ATEC JOURNAL

SPRING 2012
Volume 34 • Issue 1
ISSN 1068-5901

A gift honoring Ivan Livi's long service to ATEC

This Publication is Dedicated to Aviation Maintenance Technician Training

Education Government ATEC Industry

Aviation Technician Education Council

ATEC Journal is the official publication of the Aviation Technician Education Council. It is published twice yearly by ATEC, 2090 Wexford Court, Harrisburg, PA 17112, (717) 540-7121. The publisher and editors of this journal do not accept responsibility for statements made by advertiser herein or for the content of opinions expressed by authors of articles published. Information contained in the Journal is for the purpose of education only and is not meant to provide actual instructions for any type of maintenance procedure. For more information about ATEC, contact:

Dick Dumarcsq; Executive Director; ATEC
2090 Wexford Court, Harrisburg, PA 17112
Phone: (717) 540-7121 FAX: (717) 540-7121
Email: ccdq@aol.com

STAFF

Editor Thomas W. Wild
Art Director Mindy Irby
Produced by Purdue University Printing Services
Email domenic.proscia@vaughn.edu for notification of new issue on the web

ISSN 1068-5901

ISSUE/AD CLOSING DATES & ADVERTISING RATES/ISSUE

ISSUE	*CLOSING DATE*	*DISTRIBUTION DATE*
Fall	Sept. 15	Nov. 15
Spring	April 1	May 1

ADVERTISING RATES PER ISSUE

1/2 page: four-color........................ $125.00
Full page: four-color........................ $250.00
2 Full page: four-color........................ $350.00

Information to be published in ATEC Journal and advertising materials can be sent to:

Thomas W. Wild
205 North Highland Court, Oxford, IN 47971
Phone: (765) 426-3102 FAX: (765) 494-2305
wildt@purdue.edu

Advertising and billing questions should be directed to:
LuAnne Davis; ATEC, 2090 Wexford Court, Harrisburg, PA 17112

As an aviation educator, industry person, or administrator, I'm sure you have many teaching techniques that are unique. These ideas can be communicated to other educators through an article published in the ***ATEC Journal***. Authors are encouraged to submit their articles, whether scholarly, research, application, or opinion, by submitting a disk copy by mail or by submitting the information by e-mail of the article to the editor for consideration. The article's illustrations, photographs, citations and structure should be included. Biographical information should be supplied for each author listed (i.e., name, current position, institution/company/organization, location, academic degree, etc.)

The ***ATEC Journal*** is a peer reviewed/refereed publication. Article submissions or questions concerning the ***ATEC Journal*** publication guidelines should be directed to the editor:

Thomas W. Wild, Editor
ATEC Journal
wildt@purdue.edu

Tools of the trade.

Whether for personal study or to form the basis of a training curriculum, ASA publications are the foundation of a strong education.

> Textbooks

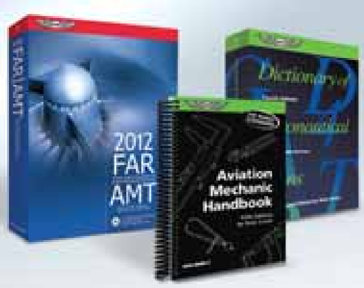
The Aviation Maintenance Technician Series provides the most complete, up-to-date textbooks for A&P students and educators in hardcover, full-color format. Meets 14 CFR Part 147 curriculum requirements and covers all the material in FAA Knowledge Exams for AMTs. Instructor's Guide and Textbook Images available for classroom support! Also available as eBooks, eBundles, and an eKit.

> Prepware Software

Questions, answers, and explanations included for the General, Airframe, and Powerplant FAA Knowledge Exams. An essential study tool that combines a powerful software program with the accurate and instructional material you expect from ASA.

> Test Guides

ASA's test guides help applicants pass the FAA Knowledge Exams required for A&P certification. The "Fast-Track" Test Guides include the largest sample of representative FAA questions available, supported with answers and explanations, as well as a helpful guide to the Practical and Oral Tests. Also available as eBooks!



> Reference Resources

ASA's references provide mechanics with the essentials. These handbooks are the source for all the regulations, terms, definitions, encyclopedic information and data fundamental to every AMT toolbox. *FAR-AMT* and the *Aviation Dictionary* are also available as apps and eBooks!

> FAA Handbooks

ASA's authentic FAA reprints have been the standard regulations and source material references of the industry for more than 30 years. ASA reprints are the real-deal with no interpretation, editing or modification from the original FAA release. Rely on ASA's authoritative study materials straight from the FAA to you. Also available as eBooks, eBundles, and in an eKit.

> Toolbox Essentials

ASA's logbooks and pilot supplies are built to withstand the typical AMT working environment. The AMT and IA logbook provides a way to track your hours for FAA, job, and insurance requirements. The LED flashlight is compact, bright, and durable.

Training Starts Here.

AVIATION SUPPLIES & ACADEMICS, INC.
Quality & Service You Can Depend On

www.asa2fly.com/amt

See our complete line of study aids, textbooks, pilot supplies and more at your local airport and in bookstores nationwide.
www.asa2fly.com | **1-800-ASA-2-FLY**

Technology Advancements within the Helicopter Industry that Result in Increased Safety, Speed and Efficiency

Daniel Mattingly
Southern Illinois University Department of Aviation Technologies

ABSTRACT
The purpose of this paper and presentation is to educate the reader and audience about the cutting edge technologies that are being tested by a couple of helicopter manufacturers. The two aircraft that will be discussed include the Sikorsky X2 and the Eurocopter X3.

A top level overview will be given for each helicopter that will include the technology advancements that are being pursued and the resulting impact that it could have within the aviation industry. Information will be presented that discusses the unique designs as well as information concerning Health and Usage Monitoring Systems (HUMS) and Active Vibration Control Systems (AVCS) that are being used to significantly enhance helicopter safety and maintenance.

INTRODUCTION
The first full production helicopter that was mass produced was Sikorsky's R-4 and it was introduced into the U.S. Army Air Forces in 1942. The Vietnam War was considered to be the first "helicopter war" in which helicopters were used extensively for air warfare as well as medevac and supply missions. The helicopter has evolved over the decades and the challenges that are consistently being faced by the manufacturers are innovative ways to increase their speed, reduce the noise, reduce the vibration levels, and increase the range that they can fly.

The rotor blades on a helicopter have to be large enough and long enough to support the weight of the helicopter while in flight while at the same time making sure that the tips of the blades do not reach the speed of sound. If the tips of the rotor blades were to reach the speed of sound the drag and vibration levels would be vastly increased. One of the most recent improvements within the helicopter industry are new rotor blade designs that are allowing helicopters to reduce the rotor noise and vibrations that are created during operation. (Wilson, 2011) Airframe, power train, and propulsion differences are also being introduced that are also allowing helicopters to set new speed records.

Sustained airspeeds in traditional helicopters that are flying faster than 170 knots can result in a hazardous operational environment. The vibration levels are extremely high that will rapidly exhaust the pilots, make reading the instrument panel difficult and can cause equipment to become unfastened or loosened. Sikorsky and Eurocopter are two of the most recent helicopter manufacturers that have seemed to solve the old engineering difficulty of increasing the helicopter's speed without forfeiting the aircraft's stability or maneuverability.

An unofficial speed competition has taken place between the Sikorsky X2 and the Eurocopter X3 aircraft. The Sikorsky X2 achieved a maximum cruise speed of 252 knots in level flight on September 15, 2010 and the Eurocopter X3 flew 232 knots on May 12, 2011. The previous helicopter airspeed record was 216 knots set by the Westland Lynx ZB500 in 1986. (Bernstein, 2011)

SIKORSKY X2
The Sikorsky X2 helicopter is an entirely new design. As shown in figure 1, one of the unique characteristics of Sikorsky's X2 is that the aircraft has no tail rotor. The tail rotor is not required as an anti-torque device due to the aircraft having two coaxially installed four blade contra-rotating main rotors.

