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Challenging Aviation Maintenance Students to Design and Build an Advanced Composite Aircraft

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ABSTRACT
Today's aviation industry is evolving more towards the production of advanced composite aircraft. Polymer based aircraft structures can be found in every category of aircraft from Air Transport to Light Sport. The General Aviation industry shifted in 2007, with composite aircraft out selling traditional sheet metal aircraft. Building on the FAA Part 147 Aircraft Structures Courses, the Advanced Composite Course AVT410 farther exposes students to theory and application of advanced composite materials in modern aircraft structures. Students evaluate structures and implement various methods of repairs in accordance with Aircraft Maintenance Manuals (AMM). At Southern Illinois University Carbondale a new course project has been introduced, mimicking manufacturing processes used by the top three GA composite aircraft manufacturers. Working together as a team, students must design and build a complete, 1/6 scale model composite aircraft. Each student is part of a project team responsible for their part of the design and build. During production, the students are required to fabricate any needed tooling, including additional molds, trim fixtures, and bonding structures. Two open molds for the fuselage build were constructed during the initial class, providing the opportunity to wet layup in open mold designs using a team designed ply orientation schedules. The wings use Burt Rotan's moldless composite construction methods with the flight controls, propellers, and gear designed and built using manufacture's processes taught during the course. Normally, all composite repairs are called out in AMM with systematic procedures. This project is designed for the student to practice and demonstrate their knowledge of fiber science used in aircraft manufacturing. This build teaches more than composite manufacturing techniques. For students to be successful in this project and the industry, they must work as a team, coordinating parts design and fit, while managing time and recourses.

INTRODUCTION
Composites have been in use on aircraft, in one form or another for decades now. Wood laminated props, dope and fabric surfaces are some of the earlier forms found aboard an aircraft. As aircraft evolved traveling faster and higher, metal skins riveted to metal ribs, and stringers replaced wood and fabric giving us today's aluminum aircraft. The standards for repair on sheet metal aircraft are well known and documented with published substitutions and variances. Typically, repair technicians may have a supply of rivets, fasteners and various sheets of metal on hand to mend most damaged metal aircraft.

Today's aircraft manufactures made a distinctive shift from building with aluminum to building aircraft using advanced composite materials. Boeing Aircraft Company is constructing the Boeing 787 Dreamliner with over 50 percent composite materials. The business aircraft, Hawker Beechcraft 4000 is in production with a three-part, all composite carbon fiber fuselages. Bombardier Aerospace's Learjet 85 is positioning itself to be the first all composite aircraft structure for certification under Title 14 Code of Federal Regulations and the Federal Aviation Administration's Federal Aviation Regulations Part 25. The Very Light Jet (VLJ) market is designing and engineering to build economical jet flight transportation. The Honda Jet, Diamond's D-Jet and Cirrus's Vision SF50 are just a few of the early VLJs built with advanced composite materials. General Aviation Manufactures Association (GAMA) reported in 2007 over 51 percent of all general aviation aircraft sold were of composite construction (Black, 2008). Light Sport Aircraft (LSA) is favoring composites for their known strength to weight ratios. The LSA category relatively new to the industry, is showing innovative designs using composite structures.

With the inundation of composite aircraft, owners and operators are arriving at repair stations with plastic aircraft for repairs. Aircraft maintenance technicians and inspectors are adapting their thinking and training requirements to cope with these new aircraft designs. Fiberglass shops' repair techniques of older non-structural designs do not work with the advanced composites materials used today.

BACKGROUND

Currently, students attending Southern Illinois University, Aviation Technologies Department courses are introduced to composites during the FAA Part 147 course AVT110, Aircraft Structures. During the course students build a fiberglass sandwich foam core panel. The panel is ceremoniously damaged. After evaluating the damage, the panel is repaired using Boeing's 767-200 Structural Repair Manual. During the course, students are introduced to basic vacuum bagging techniques and hot bonding equipment. After completing the FAA approved airframe and powerplant requirements of the Part 147 curriculum, students continue with Aviation Technologies related classes pursuing a Bachelor of Science degree in Aviation Technologies. Within the degree, the students have a three-track specialization option, which is offered for Aircraft Maintenance, Aviation Electronics, and Helicopters. The specializations provide an opportunity to advance technical skills in theory, maintenance, overhaul, and inspections within each track. The Maintenance specialization students must attend Advanced Composite Course AVT410, while the Aviation Electronics and Helicopters may attend as an elective. The AVT410 course consists of two hours of lecture and two hours of laboratory, which are designed to expose students to advanced theory and application of composite materials used in modern aircraft structures. Students evaluate structures and implement various methods of repairs in accordance with AMM. As part of an enhanced technical training initiative, Southern Illinois University students now receive training focused more for what they will find in today's aviation industry. Two recent changes to the course curriculum helped bring this forward. The first was to introduce Lean Manufacturing principles and techniques to eliminate waste in work environments. The second was the addition of a new course project, the design and build of a 1/6th scale model composite aircraft to demonstrate aircraft fiber science techniques taught in lectures. To quote Randy Pausch in his book *The Last Lecture* the "head fake" or hidden objective is to promote personal responsibility to a group project and develop team cohesiveness (2008).

BUILD TEAMS

In the fall of 2007, 23 students enrolled in the AVT410 Advanced Composites Course. It was necessary to split the laboratory period into two laboratory sessions; each lab session working independent of one other while coordinating each phase of the build. Both lab sessions built one wing and one side of the fuselage, with the remaining parts, the landing gear, spinner, propellers, rudder, and horizontals to be divided between the two lab sessions. The first order of business of setting up an aircraft manufacturing class was to define the product. A donated, ill-fated Columbia 400 remote controlled (RC) aircraft, (known today as a Cessna Corvalis) was used as the design template. The students were instructed as to what resources were available for the project. All planning, design and fabrication will be the responsibility of each team. This author's role in the laboratory changed from an instructor to the consultant, leaving all decisions to the teams. The consultant explained the challenges and a typical flow plan for a project outline. Composite manufacturing methods in the lecture

Figure 1. Design Template for Plug

portion of the course coincided with the labs. The deadline for the project was set to be the conclusion of Thanksgiving break. In the aviation industry, one still finds bonuses for meeting corporate goals. Our project was no exception. If the delivery date were met, the bonus would be no final exam for the course.

THE FUSELAGE BUILD

The first aircraft required additional man-hours to build the initial fuselage molds for open mold layup. The fuselage's size, 3 feet in length by 8 inches wide, worked well for the development of a wet layup open mold. The two fuselage teams needed to rework the design fuselage into a solid plug to fabricate the molds on. This took a considerable amount of time repairing and reinforcing the damaged structure. After making numerous repairs, the fuselage team filled the fuselage with a two-part foam to form a solid plug. Once the foam was set up and trimmed, the team began the process of covering all window and door openings with layups of multiple fiberglass plies. The solid plug was now ready for bodywork to define the size and shape of the new fuselage skins. For the molds to release from the plug, the surface of the plug had to be reworked smooth to a high glossed finish. To define the left and right fuselage

Figure 2. Body worked design plug

Figure 3. Plug with playing card ledge ready for Layups

skins on the plug, a ½-inch diameter roll of molding clay was applied to the plug with plastic coated playing cards inserted to the clay to form a ledge on the molds. This ledge was required for a future vacuum bagging process of fuselage skins laid up in the open molds. To form a fuselage skin mold, each side was fabricated, one side at a time on the new plug. Removing the first side of the mold prior to the other side's build allowed each side to overlap slightly on the other.

