



# Course Development Maintenance of Composite Aircraft Structures



# Course Development: Maintenance of Composite Aircraft Structures



- Motivation and Key Issues
  - Practical, introductory-level course for engineers, technicians and inspectors
- Objective
  - Develop framework, content and assessment criteria as a basis for curriculum training
  - Online course, with ‘hands-on’ laboratory, which will increase awareness of critical safety issues in composites’ maintenance
- Approach
  - Series of workshops and ‘beta’ class with experienced practitioners
  - Industry, regulatory and academic collaboration

# FAA Sponsored Project Information



- Principal Investigators & Researchers
  - Charles Seaton, PI, Edmonds Community College
  - Cyndi Schaeffer, Executive Director, EdCC
- FAA Technical Monitor
  - Curt Davies, Acting
- Other FAA Personnel Involved
  - Larry Ilcewicz, Curt Davies
- Industry Participation
  - Boeing, Airbus, EASA, Hexcel, Heatcon, Abaris and others

# Motivation and Key Issues

## Build Awareness: Critical Composite Maintenance and Repair Issues



- Ø Understand roles & responsibilities (importance of teamwork)
- Ø Recognize composite damage types & sources (proper team reaction to possible service damage)
- Ø Understand the inspection methods & procedures needed for detection, characterization and disposition of damage
- Ø Understand regulations and importance of approved source documentation
- Ø Realize the unique processing issues and quality controls needed for bonded composite repairs
- Ø Realize the unique processing issues and quality controls needed for bolted composite repairs
- Ø Realize need for more training to acquire technician, inspector or engineering skills (avoid working beyond skill limits)

# Objectives



- Develop awareness course through industry consensus for a practical, introductory-level course for engineers, technicians and inspectors (Phases I – III)
  - Applicable for other decision-makers, such as production planners, purchasing agents and executive management
  - Short course (7 days, traditional classroom), including labs, worth 4 credits
  - Technical Center Report
    - Terminal Course Objectives (TCOs)
    - Safety messages
    - Narrative description of critical issues
    - Instructor's guide
    - Class design guidance
- Adapt content in technical center report to a web-based, distance learning format during Phase IV
- Develop generic structural repair manual for teaching documentation during Phase IV

# Approach



- Series of workshops to bring regulators and industry together on technical issues

# Awareness Course Process



Phase I (2004 – 2005)