Another unique feature is the six blade pusher propeller that is shaft driven from the single engine helicopter. This allows the aircraft to be propelled forward at higher speeds than traditional helicopters while slowing down the speed of the main rotors.

The demonstrator helicopter was flown with a single T800-LHT-801 engine developed by the Light Helicopter Turbine Engine Company (LHTEC) which a partnership between Rolls-Royce and Honeywell. The engine produces a power output of 1,563 shaft horsepower.

The initial aircraft demonstrator utilized conventional helicopter controls that included a cyclic stick, a collective lever and anti-torque pedals while utilizing fly-by-wire (FBW) technology. Future design plans for the aircraft production would also utilize FBW that would combine the conventional controls into

Figure 1. Sikorsky X2 Experimental Demonstrator Aircraft

(Courtesy of Wikimedia)

a single side-arm controller (SAC). Yaw control is accomplished by increasing the blade pitch in one rotor and decreasing the blade pitch in the other rotor for hover and low speed operations. A rudder is used to assist in yaw control at higher speeds. (Pole, 2011)

The demonstrator aircraft was created using metal skin and structural members, with composite rotor blades and an Active Vibration Control System (AVCS). The AVCS will be discussed in more detail later in this article. Future plans call for composites to be used for the aircraft's skin and structure.

A total of 23 flights were conducted for the X2 demonstrator with the first flight taking place on August 27, 2008 and the final flight on July 14, 2011. Approximately 22 hours of total flight time were accumulated. As the aircraft entered retirement, the lessons learned from the completed testing are being used to develop and incorporate the technologies into an aircraft called the S-97 Raider helicopter. The S-97 is being designed as a light assault/attack aircraft for evaluation by the U.S. military in 2014 under the Army's Armed Aerial Scout Program along with other proposed uses. It will include a six seat cabin, have the ability to carry armament, have an endurance of more than 2.7 hours, a range of 570 kilometers and a cruise speed of more than 200 knots. The Raider aircraft may be designed as an Optionally Piloted Vehicle (OPV) so that it can be operated with or without pilots. (Sikorsky, 2011)

There will be a single General Electric T700 engine installed in two prototype S-97 aircraft that will be operated in support of the Raider test program. The current plan for production aircraft is to install the two General Electric YT706-GE-700R engines with Full Authority Digital Electronic Control (FADEC). Future aircraft could be retrofitted with engines that fall under the U.S. Army's Improved Turbine Engine Program (ITEP) that is planned as the next generation 3,000 shaft horsepower class engine for medium lift applications. The goal under ITEP is to produce an engine that provides a 25 percent improvement in specific fuel consumption, a 65 percent increase in power-to-weight ratio, a 35 percent reduction in production and maintenance costs and a 20 percent increase in engine design life. (Rotor & Wing, 2009)

The X2 design considered to be scalable which would allow it to be manufactured in a variety of sizes and cater to various potential missions within the commercial and military aviation industries. Some of the missions include search and rescue, armed aerial scout, medical evacuation, attack, VIP transport and transportation of personnel and supplies to offshore oil rigs. (Sikorsky, 2011)

EUROCOPTER X3

The Eurocopter X3 was designed by using an existing airframe from the Eurocopter Dauphin helicopter as shown in figure 3. As shown in figure 2, the conventional tail rotor was removed and a twin tail empennage was installed in its place. A pair of short span wings has been mounted with each having a separate five bladed propeller. During high speed flight, the speed of the main rotor is slowed down to avoid the possibility of exceeding the speed of sound at the rotor blade tips and the short span wings provide approximately 50 percent of the aircraft's lift. The propellers are used to counter the torque of the main rotor and are also used to provide thrust at higher forward airspeeds while the twin rudders are used only for maintaining trim. In order to counter the torque of the main rotor, the left propeller spins slower than the right propeller. The main rotor is equipped with five rotor blades. The two tractor propellers and main rotor are driven by two Rolls-Royce Turbomeca RTM322 turboshaft engines rated at 2,270 shaft horsepower each.

Multiple flights have been conducted for the X3 helicopter with the first flight taking place on September 6, 2010. Flight testing is taking place in Istres, France. A maximum cruise speed of 232 knots in level flight has been achieved.

Figure 2. Eurocopter X3 Experimental Helicopter (Courtesy of Wikimedia)

Figure 3. Eurocopter EC155 Dauphin Helicopter (Courtesy of Wikimedia)

Lessons learned and data from the X3 demonstrator flights is still under review. Eurocopter has not yet announced any plans on how this technology will be incorporated into future aircraft designs.

A well kept secret that should prove to be technologically advanced is what Eurocopter has named the X4. The X4 aircraft has been designated to replace the AS365/EC155's and is supposed to introduce a totally new way of flying. Existing technologies are being matured while pursuing significant increases in payload and performance while at the same time becoming more environmentally friendly. When it is completed, it is stated that the configuration will transform the traditional configuration of helicopters as we now know them. Per Eurocopter, "Sitting in the X4, one thing will immediately become evident: The cockpit as we know it today will not be there." (Eurocopter, 2011)

HEALTH AND USAGE MONITORING SYSTEMS (HUMS)

The original HUMS were developed almost 30 years ago and they were initially used on twin-engine helicopters being flown to oil rigs in the North Sea. Variations of the original HUMS is beginning to be used quite extensively on newly manufactured military and civilian helicopters. The V-22 Osprey is the first Navy helicopter to have factory installed HUMS hardware on all airframes and the system was called VSLED which stands for Vibration, Structural Life, and Engine Diagnostics. (Maley, Plets and Phan, 2006)

HUMS is a generic term that refers to a monitoring and data collection system that focuses on rotorcraft .It is primarily used to record engine and gearbox performance data and provide rotor track and balance data. It may also be used to monitor auxiliary power unit usage and exceedances as well as including built-in test and flight data recording (FDR) capabilities. A more advanced HUMS designed with additional capabilities can acquire, analyze, communicate and store data gathered from sensors and accelerometers that monitor the essential components needed for a safe flight. The data can be downloaded to a ground station and analyzed to help determine trends in aircraft operations and component usage. The data provided to the maintenance technician can contain important information relative to a history of vibration characteristics, fluid temperatures, and engine over-torquing events. This can help reduce unscheduled maintenance which increases the aircraft's availability to the operator. System or component exceedances or faults can be made available to the pilot so that an appropriate action can be taken in flight and the information can also be relayed to ground stations so that maintenance personnel can be prepared with the necessary parts or troubleshooting procedures when the aircraft lands at its final destination. This can lead to reduced aircraft downtime and allow for more efficient planning by the operator.

As an example and shown in figure 4, a large number of sensors can be utilized to monitor the health of an aircraft. HUMS can range from a simple event monitoring system to elaborate systems that include accelerometers that measure vibration

