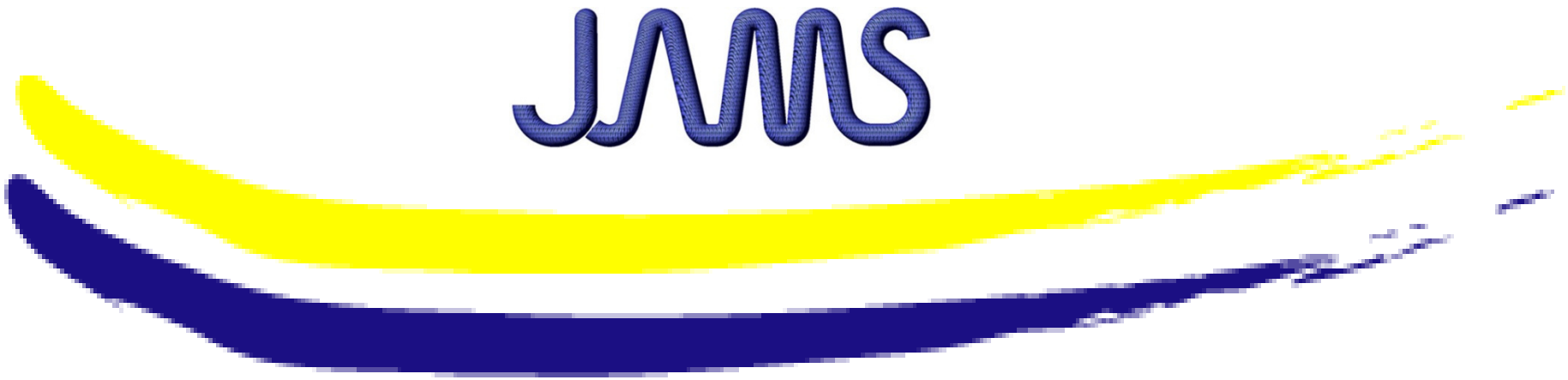


Training Strategy Development: Composite Materials Education for Aircraft Practitioners

Charles Seaton, Principal Investigator

A Center of Excellence
AMTAS
Advanced Materials in Transport Aircraft Structures

EDMONDS COMMUNITY COLLEGE

CECAM
center of excellence for composites and advanced materials

The Joint Advanced Materials and Structures Center of Excellence

Training Strategy Development

- Motivation and Key Issues
  - Education concerning the safety implications for practitioners interfacing composite materials is becoming a greater priority with the increasing use of composites in commercial aerospace
- Objective
  - Provide a lesson plan which describes an education 'road map' for the composites' practitioner
  - Build on prior initiatives sponsored by the FAA
  - Solicit feedback from industry on specialized topics
- Approach
  - Identify training through surveys, solicit JAMS feedback, integrate prior FAA sponsored content

FAA Sponsored Project Information

- Principal Investigators & Researchers
  - Charles Seaton
- FAA Technical Monitor
  - Curtis Davies
- Other FAA Personnel Involved
  - Larry Ilcewicz
  - Lester Cheng
  - Michael Shiao
  - DER seminar presenters and participants
- Industry Participation (TBD)

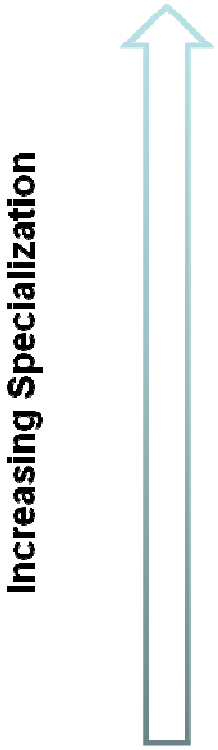
Development Outcomes (Phases I – V) Completed December 2008

- Industry standard
  - 3 years in development by broad spectrum of experts from all facets of composites industry
- Demonstration of online training to composites' maintenance training
- Technical Center reports currently under review
- Customization of awareness course for aviation safety inspectors (Abaris Training is FAA subcontractor for training up to 3,000 inspectors)
  - On-going administrative support for curriculum (current activity)

