a tap test met the requirements of the OEM?" I then asked him to explain the differences and what each method could detect. Little episode cost the carrier over \$50,000.00. (FAA Student)
    - Does it happen that a technique proposed by the OEM to "map out" damage might not be the right one? Will the operator, MRO etc make recommendations to modify or change the method of inspection? (Transport Canada Student)
      - The operator is always free to question an OEM. They don't have all of the answers and learn from operators who may have seen or heard of a better method. (FAA Student)
- **TEACHING POINT:** ...the extent of damage must be assessed by personnel qualified in the appropriate inspection techniques

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    - What was the root cause of this problem? Was it a) lack of training and education, b) Someone who 'didn't know what he/she didn't know', c) a 'John Wayne' mentality, d) Other? Comments, Class? (Seaton)
      - Many things led up to this including mechanics not realizing that this was a critical area of the component, the SRM didn't allow repairs in this area (gotta read the SRM to know this) and a whole host of other issues. As with most things we stumbled on this by accident. (FAA Student)
        - If findings like this are found mostly by accident, is there a way to increase the chances of early detection of violations like this before they become critical? Or does it just come down to internal procedures of the carrier. (GA Student)- **TEACHING POINT:** ...Recognize his/her skill limits in practice and where to find assistance

# Classroom Demographics (28)

✦ Industry (Large OEM and General Aviation)	10
✦ Military	5
✦ Regulators	11
✦ College	2