To minimize health risks and keep inventories in the composite lab low we exclusively used epoxy resin. The fuselage molds' surface needed to release the epoxy resin layups evenly. To achieve this consistency, an epoxy surface coat material, similar in design to gel coat used with polyester resins was applied to the plug and allowed to tack-up. Looking forward to reusing the molds more than once, the consultant recommended the molds be reinforced to withstand students learning to demold fuselage skins. The first three fiberglass plies were applied directly to the tacky surface coat with four additional reinforcement plies of Kevlar® fiber to follow. The teams' attention to details during the build of the plug paid off. The left and right side fuselage molds released from the plug with only minor imperfections in the epoxy surface coat. After each fuselage skins molds cured properly, the students wet sanded any imperfections. With the molds now ready for service, the teams applied several coats of wax followed by two coats of Polyvinyl Alcohol (PVA) mold release. Reviewing the structural requirements for the fuselage, each team developed a materials list and layup schedule. Both teams layup according to ply schedules and successfully vacuum bag the molds. Despite waxing the molds several times and applying the extra PVA mold release, the students still labored to get the left side mold to release its first part. Both halves eventually released with no damage to the parts or molds. The two separate fuselage teams now came together

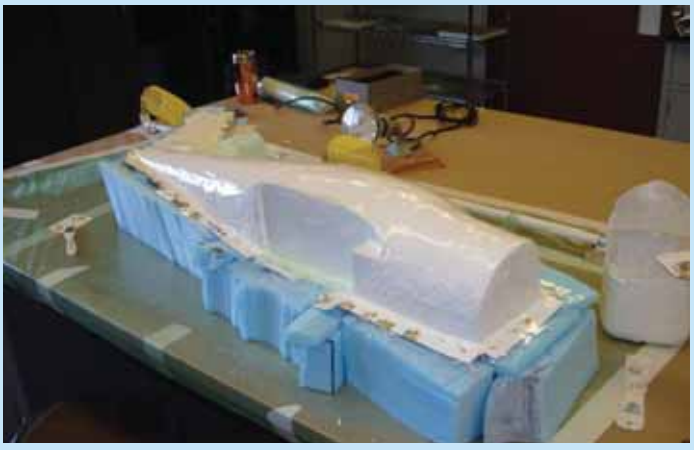

Figure 4. Epoxy Surface Coat applied to the first half of plug

Figure 5. Left, laying up Kevlar on second side of plug. Right, laying up fuselage in new mold.

Figure 6. Plug, 2 molds, and first article skins trimmed ready to bond

to determine the final dimensions for the two fuselage sides. After successfully trimming the two fuselage skins for bonding, the parts were placed back into the molds. A scribe was used to mark an outline of the trimmed parts in the surface coat of the molds. Any new parts pulled from the molds will now have established trim lines on the skin. The two fuselage halves were ready to bond, minus any existing tooling or fixtures to align and maintain the design during bond cure. A basic temporary fixture technique was introduced using tongue depressors and Cyanoacrylate Adhesive (CA). Using clear 3M packing tape on the aircraft parts, CA was directly applied to the tape and tongue depressors, building clamps and holding fixtures for use during the bond cure. This prototype tooling works well for once a year bonding and was disposed of after use, requiring

the underclassmen to experience the bonding tooling design exercise. Once bonded together, reinforcement plies applied to the bond seams from the inside of the aircraft added extra strength. After curing, a strong bonded fuselage was ready for bodywork. Experimenting with aerodynamic smoothing paste and glass microballoons for fillers, the students found a combination of the two worked best. The microballoons worked well with large area fills but required a full day of cure before sanding. The paste, used after final sanding of microballoons, worked to fill small areas with little wait time. The students quickly disproved the old adage "more is better" during sanding.

THE WING BUILD

Even though each wing is 3 feet in length, the thinness and taper of the wing did not lend itself to mold construction without requiring additional small ribs during the closeout. As a result, the wing teams elected to use Burt Rutan's moldless composite sandwich construction method. From the damaged wings of our Columbia RC, the team designed and cut out 1/8th inch plywood profile templates. The inboard and outboard templates were similar airfoil designs with the outboard about 1/3rd the size of the inboard wing root. The reduction in the templates tappers the wing to the wing tips. After a few practice cuts on scrap pieces of polystyrene foam, the team attached the templates and traced them out with a hot wire foam cutter as Burt Rutan prescribes in his book *Moldless Composite Sandwich Aircraft Construction (2005)*. After cutting the foam, each team developed a layup schedule. Prior to applying the schedule of plies, a slurry of microballoons and resin was applied to the foam for better service adhesion. At the beginning of the course, one of the first lab projects was an advanced vacuum bagging lab of various shaped parts. Everyone mastered the complicated vacuum bagging process requiring several pleats in the vacuum bagging to conform around irregular parts. Burt Rutan does not usually use vacuum bags with his moldless composite sandwich construction method. However, the wing crew armed with fresh new skills opted to pull a vacuum on the wings to ensure equal pressure was applied during the cure. By using a vacuum bag, it saved time by not having to work out any trapped air in the layup, resulting in a wing free of delaminations.

Figure 7. Students using hot wire to cut wing foam core

SMALLER PARTS

The rudder and horizontals were similar in construction to the wings using hot wire cutting polystyrene foam and composite sandwich techniques. The landing gear and spinner required to be handcrafted out of polystyrene foam with wet layups. Although all parts in this project were one of a kind, the atmosphere and commitment to scale and scope of each part was comparable to prototyping found in research and development departments preparing a new design for a production run. The progression of three bladed carbon fiber propeller designs matched as closely as possible to full-scale propeller design taken from information gained in an earlier propeller course. Special tooling fixtures were designed to reproduce a consistent pitch angle for each propeller to maintain prop symmetry.

Figure 8. Main gear wheel pant under vacuum

CONCLUSION

The basis of this project did arise from a RC aircraft. Nevertheless, the methods' and techniques used to manufacture modern composite aircraft differ drastically to RC construction. Normally, it is stressed during the course how every step of any repair or fabrication must be in accordance with the aircraft's Structural Repair Manual, Aircraft Maintenance Manual, or in the absence of either, AC43-13 2B may be used. During the build of the aircraft, the Aviation Technologies students are encouraged to use their knowledge of composites to design the part, call out the list of materials, and plan fabrication methods to meet the team's goals for the part.

The objective of the composite plane is to give the students a chance to put to use complex composite knowledge gained from lectures in the advanced composite curriculum. This course project demonstrates the students' cognitive level of composite fiber theory, but also brings out concepts of personal responsibilities and teamwork. The pleasant surprise during the build process was how the students drew on previous courses and consulted with other faculty members about designs and theories. At times, the plane became more of a culmination

of the degree program's practical final exam, and not just a course project. The students learned a real appreciation for fiber science used in designs to build composite aircraft and gained a better understanding for the strict compliance standards required to return designs to original strengths during repairs.

