A Center of Excellence
AMTAS
Advanced Materials in Transport Aircraft Structures

AMTAS/JAMS Status and Future Plans

Summary prepared by
Mark Tuttle, UW
AMTAS Director

Overview
Of All AMTAS/JAMS Activities

- AMTAS Membership
- FAA Funding and Phase I Review
- AMTAS Administrative Activities
- AMTAS/JAMS Meetings
- AMTAS Short Courses
- Current Projects
- (Potential) New Projects

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Academic Members

UNIVERSITY OF WASHINGTON

WASHINGTON STATE UNIVERSITY

OREGON STATE UNIVERSITY

EDMONDS COMMUNITY COLLEGE

FIU
FLORIDA INTERNATIONAL UNIVERSITY

THE UNIVERSITY OF UTAH

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Industry Members

Bell Helicopter
A Textron Company

BOEING

Composite Solutions

Cytec
ENGINEERED MATERIALS

General Plastics Manufacturing Co.

HEATCON®
COMPOSITE SYSTEMS
Composite Repair Solutions

HEXCEL

intec

Stoddard International

'TORAY'
TORAY GROUP

Triumph Group, Inc.

ZODIAC

Transition from Phase I to Phase II

- All FAA Centers of Excellence are funded in three Phases:
  - Phase I = 3 yrs
  - Total duration of Phase I, II, III = 10yrs (max)
- AMTAS/JAMS established in 2004
- FAA review/audit of AMTAS/JAMS Phase I delayed
- ∴ Phase I extended for additional 4th yr
  - Review/audit initiated; will be completed during autumn/winter months

FAA Funding Levels

- FAA funding received by AMTAS academic members since initiation (must be matched 1:1 by non-federal sources):
  - Sept ’04-Aug ’05: $647k
  - Sept ’05-Aug ’06: $559k
  - Sept ’06-Aug ’07: $418k
  - Sept ’07-present: $495k (does not include FIU or UoU funding)
- Funding level has allowed 5-6 projects to be sponsored via AMTAS at any given time

Future Funding Levels

- WA Senators Cantwell and Murray have sponsored legislation that (*if passed*) would increase FAA AMTAS/JAMS funding to $1M/yr, allowing an increase in the number of projects sponsored
- Outcome of proposed legislation known by Jan-Feb ’08 (about)
- This meeting designed (in part) to help develop recommendations:
  - Should on-going projects be extended or expanded?
  - Should new projects on other topics be initiated?

AMTAS Administrative Activities

- Prof. Mark Tuttle, Director
  206-685-6665
  tuttle@u.washington.edu

- Prof. Kuen Lin, Co-Director (*happy birthday!!)*
  206-543-6334
  lin@aa.washington.edu

- Ms. Ellen Barker, Assistant to the Director
  206-543-0299
  nelle@u.washington.edu

AMTAS Administrative Activities

- Website updated more-or-less continuously:
  http://depts.washington.edu/amtas
- Monthly technical progress reports assembled and submitted to FAA
- Quarterly financial reports assembled and submitted to FAA
- AMTAS “news” - updates on AMTAS/JAMS activities e-mailed to interested persons every 1-2 months (about 650 persons, presently)
- Assist in short course development and administration
- Organize-schedule-host meetings

AMTAS/JAMS Meetings

- Semi-annual AMTAS meetings
  - Seven held since initiation (nominally Oct & April; typically 50-70 attendees)
  - One-day mtg, usually (but not always) held on UW campus
  - 71 registrants for today's meeting
- Annual JAMS meetings
  - Three held since initiation (WiSU→ UW →Hughes Res Ctr)
  - Typically ~100 attendees, representing 12 universities plus many industrial partners
  - 2008 JAMS Meeting:
    Tues-Thurs, 17-19 June
    Future of Flight (Everett)
- Occasional Workshops

Short Courses

One Established Short Course

- AMTAS Institute on Advanced Aircraft Composites
  - Five-day “cover the waterfront” composites course intended for degreed/practicing engineers
  - Organized and led by Kuen Lin
  - $2,500 tuition fee
  - Has been offered three times:
    - 18-22 Sept ’06 (21 attendees)
    - 19-23 Mar ’07 (25 attendees)
    - 17-21 Sept ’07 (14 attendees)
  - Curriculum slightly “tweaked” after each offering in response to suggestions
  - ~10 instructors (5 from academia, 5 from industry/gov)
  - Next offering 24-28 March ‘08

Institute on Advanced Aircraft Composites

Sept '07 Curriculum

Monday:

- Overview and New Developments (2 hours): Kuen Lin (UW) and Patrick Stickler (Boeing)
- Materials (4 hours): Bud Das (UW)
- Nondestructive Inspection (2 hours): Dick Bossi (Boeing)

Tuesday:

- Manufacturing Processes (4 hours): Doug McCarville (Boeing)
- Manufacturing Lab Project (4 hours): Brian Flinn (UW)/MSE Lab

Wednesday:

- Tooling (2 hours): Dave Dickson (Boeing)
- Prepreg-based Manufacturing (2 hours): Moe Soleiman (Boeing)
- Testing Methods (2 hours): Mark Tuttle (UW)
- Machining & Testing Demos (2 hours): Mark Tuttle (UW)/ME Labs

Institute on Advanced Aircraft Composites

Thursday:

- Structural Analysis Methods (3 hours): Kuen Lin (UW)
- Design Methodology (3 hours): Chris Eastland (Boeing)
- Damage Resistance & Tolerance (2 hours): Paolo Feraboli (UW)

Friday:

- Repair Techniques (3 hours): John Gokcen (Boeing)
- Repair Analysis (2 hours): Michael Graves (Boeing)
- Repair Demonstration (2 Hours): Eric Casterline (Heatcon)
- Summary and Discussion (1 Hour): Kuen Lin (UW)

Institute on Advanced Aircraft Composites
Student Feedback

- Attendees usually a mix of
  - Degreed engineers with little/no composites background
  - Relatively experienced composites engineers

- Generalization of course evaluations:
  - Little/no composites background: “Very Pleased”
  - Experienced: “Pleased”, but tend to ask questions that delve into proprietary issues, and in this sense not satisfied…

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Additional Short Course(s)

- Any individual topic covered during current 5-day short course would benefit from expanded coverage…
- Paul Labossiere (UW) has developed a draft proposal for 2-day short course:

  "Finite-Element Modeling of Composite Materials and Structures"

- Preliminary internal discussion of short courses devoted to:
  - Composite joining methods
  - Composite repair methods
- Suggestions for additional short courses welcome!

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Ongoing Projects
Summary

- Damage Tolerant Composite Design (K. Y. Lin, UW)
- Aeroservoelasticity of Composite Aircraft Structures (E. Livne, M. Tuttle, UW)
- Composite Crashworthiness (P. Feraboli, UW)
- Out-of-Plane Loading of Thick Laminates (T. Kennedy, OSU)
- Adhesive Bonding of Composites through Surface Characterization (B. Flinn, UW)
- Analytical Chemistry Methods for Detecting Surface Contamination and Moisture (R. Burton, FIU)
- Maintenance/Repair of Composite Aircraft Structures (C. Seaton, EdCC)

Likely New Project
Conducted at University of Utah

- Extension of “Shear Characterization of Composite Laminates and Adhesives” (D. Adams, UoU)

  (Summary of Adams slides from July ’07 JAMS meeting)

(Potential) New Projects

Preliminary Comments (as per Curt Davies and Larry Ilcewicz):

- AMTAS intended to support the overall FAA mission…each project must be somehow related to safety and/or certification efforts
- Most AMTAS projects expected to have a near-term focus (useable results within 1-2 years, say)
- More demanding projects may have longer term focus ("mid" = 2-4 yrs, "long" = > 4yrs, say) but must retain safety emphasis
- FAA funding *not* intended to develop new technologies for industry

(Potential) New Projects

- Two ‘breakout sessions’ held as part of Spring ’07 AMTAS Meeting:
  - Breakout #1: Current AMTAS Research Projects
  - Breakout #2: Future Research Areas
- ‘Report outs’ from both sessions recorded and available:

  depts.washington.edu/amtas/events/amtas_07spring/presentations.html
- Input also received from Michael Borgman/CACRC and directly from Boeing engineers
- Based on the above Tuttle developed a possible list (...but other suggestions are welcome!):

(Potential) New Projects

- Strain Invariant Failure Theory (SIFT)
- Precise Control of Cure Processes During Repair
- Nano-reinforced adhesives
- Nano-reinforced pre-preg systems
- Aging/accelerated testing of adhesive bonds
- Aging degradation of composites
- Structural health monitoring
- Morphing composite structures

Brief (3-5 min) summaries of each of these areas will be presented this afternoon, following by group discussion (2:05pm-4:00pm)

"In Conclusion" *(And To Repeat!)*

- This afternoon we seek your input and recommendations in two areas:
  - Short Courses: what focused short courses (if any) are needed by your company or agency that can be offered by an AMTAS university-industry-government team (in general, material presented must be non-proprietary)
  - Projects:
    - Should on-going projects be extended or expanded?
    - Should new projects on other topics be initiated?