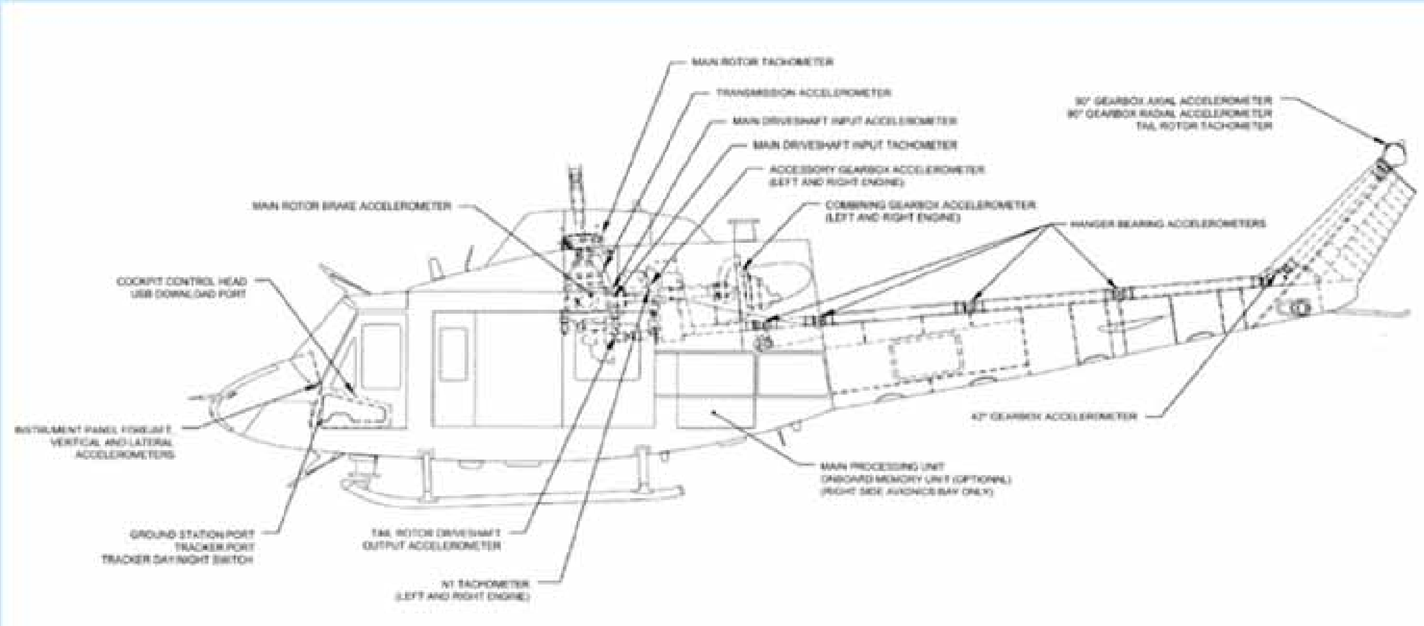


Figure 4. Sensor Locations on a Bell 412 HUMS Helicopter

(Provided by Bell Helicopter Textron Inc.)

levels to identify impending component failures, sensors that monitor the rotor and engine speeds, strain gauges that monitor loads being applied to various parts of the structure, temperature sensors, pressure sensors, chip detectors, and control position transducers.

Another advantage of HUMS is that while it monitors the health of the aircraft's components, items that are found to be nearing their life limit may be retired early based on the results of the data and as a result it can lower the overall operating expenses. It can also be used to provide data that could possibly increase the life limit of healthy components. The collected data can also provide information to a data recording system that would assist investigators in the event of an accident.

HUMS is considered to be one of the major contributors that can be installed and used to help reduce helicopter accidents. When properly used, HUMS can significantly enhance helicopter maintenance and safety. It is considered by some to be the most significant single contributor to safety improvement. (Aviation Today, 2006)

ACTIVE VIBRATION CONTROL SYSTEMS (AVCS)

In general, when helicopters operate there are many different vibration frequencies present at different levels of amplitude due to the large number of rotating components operating at different frequencies/speeds. Over a prolonged period of time the vibrations can damage or compromise the integrity of precision aircraft instruments, structural members can become fatigued and components of the aircraft could suffer leading to a shortened service life as a result. The higher levels of vibration can also attribute to pilot fatigue. Technology is consistently being pursued to help lessen or dampen the vibrations that are created as the result of operating the helicopter.

There are basically two type of vibration control systems that can used in helicopters and they are either passive or active in design. A passive type system is purely mechanical and typically contains a mass consisting of a large weight, a spring and a damper. They are normally very heavy installations and can only dampen limited vibrations in a specific orientation whether they are longitudinal, lateral or vertical vibrations.

An active vibration control system typically contains accelerometers that measure helicopter vibration levels and the signals are then sent to a centralized computer. The computer then interprets the data and sends commands to force generators that are located throughout the aircraft. The force generators then create forces that stop the progression of the vibrations caused by the rotor system or other dynamic components. Force generators have been designed that can work to create either linear or circular control forces. Figure 5 depicts the typical equipment used with a linear force generator and figure 6 depicts typical equipment used with circular force generators.

CONCLUSION

The Sikorsky X2 and Eurocopter X3 are two very different design concepts, but what they have in common is the ability to sustain forward cruise airspeeds above 225 knots. The challenge now before the two companies is to development production aircraft using the proven designs that can meet the needs of the customers while keeping the purchase and operating costs down. The possible production applications for these types of versatile aircraft are abundant in both the military and the civilian industry.

Some of the technology that was once considered to be leading edge is now becoming more common as the rotorcraft designs evolve to include technology that was found only in military or commercial fixed wing aircraft. This could include the use of composites for rotor blades, structure and skin. It also includes the use of glass cockpits and data busses, fly-by-wire flight control systems, Global Positioning System (GPS) navigation, some type of Health and Usage Monitoring Systems, and an Active Vibration Control System.

Helicopters are progressively becoming faster with less vibration, have more power available while operating at a lighter gross weight and at the same time they are safer and have the diagnostic capability to monitor systems and components for impending failures. The ability to remove a component prior to total failure is in itself safer while also decreasing the turnaround times of the helicopter due to maintenance. Scheduled operations are more reliable while keeping the operational costs lower.

Figure 5. Components with Linear Force Generator (Courtesy of Lord Corporation)

Figure 6. Components with Circular Force Generator (Courtesy of Lord Corporation)

REFERENCES

Aviation Today. (2006, February). HUMS: Health and Usage Monitoring Systems. *Aviation Today*. Retrieved from http://www.aviationtoday.com/am/categories/bga/76.html.

Bernstein, J. A. (2011, January). Sikorsky and Eurocopter Compete to Build Super-High-Speed Choppers. *PopSci*. Retrieved from http://www.popsci.com/technology/article/2010-12/concepts-and-prototypes-twice-fast.

Eurocopter. (2011, March) Eurocopter's X4: A Look into the Future. *The successor to Dauphin will transform the helicopter industry*. Retrieved from http://events.eurocopter.com/en/article/ eurocopters-x4-look-future.

Maley, S., Plets, J., and Phan, N.D. (2006, May). *US Navy Roadmap to Structural Health and Usage Monitoring – The Present and Future*. Paper presented at the American Helicopter Society 63rd Annual Forum, Virginia Beach.

Pole, K. (2011). Sikorsky's X2 Technology. It's as much evolution as revolution. *Helicopters Magazine*. Retrieved from http://www.helicoptersmagazine.com/content/view/92/61/.

Rotor & Wing. (2011, September). Rotorcraft Report: Next Steps for Army AATE/ITEP Program. *Rotor & Wing Online News*. Retrieved from http://www.aviationtoday.com/rw/ products/engines/Rotorcraft-Report-Next-Steps-for-Army-AATEITEP-Program_34802.html.

Sikorsky. (2011, July). X2 Demonstrator Takes Final Flight as Sikorsky Paves Way for S-97 Raider. *Helihub*. Retrieved from http://www.helihub.com/2011/07/18/x2-demonstrator-takes-final-flight-as-sikorsky-paves-way-for-s-97-raider%e2%84%a2/.

Wilson, J. R. (2011, April). Helo Evolution. *Defense Media Network*. Retrieved from http://www.defensemedianetwork.com/stories/helo-evolution/.