Visitors touring the composite laboratory today may see it as a class on how to build a RC aircraft. It is, however, much more. This class teaches something the aviation industry is looking for in new graduates. It teaches students to be able to work as a team and be responsible for their portion of the project. These values have to be present in every aspect of the aviation industry to achieve a common goal. It teaches the students to plan, coordinate and produce to tight timelines and rigid aircraft specifications. The pride of ownership in the plane was instantly recognizable as the "N" numbers went on signifying course number and year, N41007. Since the initial course, two consecutive aircraft have been built. All three are unique aircraft designs and builds. All three had unforeseen problems that had to be addressed individually and as a team, but all three taught lessons in team dynamics and personal responsibilities. The third aircraft, N41009 was the first aircraft build team to receive a bonus for meeting the goals set for production.

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Figure 9. Completed aircraft flying overhead in Composite laboratory.

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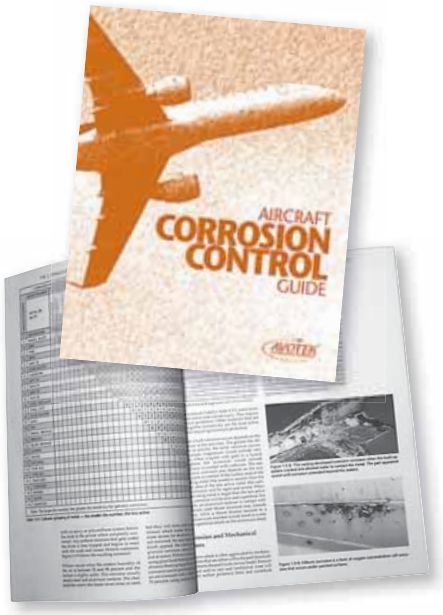

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A Student Research Project:

An Innovative Repair Method for Composite Aircraft Using Vartm Techniques

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ABSTRACT

Students at Purdue University developed a structural repair method for repairing damaged carbon fiber aircraft structures. The purpose of this research study was to stimulate student learning through experimentation and critical thinking. The goal of this research was to develop a repair method to restore the strength of the original aircraft structure, using a process that is predictable, repeatable, and clean. A four ply carbon fiber patch combined with a titanium foil seal patch was impregnated with West System's 105 epoxy resin using the VaRTM (Vacuum Assisted Resin Transfer Molding) method. Three different types of specimens were used in this research project: Original specimens with no damage, specimens with unrepaired damage, and specimens that were repaired. The results showed that the VaRTM method was able to fully impregnate the carbon fiber fabric. However, the repaired specimens failed prematurely and only restored 83% of the original strength. The test specimens failed in adhesion which could be attributed to the particular epoxy resin that was used. Specially developed RTM (Resin Transfer Molding) resins could substantially improve the adhesion and strength of the repair. It was determined that further research and testing needed to be doneto determine the differences.

INTRODUCTION

The purpose of this research study was to introduce the students to the research process and allowed the students to develop innovative ideas to accomplish a predetermined goal. Innovation was enhanced when students were given the opportunity to identify problems and proceed to finding solutions for the identified problems. In this study, students determined the characteristics and relative strength of a repair made to a carbon fiber structure utilizing the VaRTM method on a titanium and carbon fiber hybrid patch. The study was a pilot study for developing a repair method for common damages that may occur on composite aircrafts. A traditional method for repairing minor damages to a composite aircraft structure was the wet layup approach. The wet layup method has several undesirable characteristics: inconsistency from one layup to the next, tendency for being resin rich, and the wet layup method is generally very messy exposing personnel and the environment to resins. The purpose of utilizing the VaRTM method in this study was to design a predictable repair process that contained a proper resin to fiber ratio and at the same time reduced or eliminated the technician's direct contact with any chemicals associated with the repair.

METHODOLOGY

An exploded view of the VaRTM patch is shown in Figure 1 below.

The base material for the specimens consisted of four plies of Hexcel BMS8-168 prepreg carbon fiber plain weave fabric. The laminates were cured in an oven with a 121 C° (250 F°), 2 hour cure cycle.

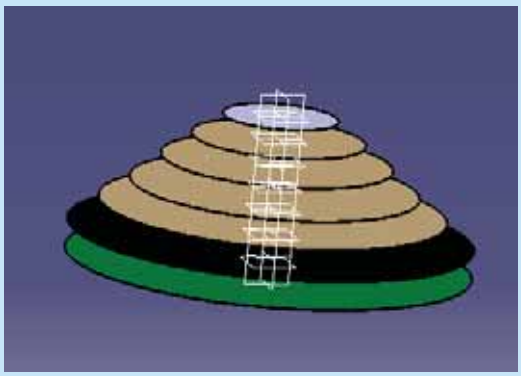

Figure 1. A sketch of the carbon fiber/ titanium patch.

The completed specimen is shown in Figure 2 below. Annealed titanium with a thickness of 0.127mm (0.005in) was used for the patch. The material used for the carbon fiber patch was Hexcel BMS9-8K dry fabric. The two part epoxy that was used to impregnate the dry carbon fiber fabric was West System's 105 resin and 206 hardener. A 16mm (0.63in) hole was cut through the base plate using a diamond tipped hole saw, and then the titanium patch was bonded to the structure

surrounding the hole using Weld-On SS305 structural adhesive. Four plies of carbon fiber, one ply of peel ply and one ply of transfer medium were sewn together with polyester thread to form the carbon fiber patch kit. This patch kit was then centered over the titanium patch and sealed inside a vacuum bag. The two part resin was then drawn through an inlet port, across the dry carbon fiber fabric, and through an outlet on the opposite side. Once the resin had transferred completely across the dry fiber, the inlet port was closed to prevent excess resin from entering the vacuum bag. A constant vacuum was kept throughout the entire cure cycle. After 12 hours, the VaRTM patch reached full cure as shown in Figure 3 below. A strip was cut from the center of the patch to create a test specimen. Fiberglass tabs shown in Figure 4 were adhered to both sides of the test specimens to eliminate slippage and premature failure at the clamps during tensile testing.

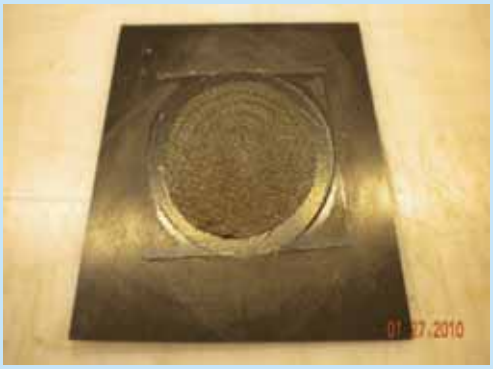

Figure 3. Cured patch on the preformed base material

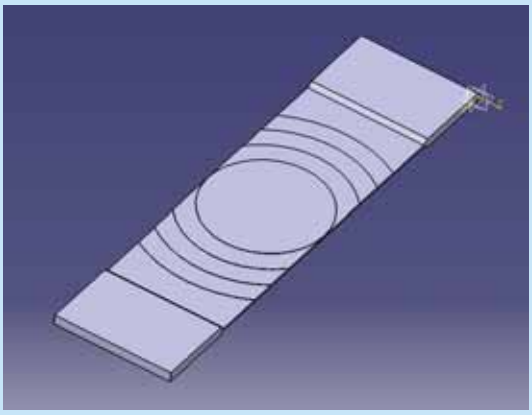

Figure 2. Sketch of the completed test specimen

Figure 4. The tabs fixed to the end of the test strips.