Training Strategy Development Justification

Industry	Skill development via on-the-job training
FAA	Difficulties in recruiting staff with required skills
Education gaps	Talent pool versus identified institutions to address subject matter regarded as important in composites
Education delivery options	Classroom, laboratory, distance (on-line)
Educators	Availability of training expertise

Training Strategy Development Strategies

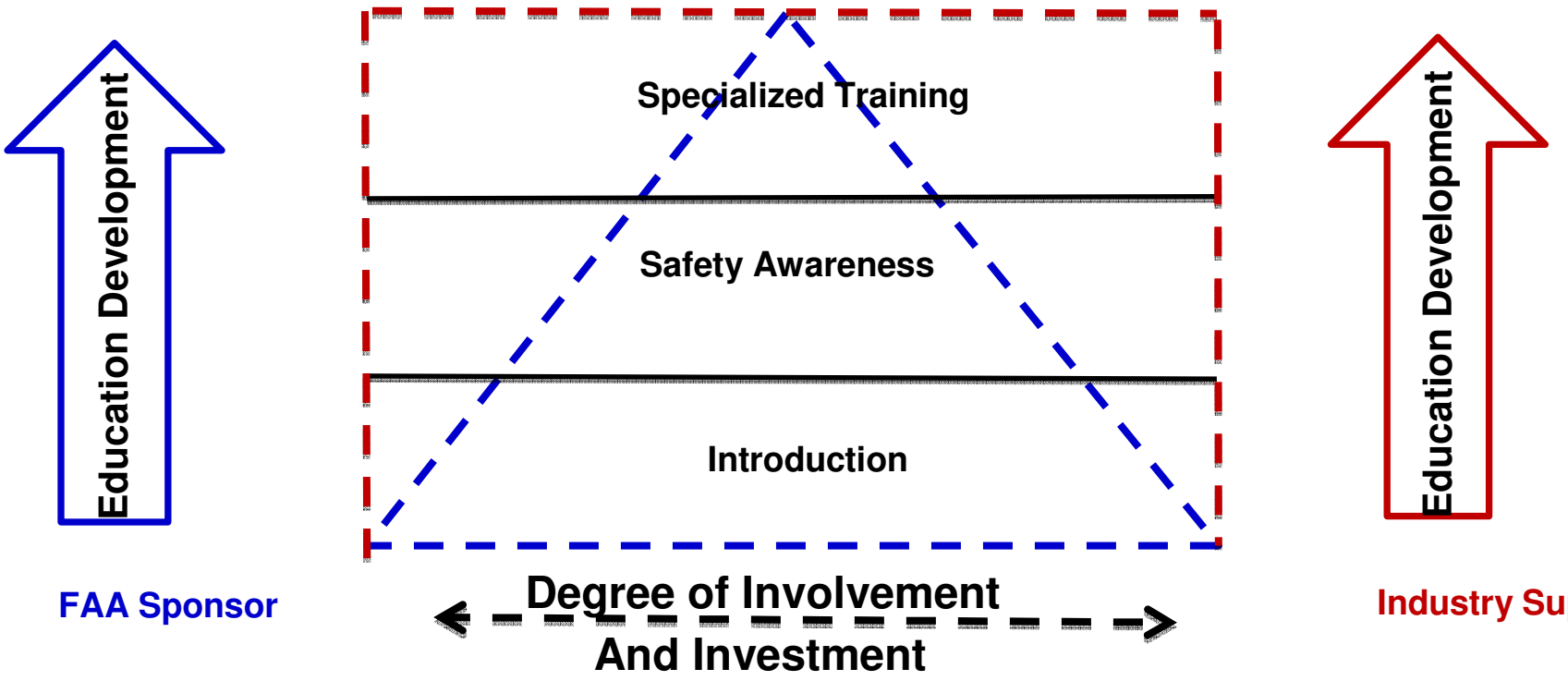


Specialized Training	→	1. Skill building in specific areas 2. Institutions responsible for training which have subject matter expertise
Safety Awareness (40 - 60 hour classroom equivalent)	→	**1. Safety issues** **2. Hands-on laboratory** **3. FAA guidance and policy**
Introduction to Composites (8 - 16 hour classroom equivalent)	→	1. Basics of composites' technology 2. Roles & responsibilities (engineers, technicians, inspectors) 3. Composite certification basis