BIOGRAPHICAL INFORMATION

Name: Daniel I. Mattingly

Affiliation: Southern Illinois University, College of Applied Science and Arts, Department of Aviation Technologies

Location: Carbondale, Illinois

Title: Assistant Professor in Part 147 Curriculum and Helicopter Specialization

Degrees: M.S. Aeronautical Science, Embry Riddle University
B.S. School of Technical Careers, Southern Illinois University
A.S.T. Electronics Engineering, Pennsylvania Institute of Technology
A.A.S. Aviation Technologies, Southern Illinois University

Contact: email: dmatting@siu.edu

Phone: 618-453-9284

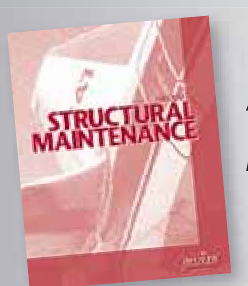
AMT Textbook Series

- Designed for 14 CFR Part 147-approved curriculum
- Contains thousands of updated, high-end images
- Reduces repetition, streamlines material
- Most up-to-date content available

Introduction to Aircraft Maintenance

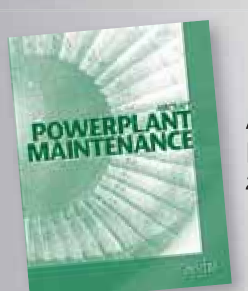
3rd Edition

Chapter structure revised to flow better with most Part 147 programs. Additional graphics and illustrations added to enhance concept explanations.



Aircraft Structural Maintenance
Revised

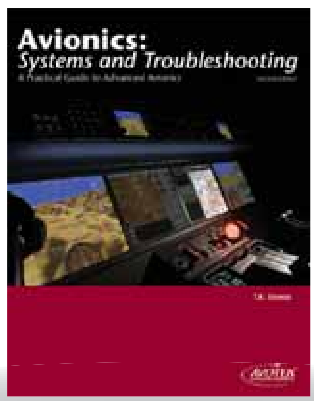
Aircraft System Maintenance
Revised



Aircraft Powerplant Maintenance
2nd Edition

New avionics titles from AVOTEK®

Avotek is pleased to present its newest editions for avionics systems training. These publications were developed to meet the needs of avionics training programs and those desiring NCATT certification.



Avionics: Systems and Troubleshooting

The second edition by T.K. Eismin. Updated to focus on new technologies and the latest aircraft developments including those found in Boeing and Airbus aircraft. Student workbooks are available to supplement the textbook.

Avionics: Beyond the AET

Designed for those who already have an AET certification and want to add NCATT endorsement. Begins with a review of key AET concepts and quickly moves on to more advanced avionics material. Written by respected author Tom Inman.

AVOTEK® INFORMATION RESOURCES

P.O. Box 219 Weyers Cave, VA 24486
800.828.6835 | Int'l 540.234.9090
www.avotek.com

Cooling Down Your Reciprocating Aircraft Powerplant Run Stand

Matthew W. Harrison and Michael L. Kasnick
Southern Illinois University
Department of Aviation Technologies

ABSTRACT

Most aircraft technician training schools utilize some form of runnable aircraft engine test stand. This practice gives the aspiring A&P technician a vital background in engine troubleshooting and servicing. However, when using an air-cooled aircraft engine such as the Lycoming O-360 using automotive fuel with ethanol, the operator may realize that proper engine cooling tends to suffer because the propeller or test club provides the only source of cooling. Without a cowling to duct the inbound propeller air through the cylinder cooling fins and baffling system, engine cylinder head temperatures are at the whim of this "unguided" air. While this scenario is not a wasted experience for training, it does not reflect parallel operation to an actual aircraft engine installation. With the addition of an in-house fabricated bonnet or test stand cowling, the operator will notice that cylinder and exhaust temperatures become closer to each other and reflect ranges that are representative of its aircraft counterpart. This particular installation takes advantage of the undergraduate research assistant's training in aircraft sheet metal and composites courses to create a cowling that closely resembles a modern cowling and baffling installation that is seen on aircraft. This could easily be included as a special project into a current Part 147 program's structures, sheet metal or composites course. In addition to the fabrication of a cowling to aid in evenly cooling engine cylinder temperatures an oil cooler system was created and installed to lower engine oil temperatures using standard AN hardware/hoses and an aftermarket automotive oil cooler with similar characteristics to an aircraft grade oil cooler. This could also be a great project to be included into a Part 147 fuel/oil systems or hydraulics course. This presentation will examine the processes used to create the test stand cowling and oil cooler system. It will also explore possible inclusion of these projects into the Part 147 curriculum.

BACKGROUND

This project evolved around using a reciprocating aircraft powerplant on a test stand. The powerplant is a Lycoming O-360 A1A engine. It is installed on an in-house fabricated test stand that is utilizing a Dynon EMS-D120 engine monitoring system capable with data logging and Unison LASAR ignition system. The test stand was built in order to observe small changes in engine and system wear patterns while operating on automotive gasoline with approximately 6-15 percent ethanol in addition to overall engine performance. The test stand was also created to fill an instructional gap with current and emerging technologies that are seen within the certificated and experimental aviation markets. While not having this setup on a flying aircraft, which would be ideal to gather performance data, within the limits of our university budget, this project could have a real impact on quality training for emerging technicians. There are many other topics that are found inside this paper that could become other papers and research ideas. This article will be limited, however, to creation of and needs for cooling a stationary reciprocating aircraft powerplant that is typically seen in FAA part 147 training environments.

Reasons for deciding to add a cowling or oil cooler system to a powerplant test stand may not appear to be obvious at a brief glance. But when taking a closer look it will become known that it is necessary and that it is no simple task. There are many possible ways to accomplish these tasks. The methods we employed for creation are based on major deciding factors such as, available university funds and tools/equipment that are available within our facilities.

Aspects of this project could also be easily tied into current FAA 147 curriculum courses as additional lab/research projects.

WHY DO WE NEED TO COOL OUR ENGINE?

Maybe the best way to begin looking at cooling the engine requires a slightly different mindset. If we pose the scenario of an aircraft engine that has no cowling or cooling shroud, running outside on a day where the outside temperature is say, 40 degrees. We might be led to believe that the engine is not having a cooling issue as long as the engine oil temperature never goes above the green arc. This might be true to a certain extent. One major issue that you will find if you watch engine cylinder head temperatures (CHT) is that these numbers are drastically different. These variances can lead to engine performance changes. For example: our test engine (which is still in the break in process and had no oil cooler or cowling installation before this paper was written) was victim to that type of running scenario with vastly differing CHT temperatures between each of the 4 cylinders. The front cylinders (1,2 on the Lycoming), which are closest to the propeller, run significantly cooler in CHT than the rear cylinders (3,4) on the same engine. This is largely due to the fact that the engine cylinders are relying on cooling air that is only coming from the thrust air being produced by the propeller. Without a cowling this air is quickly dissipated around the engine and not through the engine, as you would find on the same engine mounted on an airframe with a cowling.

For generic engine installations that are being used for traditional technicians tasks, such as magneto timing or fuel delivery adjustments this setup may work just fine. But for the application where you want to simulate actual aircraft performance as best as you can without being able to fly, a cowling/bonnet system is mandatory.

Another aspect of this test stand that became evident during our initial runs is how much hotter the engine runs while using standard automotive gasoline with 6-15 percent ethanol added, at least during engine break in. Thanks to liquid cooled engines in automobiles and limited aviation setups, this temperature change is less evident. But for a post WWII air-cooled aircraft engine, it is obvious. When running our engine with no cooling aids, the engine oil temperatures runs very close to redline when operating for longer than approximately 40 minutes. Fabricating a cooling system was warranted to bring these temperatures down, for the engine's benefit but also so we can increase running duration for simulated flights.

FABRICATION OF OIL COOLER SYSTEM

Creation of the oil cooler system is fairly straightforward. It can also be rather inexpensive when compared to other aircraft parts and systems. If desired, this project could be added to a powerplant testing or lubrications course within the FAA part 147 curriculum. It would also be a suitable student worker project. The project started by selecting a location on the engine test stand to mount an oil cooler and its required hoses, fittings and connectors. The main concern was to have the cooler in the propeller airstream but not have it disturb airflow or further complicate the soon to be constructed cowling. After selecting the B & M SuperCooler Automatic Transmission Cooler P/N B&M70273 (11" x 5 ¾" x 1 ½"), which are 100% aluminum construction and use stamped, plates sandwiched together. Not only does this cooler design provide for good cooling but it also provides a sturdy design to be impervious to flying rocks or other debris in an automotive racing situation (JEGS, 2012). Because of this it should be suitable for an aircraft powerplant test stand environment.