Besides the titanium and carbon fiber repair test specimens, two other types of test specimens that were shown in Figure 5 were prepared. The control group consisted of undamaged test specimens to simulate the original aircraft structure that used identical material types and dimensions as the titanium/carbon fiber repair specimens. The second group consisted of test specimens fabricated to identical specifications and also had a 16mm (0.63in) diameter hole in the same location as the titanium/carbon fiber repair specimens. This type of specimen was prepared to simulate the aircraft structure with damage that was not repaired. All of the test specimens were prepared in accordance to ASTM D 3039 standards to ensure the consistency of the specimens.

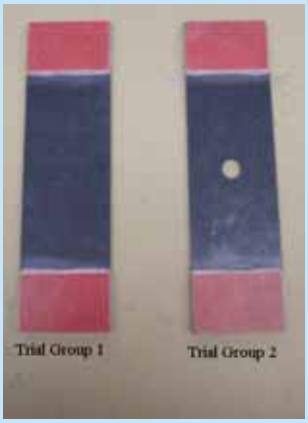

Figure 5. The two control groups prepared for the test

- Total length of the specimen = 280mm (11in)
- Diameter of simulated damage = 16mm (0.63in)
- Width of the specimen = 75mm (2.95in)

RESULTS

All three types of test specimens were tested until failure with a MTS Systems Corporation 100kN tensile tester. Individual load-displacement curves were shown for different test specimen configurations to illustrate the failure mode. Figure 6 showed the load-displacement curve for the original non-damaged specimens. The original specimens failed consistently at 60kN. The unrepaired specimens failed consistently at 41kN as seen in Figure 7. The specimens that were damaged and then repaired with the VaRTM repair technique showed some variation in failure loads. As shown in Figure 8 the VaRTM portion of the patch de-bonded from the specimen at approximately 48kN. The titanium foil patch then held the full load until final failure at 50kN. Comparison of the three test coupon types was shown in Figure 9. The repair patch restored approximately 83% of the structure's original strength. Investigation of the failed test specimens showed that the repair failed in adhesion. The repair patch was found to be properly impregnated but the adhesion strength of the selected epoxy resin system was insufficient. The concept of creating a carbon fiber-titanium repair patch using the VaRTM process was deemed successful. The carbon fiber was fully impregnated and the titanium was properly bonded to the structure. Further investigation revealed that the VaRTM patch itself had not actually failed, just the bonding interface between the resin and the structure. The resin used in this process was a general purpose room temperature cure resin typically used for the marine industry. This process will be repeated using an aerospace grade RTM resin.

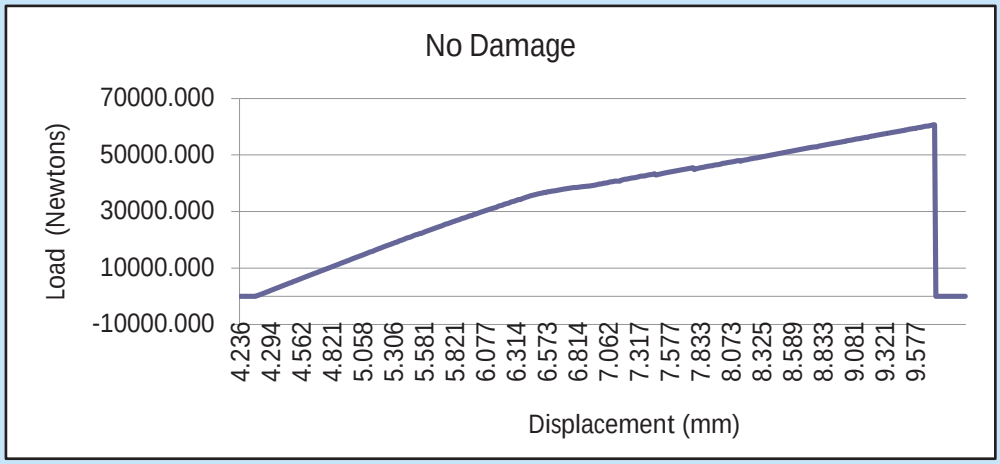

Figure 6. Failure curve for a specimen with no damage.

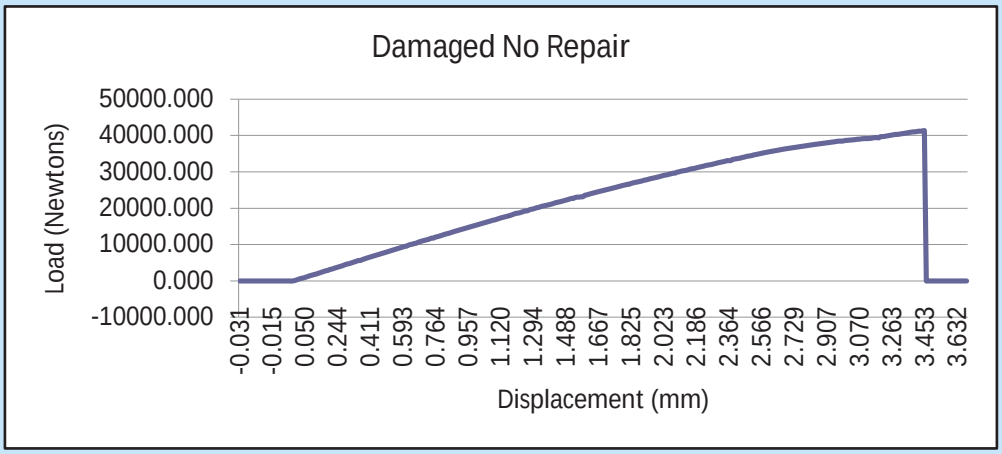

Figure 7. Failure curve for a specimen with damage and no repair.

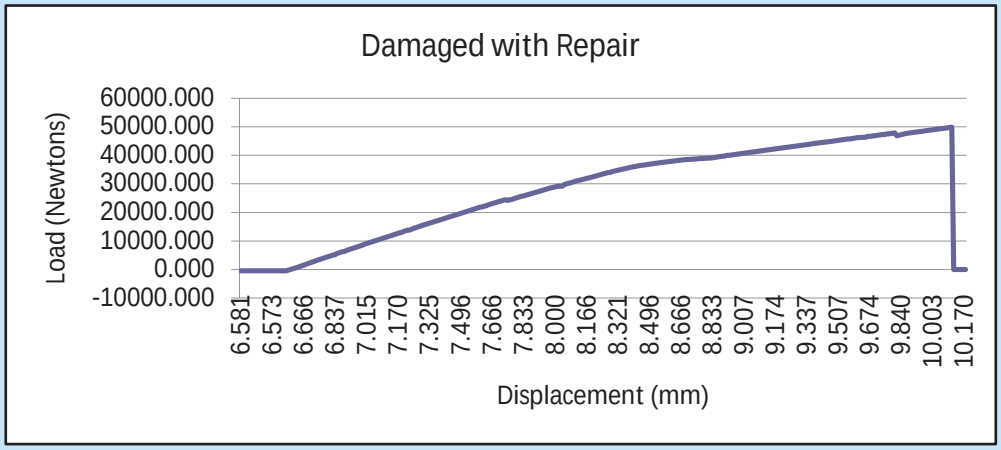

Figure 8. Failure curve for a specimen with repaired damage.