# Participation in Discussion Boards (4 weeks)

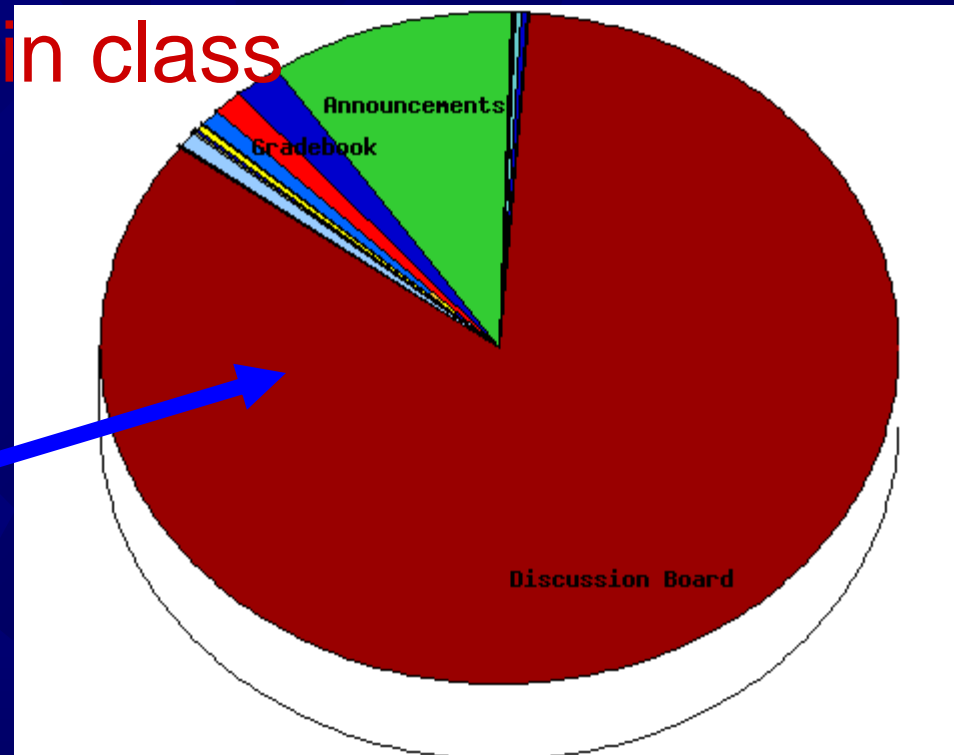
22,625 'hits' in class

18,857 Hits

8 p.m. Nov 12

1,689 Posts

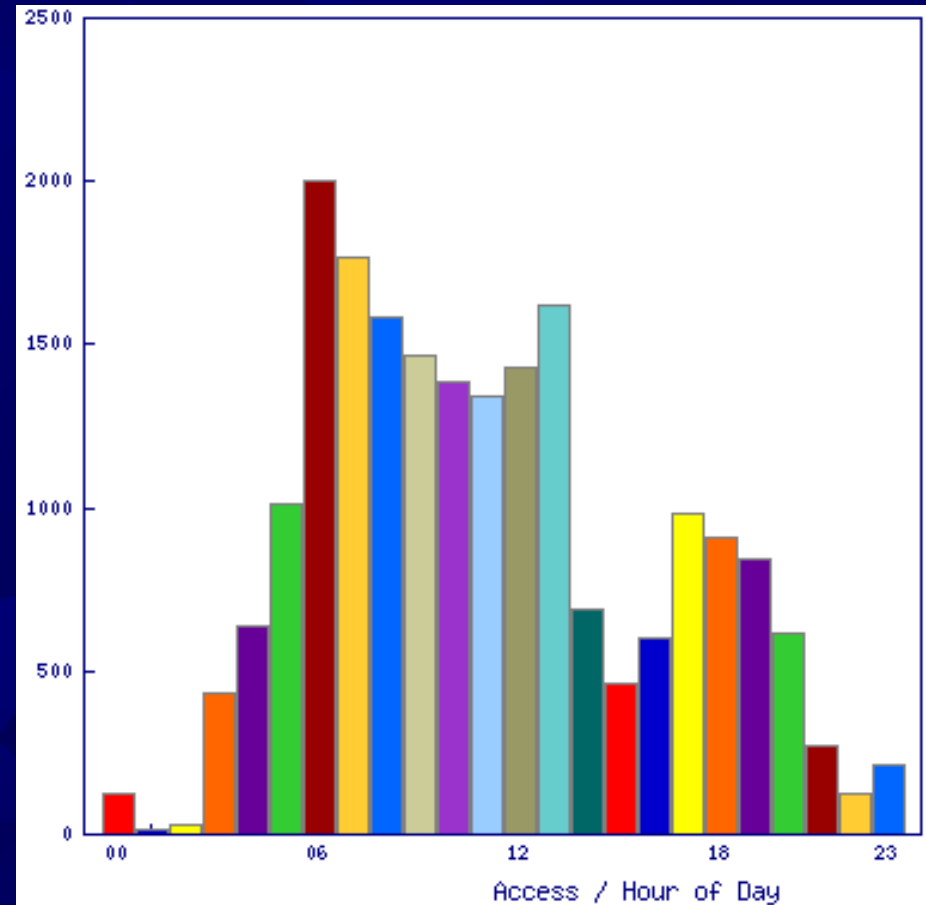
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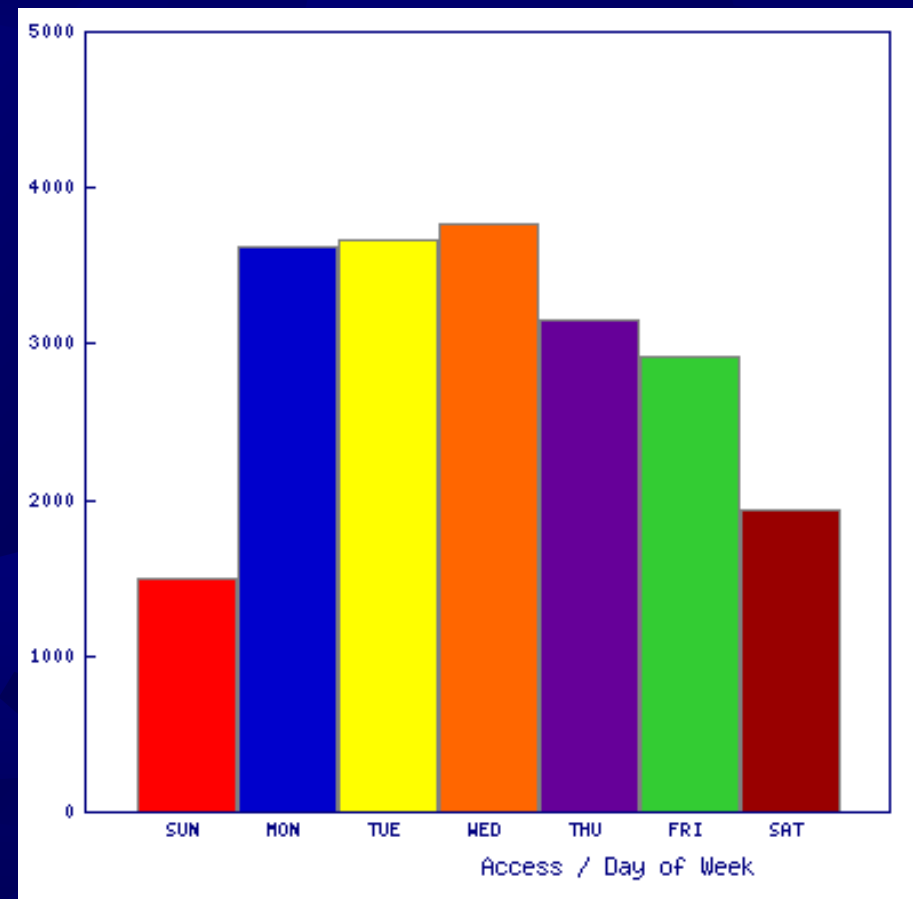
# Online – Access by Hour of Day

- ☀ Bar Graph – Represents ‘hits’ by time of day (pst)
- ☀ 24 hours/day
- ☀ Heaviest activity
  - 4 a.m – 1 p.m. (workday)
  - 6 p.m. – 10 p.m. (evening)



# Online – Access by Day of Week

- ☀ Bar Graph – Represents ‘hits’ by day of week
- ☀ Heaviest activity
  - ☀ Monday - Wednesday
  - ☀ Significant weekend access



# Summary

- ✦ Enthusiastic Class – 85%+ involvement
- ✦ Wide range of experiences blends well
  - More experience – teachers and facilitators
  - Less experience – no threat from asking ‘dumb’ questions
  - Expertise usually limited to specific topic
- ✦ Students taking advantage of course flexibility
- ✦ Discussion Boards – Showing capability of adding experts to the discussions with unique insights
- ✦ Preliminary feedback – quite positive



# One Skeptic Turned Believer

*Thread discussion wise I am enjoying it immensely. Sorry to hear this is the last week. Would it be possible for [the training manager] to access the threads/board to see how much is possible with web learning? You made a believer out of me and we can learn from it. Maybe even get more people on the course once it is publicly offered.*

- Experienced Regulator Student

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