Figure 1 shows that the oil cooler has a large frontal area and capacity, similar to an aircraft style cooler. It was mounted to the test stand structure aft and below of the engine. It was also decided to mount it away from exhaust tail pipe as much as possible to not add undo heat from the exhaust to the oil cooler heat exchange process.

Figure 1. Oil cooler installation

Figure 2. Oil cooler lines to engine

Figures 1 and 2 show the oil lines to and from the oil cooler and engine that are standard AN Aeroquip 303-10 hose with Aeroquip -10 fittings covered with fire sleeve. Cheaper automotive style hoses may have been used, but in order to make the test cart as similar to an airplane as possible and to utilize the A&P skills of the student technician building components for the test cart, AN hoses/fittings were selected.

Installation was quick and simple. We drilled ¼ inch holes in the test stand frame to mount the oil cooler using standard AN hardware. Once the cooler was mounted we took measurements for the length of oil cooler and return lines that would be needed. With those dimensions, the oil lines were cut and assembled with the Aeroquip fittings.

Upon completion of the oil cooler and line installation, the engine was run to operating temperature and a leak check was performed to see if any additional torqueing of cooler/line fittings had to be done. It was noted that after about 40 minutes of running that the oil temperature was significantly lower at about 190 degrees with the oil cooler compared to runs without the oil cooler where oil temperatures would be nearing 280 degrees. A difference of 90 degrees! This was a very positive result and proof that the oil cooler alone provided a significant amount of cooling to the engine as a whole. It however had no bearing on the temperature differences between the front and rear cylinders. These indications made the need for a cowling seem all the more critical now.

THE NEED FOR A COWLING ON THE TEST STAND

When an aircraft engine is nestled inside of an assembled cowling and running, air flows through the opening in the cowling via the propeller thrust and/or forward movement from the aircraft. This air flows through the cylinders and exits the bottom or rear of the cowling assembly. Figure 3 shows a typical air-cooled aircraft engine setup (Jeppesen, 2009). The exit of the cowling creates a low pressure during operation. The inbound air from the cowling entrance is high impact pressure. The differences in pressures throughout the cowling keep air moving through the cylinder assemblies drawing hot air from the combustion process that is radiated off of the cylinder cooling fins and carries it out of the cowling. This airflow also attempts to keep individual cylinder temperatures in line with each other. This process is the major way an air-cooled aircraft engine's temperatures are kept constant. Accomplishing precisely even cylinder temperatures is a topic for another day. Companies such as GAMI have devoted their careers to increasing engine horsepower and life by synchronizing these temperatures.

In a test stand environment such as ours, where the temperature of the engine is dependent on the quality of the cowling/oil cooling system when installed has a direct correlation to engine and cylinder temperatures during operation. The creation of the cowling for the test stand is an attempt to keep engine and cylinder temperatures comparable to one on an aircraft that is in flight. There are limitations however. The test stand only

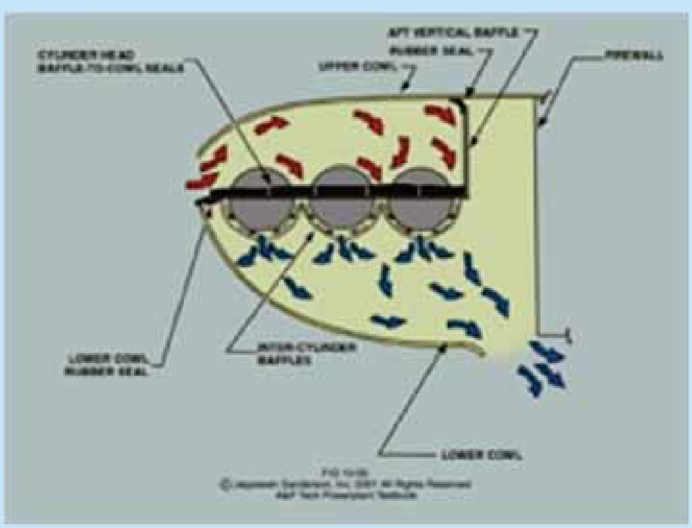


Figure 3. Showing typical cylinder cooling

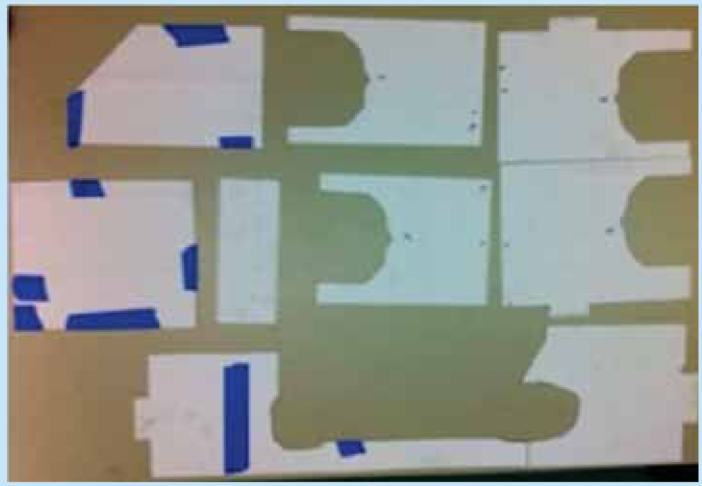


Figure 4. Prototype Cardstock Cylinder Baffling

operates at field elevation and is at the whim of Mother Nature for outside air temperature. In lieu of this our goal was to cool the engine as best we can and lessen the difference between front and rear cylinder temperatures as much as possible.

This was accomplished by building a cowling that could be installed to the test stand structure and to mimic an aircraft cowling as close as possible with equipment and supplies that most technician training schools might have on hand and still be able to cool the engine and cylinders in an acceptable manner.

FABRICATION OF TEST STAND COWLING

Creation of a cowling for this test stand was broken into several smaller projects. Aspects of both sheet-metal and composite construction were used. Because there is no existing airframe to mount a full cowling to, the inner cylinder baffling had to be built strong enough to mount the outer composite cowling to. In traditional aircraft the inner cylinder baffling is usually .032 aluminum or less and is attached directly to the engine. The upper cowling and lower cowling are connected together and attached to the airframe by the rear sitting loosely around the engine core. This engine test stand was created with a composite upper cowling or duct that mounts to the cylinder baffling system, which uses .060 aluminum in order to maintain sufficient strength in order to secure the upper composite cowling/duct directly to the cylinder baffle structure.

PHASE ONE

The first phase of construction was designing the sheet-metal baffling structure. (If desired, this type of project could be completed in a basic sheetmetal FAA part 147 course or utilizing a student worker. To simplify the fabrication process, the baffling was prototyped using large sheets of card stock cut into the desired shapes of each metal baffling piece. Figure 4 shows the pieces that were made for use on this Lycoming O-360-A1A engine. Once the templates were fitting properly, those were transferred to the sheet metal and the respective pieces were cut, drilled and were trial fitted on the engine. Once trial fitted, final tweaks to each piece were made and the baffling was secured to the engine. The baffling was created in several pieces to allow a some movement during expansion and contraction as a result of engine heating and cool down. We did this intentionally to minimize repairs due to cracking. In addition, when cracking occurs we can make repairs to affected areas without having to remove the entire assembly. Figures 5 and 6 show views of the completed engine baffling installation to which the upper composite cowling will be mounted.