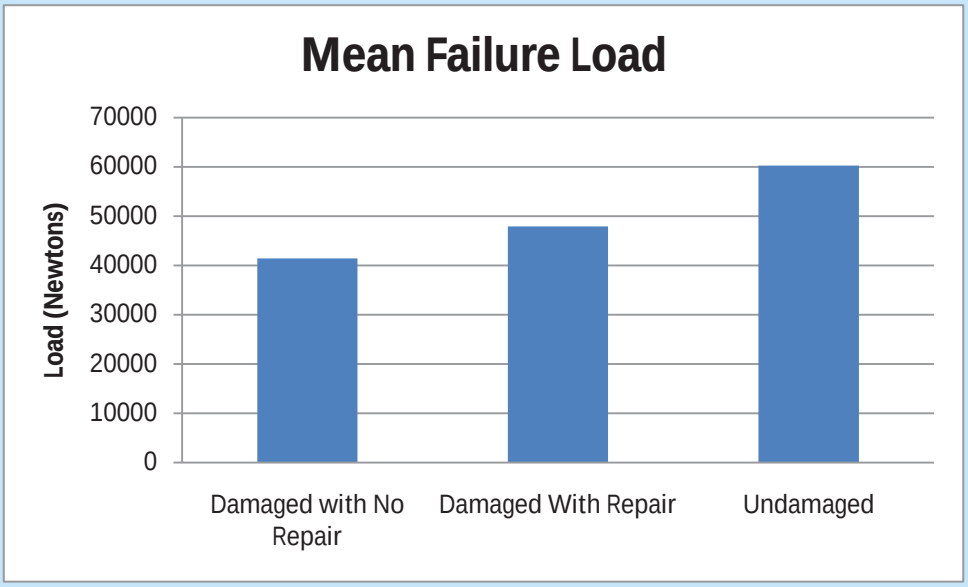

Figure 9. Comparison of the mean failure load of the three types of specimen.

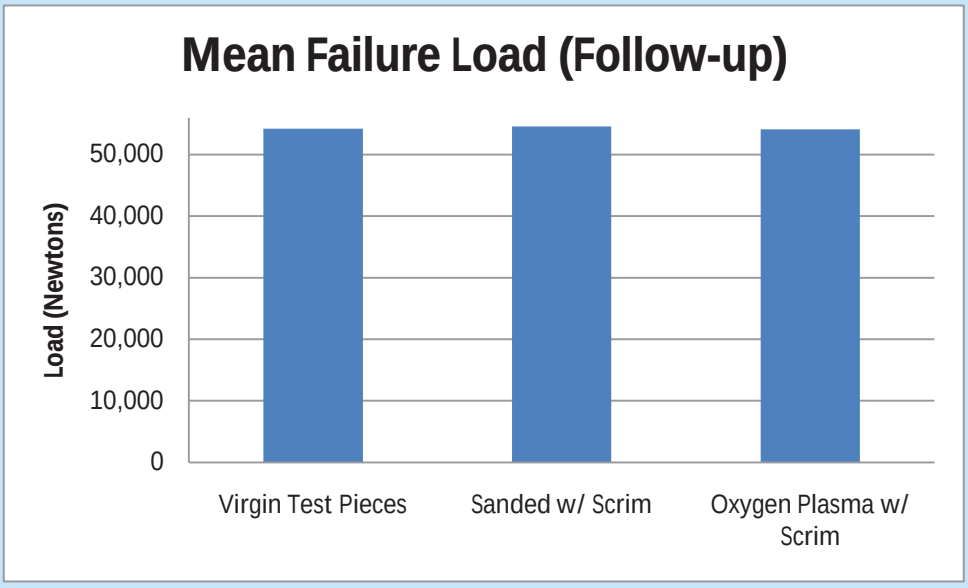

Figure 10. Comparison of the mean failure load of the follow-up study specimens.

FOLLOWUP STUDY

After the pilot study was performed, further research including a follow-up study was conducted and the repair strength was found to have greatly improved by the addition of a proper surface treatment and an additional layer of scrim cloth within the repair patch. The scrim cloth was incorporated in order to control the bond line thickness between the repair patch and the damaged structure. Aside from the addition of surface treatment and the scrim cloth, the specimens used in the follow-up study were identical to the pilot study. However, the repaired specimens in the follow-up study were able to restore 100% of the structure's original strength. Figure 10 above shows a comparison of the mean failure load of the specimens tested in the follow-up study.

CONCLUSION

This research was intended for students to experience the research process from initial conception to actually performing the experiments and analyzing the results. The result showed that the VaRTM process typically used for larger structures can effectively be adopted for aircraft structural repair. Full impregnation of the dry carbon fiber fabric can be achieved with simple inexpensive tools. The VaRTM repair process has the potential to be a suitable alternative for traditional wet layup techniques and can be applied consistently with minimum equipment requirements. Even though the initial pilot study was not able to achieve the goal of restoring 100% of the original structural strength, further research that was conducted was able to achieve the goal through the addition of a scrim cloth within the patch and by performing a proper surface treatment. Based on the data gathered from this research, the VaRTM method can efficiently replace the wet layup method for permanent composite aircraft repairs.

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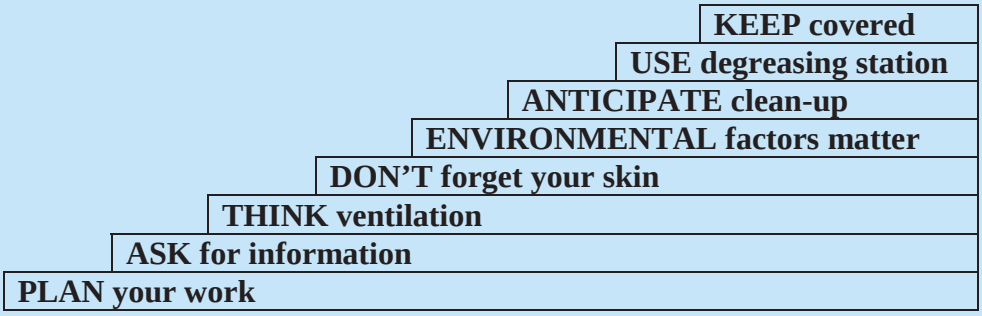
A Brief Communication:

Following up from the 50th Anniversary ATEC Conference

At the 50th Anniversary ATEC Conference, held in Mesa Arizona, April 11-13, 2010, James Allen MD gave a technical presentation titled "Teaching Human Factors to Protect Your Health". In that presentation, Doc Allen encouraged instructors to teach healthy working techniques by using a series of eight small steps. Each step reminds the mechanic of techniques to reduce specific workplace hazards. He organized these steps into a stair case which he called the Working Healthy -8. Attendees at the conference received a color chart (below) of the Working Healthy-8 which reinforced topics associated with each step.

Working Health -8, eight steps to prevent exposures in the hangar.



Dr. Allen has reported to ATEC that he has completed a Computer Based Education (CBE) program that is now available, *free of charge*. The CBE is on the learning center of FAASafety.gov and is titled "Working Healthy – 8 steps for Protecting your Health". Completion of the course requires the student to achieve a passing grade on the test questions. Upon satisfactory course completion, students can print out their certificates of completion. Below is a link to the course:

http://faasafety.gov/gslac/ALC/CourseLanding.aspx?cID=117

Initial response to the Working Healthy -8 is encouraging. The FAA safety team introduced the course at the FAA booth at Air Adventure, Oshkosh, WI in July, 2010. Initial evaluation from 64 registrants shows an average course feedback rating of 2.5 and course content of 2.7 out of a total score of 3. The course takes about 45 minutes to complete.