Training Strategy Development
Roles and Involvement

FAA Facilitator

Industry Sponsor



FAA Sponsor

Industry Support

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Training Strategy Development Resources

	Conceptual	Developing	Mature
Specialized [Level 3]	Subject Matter TBD		
Safety Awareness [Level 2]		CMT Classroom (Safety Issues) Regional laboratory site identification	CMT Online (Safety Issues) w/Laboratory (Abaris, Wichita Area Technical College)
Introduction [Level 1]			CMH17 Tutorial CMT (Prerequisite)

CMT: Composite Maintenance Technology: Prerequisite, Safety Issues Main Course and Laboratory

CMH-17 Tutorial – Certification and Compliance Basis for Composite Aircraft

Training Strategy Development

DER Feedback (Five Groups, 200 Participants)

Degree of Importance for Courses (5 is highest)

Composites Structural Design	4.2
CMH 17 certification tutorial	4.0
Composites Maintenance	3.9
Composites Manufacturing	3.2

Training Strategy Development

DER Feedback (Five Groups, 200 Participants)

Preferred Course Format (percentage of respondents listing one or more)

Online Teaching	87%
Laboratory	48%
Classroom	37%

Training Strategy Development
DER Feedback (Five Groups, 200 Participants)
(percentage of respondents listing one or more)

Bonded Composite Repair	68%
Static Strength Substantiation	64%
Fatigue and Damage Tolerance	61%
Allowables and Design Value Development	53%
Structural Bonding (composite and metal)	51%
Laminate Bolted Assembly and Repair	43%
Regulatory Requirements	41%
Damage Types and Sources	33%
Inspection Procedures	32%
Composite Structural Analysis & Test Protocol	32%

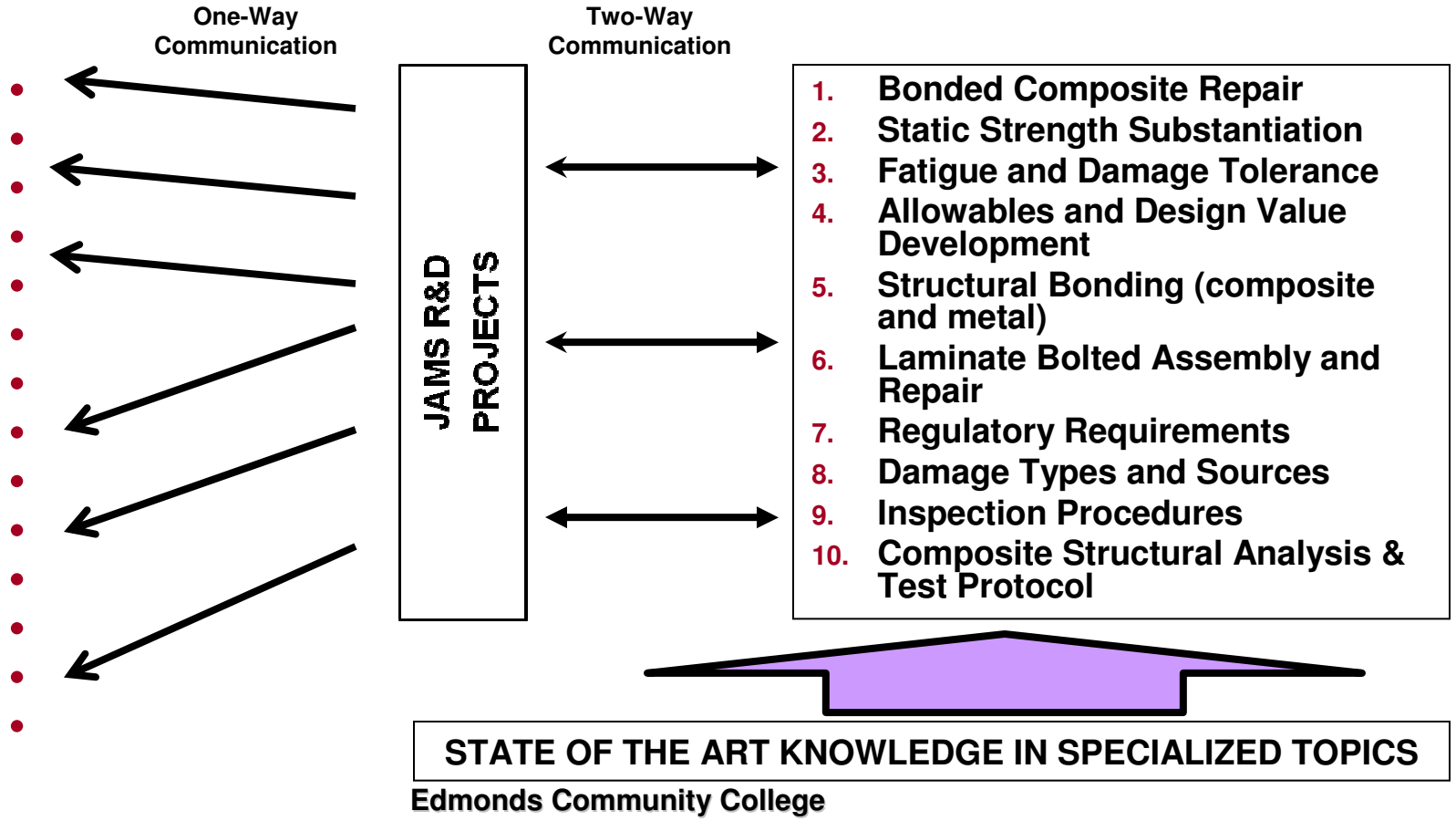
Training Strategy Development
Integrates Initiatives & Course Development