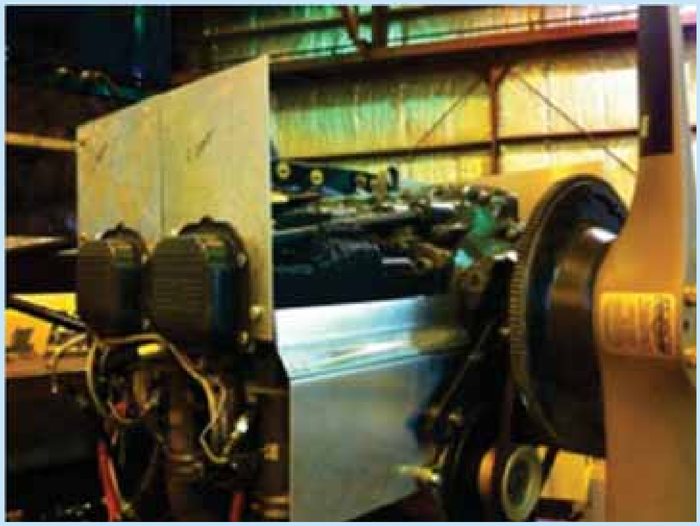


Figure 5. Right Side Cowling View

Figure 6. Left Side Cowling View

PHASE TWO

Once the lower cowling/engine baffling installation was completed the composite fabrication for the upper cowling can begin. (This portion of the project could be done in an FAA part 147 basic structures or composites course. It could also be accomplished using a student worker.) For this assembly, a foam plug was created for the fiberglass and honeycomb cowling lay-up. The foam plug essentially creates a negative of what the cowling will be. Blue polystyrene foam with a 2 lb. density was used to create the fiberglass plug. The plug acts as the part that the cowling is made up around. Shaping the foam can be accomplished in a couple of ways, coarse sanding or a hot wire setup and then finish sanding would be the ideal methods. Then once the fiberglass process is completed, the foam is removed and the cowling can be prepped for paint etc. Figure 7 and 8 show plug mock up and final plug finishing prior to being covered in protective plastic and being laid up with fiberglass, honeycomb and resin.

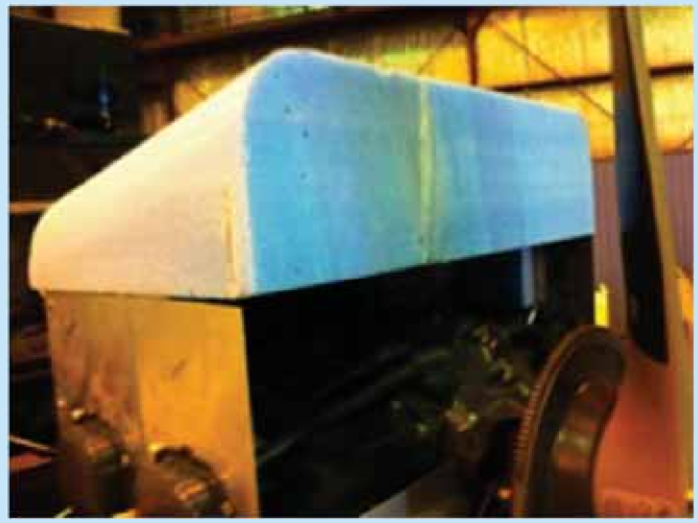


Figure 7. Plug Mock Up on Engine

Figure 8. Plug Finishing

After completion of the plug, the actual fiberglass lay-up and honeycomb process can be started. The fiber used could be many different types of material. Our composites lab had an excess supply of 7781 fabric (see figure 9) that is 8.95 oz./yd.^{2} (303 g/m^2) 57 Warp X 54 Fill, 8H Satin Weave, 9.0 mils (.23mm) thickness, so that was chosen to be used (Fiberglass Supply, 2012). When orienting fiberglass it is important to take note of the warp direction and fill direction. Warp direction is in the direction the fiberglass comes off of the roll but also it is the direction that has more fibers. For the 7781 fiberglass there are 57. The fabric is stronger in this direction. When creating the layup of fiberglass for the cowling, this warp direction has to be monitored and alternated in each layer to give the fiberglass cowling strength in many directions. If all the warp layers were lined up with each layer the fiberglass would be very strong in one direction only. In order to prevent this ply orientation for each layer of fiberglass was oriented 45 degrees from the previous layer.

In between the top 2 layers and lower 2 layers of fiberglass a honeycomb core (See figure 10) was inserted to give additional strength to the cowling. This honeycomb was 1/8 inch resin coated phenolic. Like the fiberglass being used, the honeycomb core is also weaker/stronger in a certain directions. This weaker direction is called the ribbon direction. The honeycomb is made up of thousands of strands of the phenolic ribbons and then glued together. This is called the ribbon direction and is similar to the grain structure of wood. Wood is very week along this grain line and very strong perpendicular to it. The ribbon direction or grain line needs to be considered when adding honeycomb to a project. The cowling needs to be stronger against the inbound air coming from the propeller. To accomplish this the honeycomb ribbon direction was laid perpendicular to this airflow stream. If it was laid parallel to the airstream the pressure from the air entering the cowling could cause it to crack along that ribbon direction. In addition to this, the edges of the honeycomb were also sanded to a taper. This was done to prevent delamination of the fiberglass at the edges of the honeycomb.

Figure 9. Fiberglass #7781

Figure 10. Honeycomb Fitting

The honeycomb was sandwiched between two saturated layers of fiberglass using West Systems 105 Epoxy and West Systems 205 Slow Hardener that were mixed at a ratio of 1:1, see figure 11. It was allowed to cure over night and then the foam plug was removed and the upper cowling was trimmed of excess resin and fiberglass. After it was test fitted on the engine baffling to check for any last minute adjustments it was sanded, primed and painted.

Figure 11. Wet-layup

Figure 12. Temporarily Mounted Cowling

FINAL INSTALLATION AND TEST RUN

The final installation and test run were an exciting few hours. The cowling was set onto the lower baffling structure and then all the mounting screw holes were marked on the rear side of the cowling. In figure 11, blue masking tape was used along the bottom edges of the cowling where the holes were to be drilled in order to see the pilot-hole drill markings that were made through each nutplate hole. MS21059 floating nutplates were then riveted into the lower sheet metal baffling. Once the nutplates were secured the final holes were drilled in the fiberglass cowling and mounted using stainless screws and washers.

The test unit was then secured outside on the ramp for a test run. The run-up yielded some very positive results. For the runs, the cylinder with the highest temperature was selected for pre and post cowling runs. The numbers were taken after a 30-minute warm up period on the engine and after accelerating to full power for approximately 30 seconds. Peak cylinder head temperature during engine operation before the cowling installation was #1 at 378, #2 at 369, #3 at 454 and #4 at 460. After the cowling was installed, the cylinder head temperatures were checked again and were as follows #1 at 371, #2 at 380, #3 at 327 and #4 at 354.

The cowling gave immediate cooling results to individual cylinder temperatures just as the oil cooler did for overall engine oil temperatures. It also brought the cylinder temperatures more in line with each other, which is an ideal performance consideration. This is a great outcome for the cowling fabrication. The front cylinders (1, 2) stayed less than 11 degrees apart from their original temperatures and the rear cylinders temperature in #3 dropped 127 degrees and in #4 dropped 106 degrees. The cowling made a significant difference to the rear engine cylinders and maintained temperatures the front cylinders were already creating.

SUMMARY

Many aircraft technician training schools are utilizing aircraft engine test stands to train their students about the maintenance and troubleshooting of the engine and its related systems. Others may be using the test stand as a research platform for other projects such as this author. In order to keep the engine in peak operating condition and to have it mimic the test stands flying counterpart, it is critical that as many steps as possible be taken to accomplish this.

Running an aircraft engine without proper cooling systems may yield performance that isn't comparable to actual engine operating environments. Negative aspects of this such as engine life may be deteriorated and significant performance changes can be seen. Engine parameters like oil temperature and cylinder head temperature are two of the major elements to be seen performing less than satisfactorily.