For those of you who did not attend the 50th Anniversary Conference, the Working Healthy -8 is but one example of the quality presentations that you missed. Our congratulations go to Dr. Allen on a well done CBE program. You can contact him with your feedback on the course by email: jallen@workinghealthyalways.com

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ATEC 2011

International Palms Resort & Convention Center

April 10-12, 2011

Orlando, Florida

PRELIMINARY AGENDA

Saturday, April 9	**IA Renewal** (Electronic Registration at http://www.amtsociety.org/roadshow.jsp)
Sunday, April 10	
10:00 AM-5:00 PM	Registration
10:00-12:00 NOON	ATEC Board Meeting (all members welcome)
1:00-5:00 PM	Pre-Conference: Classroom focused sessions
1:00-2:30 PM	"Best Practices in Student Recruiting and Marketing"
3:00-4:30 PM	"Beyond the Technical: Teaching Professionalism…"
5:30-7:00 PM	Networking Reception – Exhibit Area
Monday, April 11	
7:30 AM-4:30 PM	Registration
7:30-8:30 AM	Continental Breakfast – Exhibit Area
8:30-8:45 AM	Welcome-Raymond Thompson, President-ATEC (Board Floor Nominations)
8:45-10:00 AM	**"Keynote: Understanding and Teaching the New Millenial Students" Part 1 – Dr. Mark Taylor**
10:00-10:20 AM	Break
10:20-11:45 AM	**"Keynote: Understanding and Teaching the New Millenial Students" Part 2 – Dr. Mark Taylor**
11:45-12:15 PM	**"Legal Issues"**
12:15-1:00 PM	**"FAA and 147 Issues" – Ed Hall, FAA**
1:00-2:20 PM	Lunch (Awards and Scholarships) Board Candidate speeches- 3 minutes each
2:30-5:00 PM	Voting (Registration Area)
2:30-4:00 PM	Call for Paper Presentations – Technical Classroom Presentations from Schools
4:00-4:30 PM	Break in Exhibit Area
4:30-5:15 PM	**"Latest Technologies-UAV**
Tuesday, April 12	
7:30-8:15 AM	Continental Breakfast – Exhibit Area
7:45 AM	Executive Board Voting for Officers- Registration Table
8:15-9:00 AM	**Annual Business Meeting** – Raymond Thompson, Pres.
9:00-10:15 AM	**"RAA Panel"**
10:15-11:00 AM	Break in Exhibit Area (Door Prize Drawing)
11:00-12:00 NOON	**"2011-2012 Hiring Trends Across the Industries"**
12:00 NOON	Adjourn
12:15-4:00 PM	**Tour of Aviation Maintenance Facility (TBD)**
Wednesday, April 13	**DME Renewal** (FAA Electronic Registration at: https://av-info.faa.gov/DsgReg/Sections.aspx?courseaid=80)

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CALL FOR NOMINATIONS

ATEC BOARD OF DIRECTORS

At the Annual Convention, International Palms Resort, Orlando, FL, April 10-12, 2011, an election will be held to fill **three Board of Director positions for four-year terms and two members will be appointed** by the President with approval of the Board for two-year terms. Five seats will be vacant due to the By-Law changes approved by the General Membership at the 2009 Annual Conference which changed the term of office from three years to four and the need to fill the seat vacated by the elected Vice President. This combination of terms is necessary to create a smooth future transition of vacancies on the Board starting in 2013 when all seats will be four-year terms and we will elect 3 members annually.

An elected Board member may serve up to two consecutive terms of office and then be eligible for further election to the Board after a waiting period of one year (the appointed members will be eligible for an additional two elected full terms).

All Institutional and International Institutional Members are eligible to be nominated for the above positions.

If interested, please contact the Business Office at ccdq@aol.com no later than March 1, 2011.

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ATEC Update

SEPTEMBER FAA MEETING

On September 10, 10 ATEC Board members met with Dan Bachelder, Murray Huling and Ed Hall, representatives of the FAA, AFS300 Aircraft Maintenance Division. They discussed the following issues:

1. PART 147 ARAC transition to an NPRM.
   The 147/ARAC final report is still on hold at least until 2012. Other higher priority rule changes have been placed ahead of 147.

2. Encourage the transition of FAA Form 8610-2 into the IACRA or some other form of electronic processing and filing system.
   In an email from AQS-232 Development Services Section Oliver Jaksons to Ed Hall the 8610-2 will be built into and added to the IACRA revision package beginning on or about December 8, 2010.

3. Encourage ways to make the Oral & Practical testing process less time consuming (average General, Airframe & Powerplant is 20 hours).
   No movement in this area at this time; discussion about the PTS and core competencies being relative new to the testing process time and DME creativity may help in this area. DME renewal is also encouraging margining practical projects together as ways to speed up the test.

4. License and certificate terminology.
   The FAA does issue Commercial Space Licenses for operations including launch and recovery, however, the FAA Mechanic document is a Certificate, not a license.

5. Discussion of Submission of School Graduation List to be electronically transmitted per John Allen's memo June 24, 2010.
   The memo is under revision and will be sent out soon with clarity on procedure and process. This directive will assist the FAA with better school data for analyses.

6. Discussion about age requirement for General, Airframe and Powerplant Written/Knowledge Testing.
   Presented as an idea from a 147 high school program about dropping the 18 years of age requirement for knowledge (computerized) testing. The FAA will be looking into this as a possible regulation change.

RAA MEETING

ATEC Board members met with Roger Cohen, President of RAA and Kelly Murphy, media staff to discuss how ATEC and RAA can help one another.

Ray Thompson discussed connecting RAA members as employers of our ATEC school graduates and the value of partnership with RAA. Ray shared that ATEC would be better conduit to RAA members in the employment process for aviation maintenance professionals and provide more RAA information back to ATEC schools.

Also discussed were pilot and mechanic shortages.

Roger Cohen stated RAA's desires for focus on education are: Strive to teach good work ethics, increase student knowledge in advancing technologies, let students know that RAA member airlines are good career opportunities, teach and demonstrate team-oriented work. Roger shared that RAA member airlines have matured and grown much more than expected or perceived and they operated 21st century, leading technology equipment.

ATEC and RAA plan to work together. RAA offered some article space to ATEC in the REGIONAL HORIZONS publication and ATEC is planning to invite some RAA members to the Orlando ATEC Conference for network interaction and to present RAA topics.

BOEING PROJECTS ONE MILLION AVIATION JOBS

Boeing reports that the airline industry will need to hire more than one million workers globally over the next 20 years to prepare for a wave of 30,000 new aircraft.

The airlines will need to hire 466,650 pilots and 596,500 maintenance crew workers between 2010 and 2029, the aircraft maker said.

That means the industry will need an average of 23,300 new pilots and 30,000 maintenance workers annually from now until 2029, the company said.

“Our challenge is adapting our training to engage the future generation of people who will fly and maintain the more than 30,000 airplanes that will be delivered by 2029,” said Roei Ganzarski, chief customer officer for Boeing Training & Flight Services, in a statement.

The largest need for new personnel is in the Asia-Pacific region, where about 180,000 pilots and 220,000 maintenance workers will be required, the company said.

In North America, the commercial airline industry will need about 97,000 pilots and 137,000 maintenance crew members, Boeing said. Similar numbers will be needed in Europe.