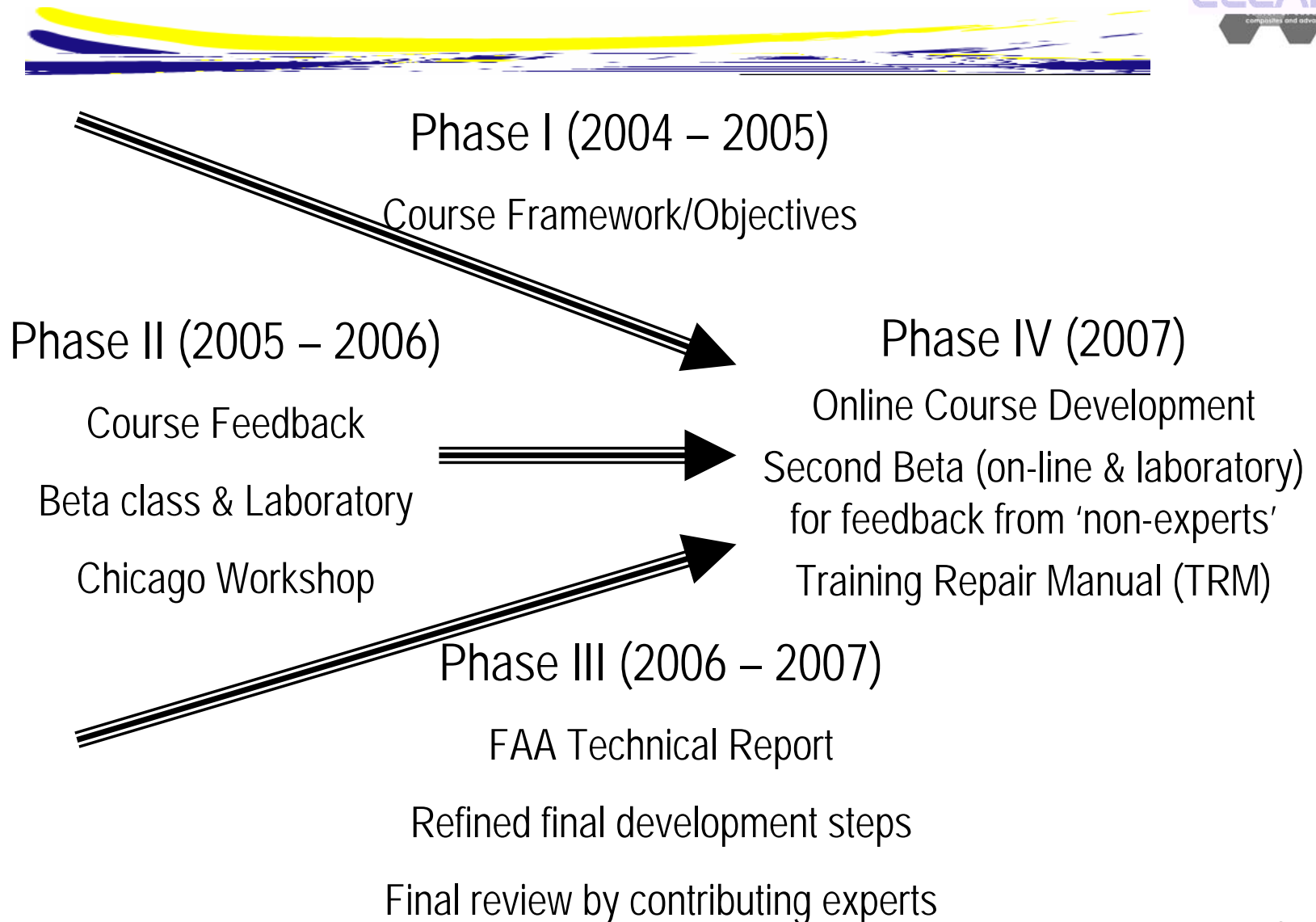
Course Framework/Objectives

Phase II (2006)

Course Feedback

Beta class & LaboratorRhj 0 29ePha4x 8x 392007 91 go Wworshops

# Awareness Course Process





# Awareness Course Content



Base Knowledge

Prerequisite: Students take assessment prior to main course

## Main Course

Understand the roles & responsibilities of key teammates

Recognize composite damage types and sources and describe composite damage and repair inspection procedures (2 labs)

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

Describe composite laminate fabrication, bonding, & bolted assembly methods and perform bonded & bolted repairs (2 labs)

Participate in case team studies (lab)