From a research and technician education standpoint these are problems that need to be monitored closely and addressed. The investment of time and money into the fabrication of a cowling such as the one laid out in this article will be seen immediately in engine performance and ultimately in the increased life of the test engine.

The projects used in this article could be accomplished inside a FAA part 147 curriculums' powerplant or lubrications course and a composite or structures type course. They may not be the type of project that would be ideal every year but they could be easily added as an additional project or perhaps they would be better served as an independent study project. Either way, the students will gain valuable skills and operational knowledge.

REFERENCES

Fiberglass Supply. (2012). On-line catalog, Fiberglass Fabrics. Retrieved March 8,

2012 from: http://www.fiberglasssupply.com/ Product_Catalog/Reinforcements/Glass_Fabrics/glass_fabrics.html

JEGS. (2012). On-line catalog, B&M SuperCooler. Retrieved February 14,

2012 from: http://www.jegs.com/i/B%26amp%3BM/130/70273/10002/-1

Jeppesen. (2009). A&P Technician: Powerplant Textbook, Englewood, CO: Jeppesen.

AUTHOR'S BIOGRAPHICAL INFORMATION

Name: Matthew W. Harrison
Affiliation: Southern Illinois University
College of Applied Sciences and Arts
Department of Aviation Technologies
Location: Carbondale, Illinois
Title: Assistant Professor
Degrees: M.S. Ed., Southern Illinois University
B.S. Aviation Management, Southern Illinois University
A.A.S. Aviation Maintenance Technologies, Southern Illinois University

Name: Michael L. Kasnick
Affiliation: Southern Illinois University
College of Applied Science and Arts
Department of Aviation Technologies
Location: Carbondale, Illinois
Title: Undergraduate Student Researcher

Gleim Maintenance Courses Approved for FAA AMT Awards Program

Gleim is proud to announce that all of our online courses for aviation mechanics and IAs have been approved in the FAA AMT Awards Program.

This program is designed to help pilots and mechanics maintain currency and proficiency and therefore become safer in accomplishing their respective duties. The AMT Awards Program encourages ongoing training by attending seminars, completing on-the-job training programs, or completing approved online courses like these from Gleim.

The newly approved Gleim courses consist of the following:

- AMT Gleim Online – Airframe
- AMT Gleim Online – General
- AMT Gleim Online – Powerplant
- Inspection Authorization Renewal Course
- Inspection Authorization Training Course

These courses join the 19 other widely used Gleim courses that have previously been approved under the Wings – Pilot Proficiency Program.

"With the approval of these courses for aviation mechanics and those with Inspection Authorization, we hope to build upon our successes and help inspire more individuals to engage in continuing education," said Dr. Irvin Gleim, company president.

As with all Gleim courses, you may try the first Study Unit of each of these Gleim courses for free at http://www.gleim.com/aviation/demos/.

Nida Corporation
Aviation Maintenance Technology

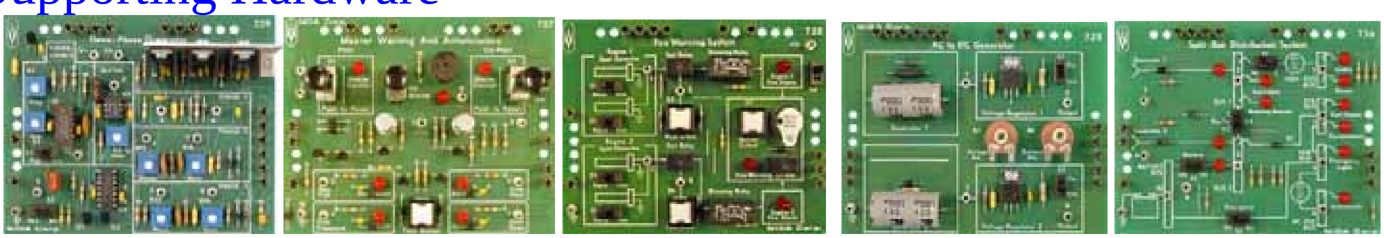
- Introduction to Aviation Maintenance
- Science for Aircraft Technicians
- Aircraft Support Systems
- Basic Aircraft Electronics **
- Aircraft Power Generation and Distribution Systems
- Aircraft Instrument Systems
- Aircraft Systems
- Introduction to COM/NAV Systems

Additional Available Courses:
AVIONICS MICROPROCESSORS INDUSTRIAL CONTROLS
RF COMMUNICATIONS TELECOMMUNICATIONS
CABLES & CONNECTORS DATA COMMUNICATIONS
** Additional Experiment Card Sets Required

Nida's performance based AMT program provides the perfect electrical and electronic training supplement to your airframe and power plant training curriculum. Students practice on live circuits before proceeding to very expensive aircraft systems.

Nida's Computer Assisted Instruction Training System

Supporting Hardware



Samples from Model 1438A Experiment Card Set

Contact

Nida Corporation
300 South John Rodes Blvd. • Melbourne, FL 32904 USA
Tel: (800) 327-6432 • Fax: (321) 727-2655 • Web: www.nida.com

Cost/Benefits of Blended Winglets Using Emissions Trading System Impacts

Mary E. Johnson and Alan Gonzalez
Aviation Technology, Purdue University

INTRODUCTION

Aviation Technology has an important opportunity in the Emissions Trading System. As of January 1, 2012, aviation is now included in the European Union (EU) Emissions Trading System (ETS) after the International Civil Aviation Organization (ICAO) failed to implement the mandated global scheme for aviation. (Duffy, 2011) In an effort to mitigate the climate impacts of aviation, the EU has decided to impose a cap on CO2 emissions from all international flights – from or to anywhere in the world – that arrive at or depart from an EU airport. For instance, if flying non-stop from Chicago to Athens, the emissions for the entire flight are assessed, not just the portion of the flight over EU airspace. Since emissions for the flights are capped, emissions allowances also have a monetary value and are traded, within limitations. While the United States, China, and other countries are actively fighting to stop the EU assessing ETS charges, the European courts have upheld the ETS. Individual airlines are assessed CO2 emissions based on the amount of fuel spent from pushback to takeoff to flight to arriving at the terminal. Airlines plan to pass this cost on to the consumer. The advent of emissions becoming a cost for airlines also provides opportunity for aviation technology professionals to justify the cost of fuel-saving aircraft modifications and innovations. This paper introduces the emissions trading system, describes a cost/benefit analysis using blended winglets, and suggests methods for inclusion in aviation technology classes.

EMISSIONS TRADING SYSTEM (ETS) SIMPLIFIED

Beginning in January 2005, the EU Emissions Trading System covered only the heavy energy using industrial plants that are also responsible for nearly half of total EU CO2 emissions. As of January 2012, emissions are monitored from all flights arriving or departing from an EU airport in the 27 EU Member states plus Iceland, Liechtenstein and Norway. In December 2011, the European Court of Justice decided against some US airlines and their trade association in their suit to stop the inclusion of aviation in the EU ETS. As with the industrial plants, airlines receive tradable allowances covering a certain level of CO2 emissions from their flights per year. At the end of each year, airlines must surrender the number of allowances equal to their actual emissions in that year. Airline operators use a market to buy and sell their emission allowances cost-effectively. If an airline's actual emissions are lower than their allowances, surplus allowances may be sold or held to cover future emissions. If emissions are expected to exceed allowances, the airline can either take measures to reduce their emissions or purchase additional emission allowances on the market from industrial installations that have reduced their emissions. Because emissions are now a cost, there are opportunities for investing in more efficient technologies or operational practices if purchasing allowances is too costly. (European Commission, 2012)

The total quantity of allowances to be allocated to aircraft operators is determined based on the average of the annual emissions from years 2004, 2005 and 2006. The total quantity of allowances to be allocated in 2012 will be equal to 97% of the estimated historical aviation emissions of the European Environment Agency (EEA), with further reductions planned through 2020. In July 2011, the EEA-wide cap for aviation was set at 221,420,279 metric tons (over 488 billion lbs) of CO2. The calculation of historical aviation emissions is based on data from Euro control (the European Organization for the Safety of Air Navigation) and actual fuel consumption information provided by aircraft operators. Fuel consumption by auxiliary power units (APUs) on aircraft at airports was estimated. (European Commission, 2012)

Using the following formula, CO_2 emissions from aviation activities may be estimated by:

CO_2 emissions = Fuel consumption in metric tons * emission factor

In this equation, fuel consumption may be estimated with fuel volume consumed in liters and a standard density factor of 0.8 kg/liter and 1000kg per metric ton. Emission factors are 3.10 for AvGas and 3.15 for Jet A1 or Jet A in metric tons of CO2 /metric ton of fuel. (The Commission of the European Communities, 2009)

This brief introduction is meant to provide basic information on ETS. More complete information and extensive explanations may be found at the European Commission website www.ec.europa.eu.