- Composite Maintenance Awareness Course developed by EdCC from 2004 through 2008
- Composite Certification and Compliance Tutorial developed by CMH-17 in 2008
- Composite Manufacturing Course for MIDO engineers in 2001 & 2003
- Composite Module of OK City Airframe Engineers Course in 2007 & 2008
- Coursework customized for the FAA aviation safety inspectors in 2008
- Safety management : Chapter 17, Volume 3 (CMH-17)

Training Strategy Development
Increasing Industry Involvement and Interface
Via Technical Reports and Specialized Training

Technical Reports

Specialized Training



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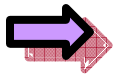
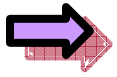
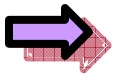
Training Strategy Development
Increasing Industry Involvement and Interface
Mapping JAMS R&D to Specialized Training Topics

EXAMPLES ONLY

UW: Improving Adhesive Bonding **UW: Thermal Repair** **WichSU: Surface Evaluation** **WichSU : Effect of Repair Procedures**		**Bonded Composite Repair**
U Of Delaware: VARTM Variability **WichSU: Statistical Analysis - Allowables**		**Fatigue and Damage Tolerance**
U Of Utah: Fracture Mechanics Test Methods **WichSU: Surface Evaluation**		**Inspection Procedures**

SUMMARY

- Online training was indicated for introductory and foundation courses
- Comments indicated that classroom/laboratory MAY be better for specialized training
- A broad strategic framework for curriculum development has been developed
- The FAA role will be migrating from that of sponsor to facilitator, with the expectation that industry will sponsor specialized training.
- Training can increase industry interface with R&D projects, complementing published technical reports

A Look Forward

- Benefit to Aviation
  - Integrates prior efforts developed through industry consensus into a strategic education framework
  - Establishes a curriculum lesson plan which is flexible and adaptable to the needs of a large practitioner student audience
  - Provides a framework to encourage industry interface with JAMS research and development activities
- Future needs:
  - Formalize training strategy and JAMS institution roles
  - Customize awareness course content and format to Aircraft Certification Office (ACO) personnel
  - Address the needs of other audience groups within FAA; other regulatory agencies such as EASA, TCCA