SERVE ON THE ATEC BOARD

The ATEC Board Nomination Form is attached. Several seats are open for April 2011. If you are interested in placing your name in nomination, complete the enclosed form and fax or mail it as indicated on the form. Voting will take place at the Conference in Orlando, Florida, April 10-12, 2011.

CALL FOR PAPER PRESENTATIONS

If you have a technical classroom related presentation that you would like to present at the April 10-12 Conference, see the attached application information and return it by **December 1, 2010**.

SCHOLARSHIPS ON THE WEBSITE

Be sure to apply for all the **awards, scholarships and grants** for faculty, students and schools on the ATEC website www.atec-amt.org. There is almost $15,000 in available awards.

INSTRUCTIONAL DVD’S

The entire (almost 200) instructional materials library is now fully converted to DVD format. They are available on the ATEC website, www.atec-amt.org (click on Instructional Materials) with a downloadable form.

The numbering system for ordering is still the same with a “check” qualifier after the number to signify the DVD format. You can also continue to order video tape format materials if you choose.

YOUR INSTITUTIONAL LISTING NEEDS TO BE UPDATED

Please go to www.atec-amt.org. Click on 147 Institutional Members then click on your state.

Review you listing for accuracy. If it needs to be changed, print it out, make changes and fax it to 717-540-7121 by December 3. Be sure to check contacts and contact information.

EDUCATOR AND STUDENT OF THE YEAR AWARD NOMINATIONS

Included in this Update are the letters announcing the two major ATEC awards to be presented at the ATEC Conference, April 10-12, 2011 in Orlando.

To download the application materials, go to www.atec-amt.org. Click on Livi (Educator) and Rardon (Student) awards. The deadline is **February 1, 2011**.

ATEC HELPS AMT SCHOOLS

During 2010, the ATEC Government Relations Committee assisted three schools with a variety of FAA problems, including curriculum issues, program start-up and the issuance of certificates.

ATEC 2011 CONFERENCE AGENDA ENCLOSED

Mark your calendar now for April 10-12, 2011 where ATEC will be held at the International Palms Resort in Orlando, Florida… Plus at the same hotel on April 9 there will be an IA Renewal Program and on April 13, DME Renewal Program.

One trip…three professional activities.

April 9 – IA Renewal

April 10-12 – ATEC Conference

April 13 – DME Renewal

ATEC PLANS NEW INITIATIVES

At our September meeting, ATEC Board members spent six hours developing a strategic plan for the next two years.

The Board:

- set priorities around improved communication
- developed greater outreach programs to industry and suppliers
- began to develop a clearinghouse of information on employment, equipment exchange, more curriculum and instructional materials

As part of the outreach plan, Ray Thompson and other Board members will attend the NBAA annual meeting in October with an ATEC booth to raise awareness of ATEC and highlight the benefits for companies in joining ATEC.

EDUCATOR OF THE YEAR AWARD

September 2010

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 22nd annual Ivan D. Livi Aviation Maintenance Educator of the Year Award. You will find the criteria for eligibility and appropriate forms on the ATEC Website at www.atec-amt.org. Click on Livi (Educator) Award. Or, request a form from ATEC fax (717) 540-7121. I sincerely encourage each member institution to carefully review these forms and forward a nomination to the selection committee as specified in the instructions.

Through this award, we have potential to recognize some of our many outstanding instructors. It has become a regular part of ATEC's activities. In addition, the school of the winning educator will receive a framed picture of the "Flying Wing" donated by the Northrop Rice Foundation.

ATEC pays all the travel expenses "and a free conference registration" to the ATEC Conference for the winner. The twenty-second annual award will be presented on April 11, 2011 at our Orlando Conference. Forward your nomination by **February 1, 2011** to the ATEC Business Office, 2090 Wexford Court, Harrisburg, PA 17112.

Upon receipt of your application material, the ATEC Business Office will send you a confirmation of receipt. If you do not receive a confirmation within two weeks of sending your material, contact the ATEC Office immediately.

Sincerely,

Raymond Thompson
ATEC President

ATEC

AVIATION TECHNICIAN EDUCATION COUNCIL

2011

IVAN D. LIVI AVIATION MAINTENANCE EDUCATOR OF THE YEAR AWARD

Purpose: This award recognizes the outstanding achievement of an aviation maintenance technology instructor. This achievement can be in the form of a single event or long term outstanding performance but must have had a direct impact on the Aviation Maintenance student.

This award will be presented at the annual ATEC Conference April 10-12, 2011 in Orlando.

The winner will be contacted in late February.

CRITERIA FOR ELIGIBILITY

TO BE ELIGIBLE for the ATEC outstanding educator award, the nominee must:

1. Be employed by an institution and/or organization that is a member of the Aviation Technician Education Council.
2. Be an active instructor of Airframe and/or Powerplant Technicians. The applicant's workload must be of such a nature that they spend 80% of their workload time in contact with students teaching actual aviation maintenance technology classes.
3. Present a completed application with appropriate signatures by **February 1, 2011** to ATEC, Awards Committee, 2090 Wexford Court, Harrisburg, PA 17112.
4. Nominations may be made for one particular outstanding achievement by a person. They may also be made for a person who has consistently contributed above average performance.
5. Nominees are not eligible if they are a current member of the Executive Board or, as regular members, they are serving on the Public Relations Committee.

CRITERIA USED FOR EVALUATION

1. Initiative/creativity: What did this person do, what new ideas or applications were used and what was the outcome?

   Total value in per cent 45%

2. Attitude/performance: What was the direct impact to the student(s)? How was the attitude and/or performance of the student effected by the event, ideas, or performance?

   Total value in per cent 25%

3. Education/training: What education and training does the nominee possess? How did this influence the event, idea, or performance?

   Total value in per cent 15%

4. Recommendation(s) and/or nomination statements from the benefit and effect of the event, idea or performance.

   Total value in per cent 15%

STUDENT OF THE YEAR AWARD

September 2010

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 12th annual award of the James Rardon Aviation Maintenance Technician Student of the Year. You will find the criteria for eligibility and appropriate forms on the ATEC Website at www.atec-amt.org. Click on Rardon (Student) Award. Or, request a form from ATEC fax (717) 540-7121. I sincerely encourage each member institution to review carefully these forms and forward a nomination to the selection committee as specified in the instructions.

Through this award, we have potential to recognize some of our outstanding students.

ATEC and Northrop Rice Foundation pays coach airfare, lodging for three nights, $75 stipend "and a free conference registration" to the ATEC Conference for the winner. The twelfth annual award will be presented on April 10-12, 2011 at our Orlando, FL Conference. Forward your nomination by February 1, 2011 to the ATEC Business Office, 2090 Wexford Court, Harrisburg, PA 17112.

Upon receipt of your application material, the ATEC Business Office will send you a confirmation of receipt. If you do not receive a confirmation within two weeks of sending your material, contact the ATEC Office immediately.

Sincerely,

Raymond Thompson
ATEC President

JAMES RARDON AVIATION MAINTENANCE TECHNICIAN STUDENT OF THE YEAR AWARDS

Purpose: These awards recognize the outstanding achievement of Aviation Maintenance Technician students. These achievements must be demonstrated through academics as well as through involvement that makes a direct impact on the student's associates, school and/or community.

Eligibility: To be nominated, an individual must be a full-time AMT student at an institution that is a member of the Aviation Technician Education Council.

Nomination Process: Nominators must complete a Nomination Form with appropriate signatures by **February 1, 2011** and forward it to ATEC, Awards Committee, 2090 Wexford Court, Harrisburg, PA 17112.