# 2006 Beta Class

## Excerpts from Instructor's Guide

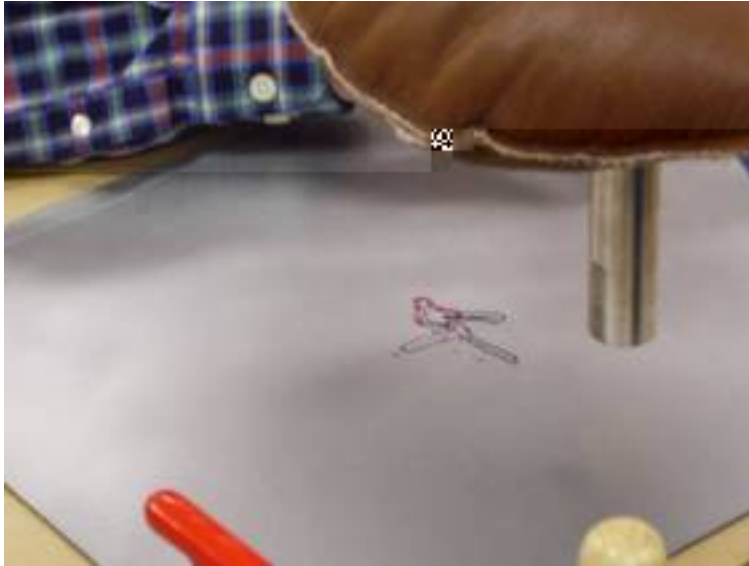






# 2006 Beta Class

## Excerpts from Instructor's Guide



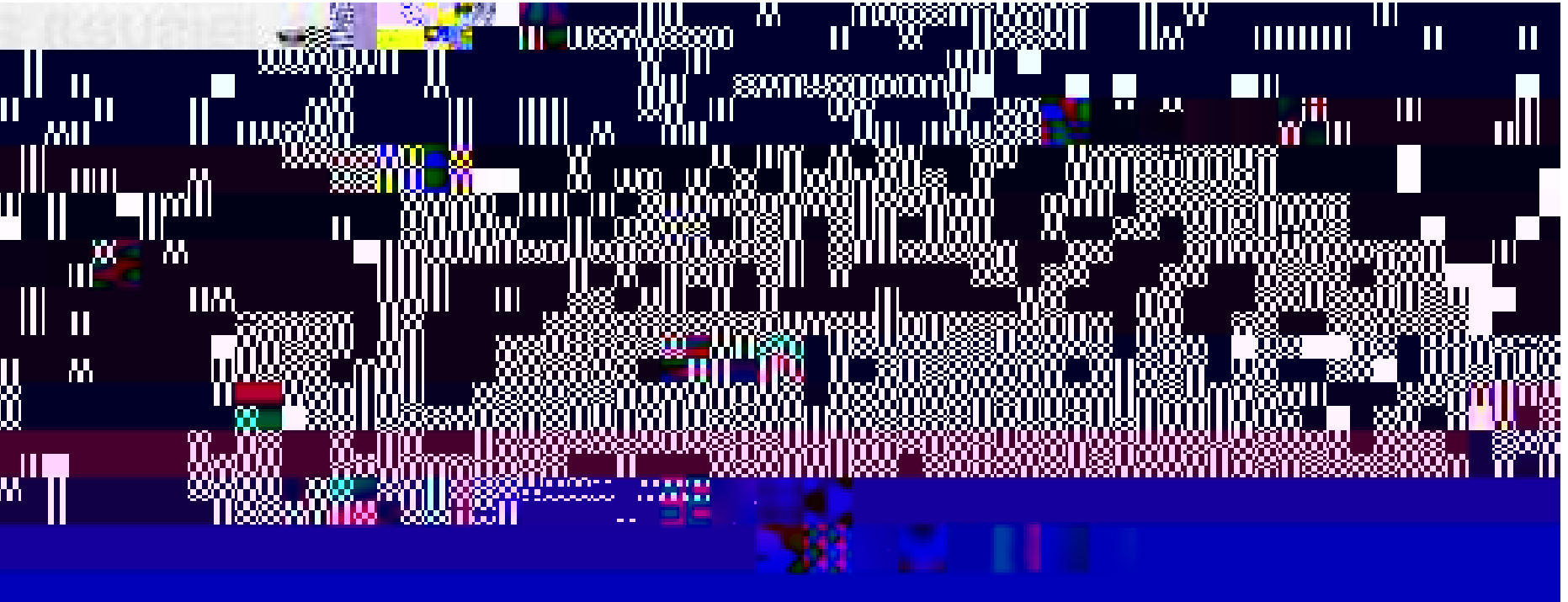
**Mapping periphery of damage**

**Mapping results utilizing pulse echo, tap test, and visual inspection**



# 2006 Beta Class

## Excerpts from Instructor's Guide



**Courtesy of Heatcon Composite Systems**

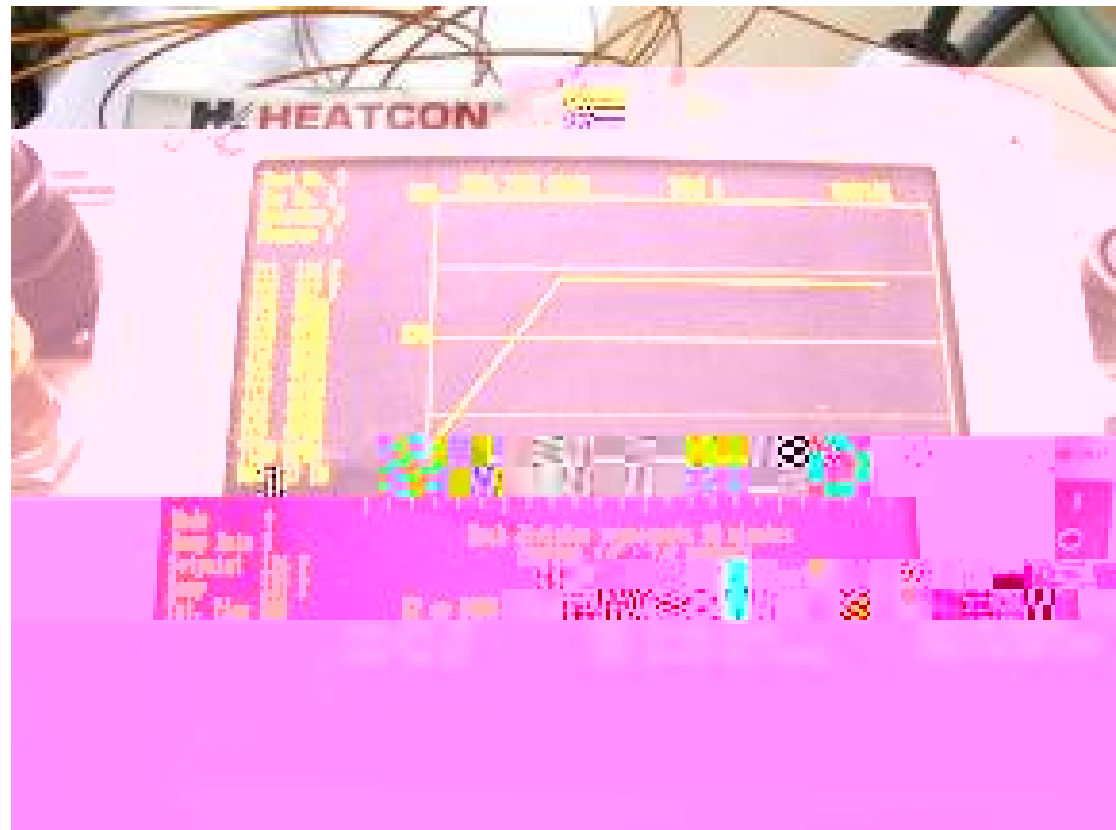


# 2006 Beta Class

## Excerpts from Instructor's Guide



**Graphic display from  
heat bonder controller**



# 2006 Beta Class

## Excerpts from Instructor's Guide S8QMC 3M



# What we have Learned



- Creating a standard course framework from diverse experts is possible!
  - Process of consensus
  - Feedback mechanisms
- Creating a standard course framework from diverse experts requires patience and considerable funding
- Synergy among dedicated industry, academia and regulatory organizations and people is high with sufficient interest
  - Must meet needs of organizations and individuals
  - Must fit with business interests of contributing organizations

# Course Development Integration Role



- Terminal Course Objective development
  - Disciplined approach
  - Reveals gaps in content and balance
  - Can be applied to a variety of circumstances as an integration agent
- Curriculum development becomes a guide for establishing priorities
  - Provides a framework for achieving consensus