Review Process: Following receipt of the nominations, they will be reviewed by the ATEC Awards Committee and Northrop Rice Foundation Board of Directors to determine ten (10) finalists. The The Board of the Northrop Rice Foundation will then select the James Rardon AMT Student of the Year award winner from the finalists. The winner will be contacted in late February 2011.

Selection Criteria:

1. **Leadership/Motivation:** What has the student done to encourage and lead his/her students to newer and higher levels of learning, or to promote aviation maintenance as a career?

   Total value in per cent. 35%

2. **Academics:** How has the student approached his/her own learning, and what grade level has the student achieved?

   Total value in per cent. 30%

3. **School/Community:** What has the student done to assist the school faculty develop new/better training methods, maintain necessary records and maintenance requirements, and/or promote the institution in the community?

   Total value in per cent. 25%

4. **Recommendation(s):** Additional (up to 3) recommendations or nomination statements will be considered to become as familiar as possible with the attributes, abilities and achievements of the nominated student.

   Total value in per cent. 10%

Awards: The 2011 James Rardon AMT Student of the Year award winner will receive transportation costs (airfare, hotel, meals, etc.) to attend the ATEC Annual Conference in Orlando, FL. on April 10-12, 2011. The recipient will be honored during the Awards Luncheon and will receive the "James Rardon Aviation Maintenance Technician Student of the Year" plaque. The other nine (9) finalists will receive by mail a "James Rardon Outstanding AMT Student" certificate. These ATEC awards are sponsored and funded by the **Northrop Rice Foundation**. Registration at the ATEC Annual Conference for the James Rardon award winner is provided by ATEC.

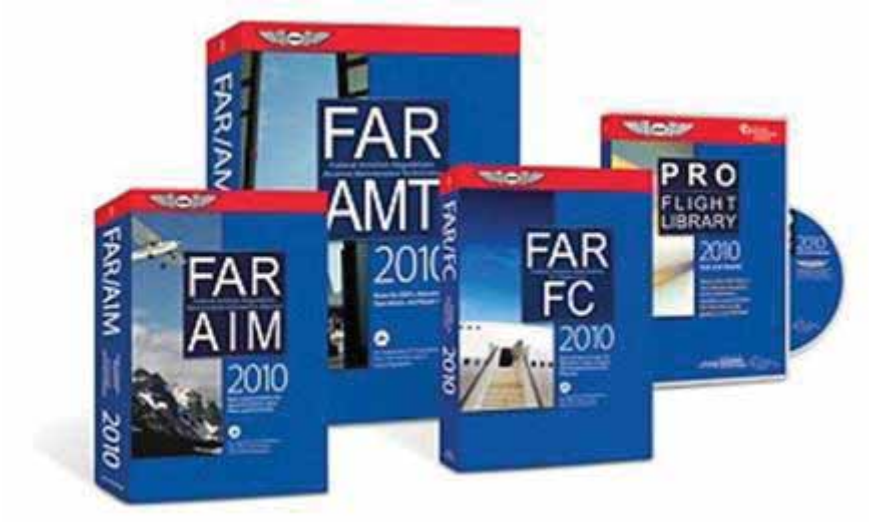
2010 FAR/AIM Series Now Available!

Newcastle, WA—ASA's 2010 FAR/AIM Series is now available. Both the *FAR for Flight Crew* and *FAR for Aviation Maintenance Technicians* are currently available. The FAR/AIM book and Flight Library Pro DVD will be available September 9.

For more than 25 years, ASA's Federal Aviation Regulations and *Aeronautical Information Manual* (FAR/AIM) books have been the standard regulatory reference of the industry. ASA has built a reputation for providing the aviation community with the most accurate and reliable FAR/AIM products available. For 2010 we continue this tradition by including the most current regulations, AIM, and Transportation Security Administration rules affecting the aviation industry, compiled throughout the year and available at the time of printing.

ASA consolidates the FAA regulations and procedures into three easy-to-use reference books and one DVD with information pertinent to pilots, flight crew, and aviation maintenance technicians (AMTs). In all ASA FAR/AIM Series books the changes are marked clearly for quick reference, and indexes provide clear and intuitive access to the subject matter and paragraph number or regulation. The *Aeronautical Information Manual* is reformatted for greater readability, and the full-color graphics provide excellent image detail and straightforward interpretation. The FAR/AIM has a user-friendly combined FAR and AIM index at the back of the book for quick and easy lookups.

FAR/AIM Series Updates are available at **www.asa2fly.com/farupdate** as free downloads and/or through a free email subscription service for automatic notification when a rule has changed. With the Federal Register released daily, yet the books and DVD only printed once a year, this Update service ensures pilots stay informed throughout the year. The quality books, DVD and Update service are what sets ASA apart from any other source available for the rules and procedures surrounding the aviation industry.



Title	Order Number	Suggested List Price
2010 FAR/AIM Book	ASA-10-FR-AM-BK	$16.95
2010 FAR for Flight Crew	ASA-10-FAR-FC	$19.95
2010 FAR for Aviation Maintenance Technicians	ASA-10-FAR-AMT	$24.95
2010 Flight Library Pro DVD (Includes thousands of FAA publications, regulations, and documents with over 18,000 graphics!)	ASA-10-FL-PRO	$79.95

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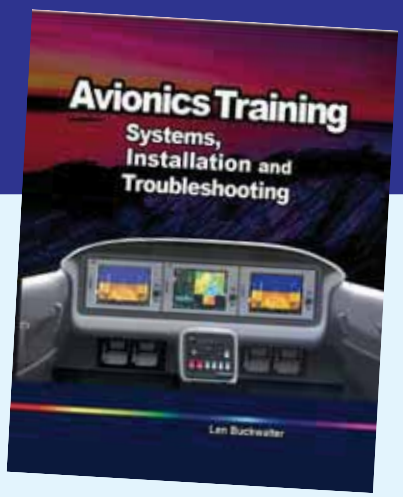
A 'Hands-On' Avionics Book for the Aviation Maintenance Technician



This book covers subjects now most in demand; including servicing and troubleshooting on the ramp and flight line.

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Avionics Training: Systems, Installation and Troubleshooting.
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To see full Table of Contents and 50-page excerpt from the book, visit ***www.avionics.com***

Call For Papers

The Aviation Technician Education Council is seeking papers for presentation at ATEC 2011, International Palms Resort, Orlando, FL, April 10-12, 2011. Papers for presentation on the following topics with the general theme of "Successes in the Classroom" are sought as they relate to the instruction and administration of FAR Part 147 programs:

Capstone Experiences

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Industry Advisory Boards

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Professional Development

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Strategic Planning

Abstracts (400 words maximum) must be electronically submitted in Microsoft Word by December 1, 2010. All abstracts will be reviewed and authors of accepted abstracts will be invited to submit a full paper. Authors must supply their own laptop computer or make other arrangements with ATEC prior to the convention. Authors must register for and present their work at Orlando, FL on Monday, April 11 (as scheduled), at the International Palms Resort.

Deadlines

December 1, 2010: Abstract Submission

January 24, 2011: Notification of Acceptance/ Rejection

February 25, 2011: Submission of Draft Full Paper/ Audio and Video requirements

March 18, 2011: Electronic Submission of Final Paper

Please direct any questions and or submissions to:

Harry Whitehead

Aviation Center

Lansing Community College

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