AIRFRAME MODIFICATIONS: BLENDED WINGLETS AND SHARKLETS

One way of reducing fuel consumption and emissions is the use of airframe modifications that reduce drag and improve airplane performance. Many older model 737, 757 and 767 Boeing aircraft have been modified to add winglets, and 737-700, -800, -900ER have winglets as original equipment. Boeing flight test data demonstrated that blended winglets lower block fuel and carbon dioxide (CO2) emissions by up to 4 percent on the 737 and up to 5 percent on the 757 and 767 (Freitag & Shulze, 2009). Block fuel is the amount of fuel consumed during a mission from engine start to engine shutdown. (Airlines.net, 2012) Fuel savings for a 737-800 with 162 passengers on a 1000 nautical mile flight are estimated at 3.5%. For a single 767 airplane saving 4%-5% results in a reduced jet fuel consumption of 500,000 U.S. gallons per year. This translates into an annual reduction of more than 4,790 tons of CO2 for each airplane Blended winglets improve takeoff performance on the 737, 757, and 767, allowing lower takeoff thrusts that result in lower emissions and lower community noise. Estimates of savings vary depending on the aircraft, load, route, and other factors as seen in Table 1 (Freitag & Shulze, 2009).

Airbus has installed wingtip fences and larger winglet type devices on the A300, A310, A330, A340, and A380 as described on their website www.airbus.com. By improving take-off performance, these devices lower emissions and noise. Airbus' newest wingtip devices providing aerodynamic improvements are called Sharklets and are installed on the A320s. Some of the benefits cited by Airbus include reduced fuel consumption and emissions, increased range and payload, lower maintenance costs, and better take-off performance and rate-of-climb among others. With Sharklets, revenue payload may increase by 500kg (1,202lbs) or an additional 100nm range at the original payload. If Sharklets perform as expected, fuel consumption by be reduced by 3.5% or more, representing an annual CO2 reduction of approximately 700 metric tons per aircraft (Airbus, 2012).

Table 1: Sample estimates of fuel savings on airplanes equipped with blended winglets.

Aircraft	Load PAX	Mission (Nautical Miles)	Fuel use without winglets (lbs)	Fuel use with winglets (lbs)	Estimated Fuel Savings (lbs)	Estimated Fuel Savings %
737-800	162	1,000	13,386	12,911	475	3.5%
757-200	200	1,000	16,975	16,432	543	3.2%
767-300ER	218	3,000	65,288	62,419	2,869	4.4%

Adapted from (Freitag & Shulze, 2009).

Table 2. Winglet Prices

Aircraft	Base Price Uninstalled
737-700/800/900	$1,000,000
737-300/500	$590,000
757-200	$1,055,000
757-300	$1,185,000
767-300 ER/F	$2,265,000

Adapted from (Aviation Partners Boeing, 2011). All prices are stated in U.S. Dollars and are subject to escalation from January 2012 using U.S Bureau of Labor Statistics producer price index: WPU142 – "aircraft and aircraft equipment".

If blended winglets for a 767-300 ER/F cost $2,265,000 (plus approximately $500,000 for installation) and save 300,000 US gallons of JetA per year, and save 3,000 metric tons of CO2 emissions per year, then a cost/benefit analysis may be performed. In Table 2 estimated costs for Jet A are $3.19/gallon (International Air Transport Association, 2012) and CO2 are $9.14 (Intercontinental Exchange, 2012) per metric ton using costs and currency conversions for April 2, 2012. The payback period is estimated at 2.8 years. This cost/benefit analysis only looks at the economic benefits and does not attempt to quantify the environmental or social costs and benefits. The installation of winglets may occur during a heavy check, but will additional days to a C-check. The increased cost of downtime for the aircraft is not included.

Table 3. Example of Economic Cost/Benefit Analysis in US Dollars (all conversions are approximate)

Modification Cost		**Benefits**	**Quantity Reduced Per Year**	**Price per Unit**	**Annual Savings**
767-300 ER/ F Winglets	$2,265,000	Reduced fuel consumption	300,000 US gallons or 925,328 kg	$3.19/gal	$957,000
Installation	$500,000	Reduced CO_2 emissions	92.5328 metric tons of Jet A x 3.15 metric tons of CO_2 per metric ton of Jet A = 2,914 metric tons of CO_2	$9.14/ metric ton	$26,634
Total Cost	**$2,765,000**			**Total Savings**	**$983,634**
Payback Period is 2.8 years.	**Payback Period = Cost/Savings = $2,765,000/$983,634**				

To get a better idea of the amount of carbon dioxide estimated for flights, Table 4 displays CO2 emission calculations round trips per passenger from and to cities between the US and Europe based information provided by the ICAO Carbon Calculator (International Civil Aviation Organization, 2012). This calculator estimates the carbon dioxide generated by airline passengers based on the fuel consumption by the aircraft typically on the route, cabin capacity, and other factors. In addition, estimates for a 3.5% and a 4.0% reduction in fuel consumption are shown.

Table 4: Estimated Carbon Emission Reduction Analysis with CO2 amounts based on the ICAO Carbon Calculator

From	**To**	**Distance Round Trip**	**Round Trip CO_2 Emissions**	**3.5% CO_2 Reduction per Passenger**	**4% CO_2 Reduction per Passenger**
London, (LHR)	New York (JFK)	11,076km (6,882 mi)	769 kg (1,695 lbs)	31 kg (68 lbs)	27 kg (59 lbs)
Chicago, (ORD)	Frankfurt (FRA)	13,930km (8,655 mi)	983 kg (2,167 lbs)	39 kg (87 lbs)	34 kg (76 lbs)
Dallas/ Fort Worth, (DFW)	Paris (CDG)	15,864km (9,857 mi)	1,096 kg (2,416 lbs)	44 kg (97 lbs)	38 kg (85 lbs)
Rome (FCO)	Miami (MIA)	16,644km (10,342 mi)	1,147 kg (2,528 lbs)	46 kg (101 lbs)	40 kg (88 lbs)
San Francisco, (SFO)	Madrid (MAD)	18,652km (11,589 mi)	1,153 kg (2,541 lbs)	47 kg (103 lbs)	41 kg (90 lbs)

CONNECTIONS TO PART 147 PROGRAMS AND AET PROGRAMS

The coverage of blended winglets could be included during airframe structures courses that cover labs for 14 CFR Part 147, Appendix C, 1. Airframe Structures, number 25, "assemble aircraft components, including flight control surfaces" (Federal Aviation Administration, 2012). In addition, winglets could be included in classes discussing STCs, aircraft modifications, fuel efficiency, gas and turbine engines, and emissions. While the ETS currently affects flights only to and from Europe, aviation companies have customers and aircraft that are from nations across the globe. Aviation students are encouraged to be exposed to regulations and jargon from the FAA and other nations in order to be more valued at future employers.

CONCLUSION

The EU Emissions Trading Scheme (ETS) imposes added costs for airlines and air travelers to and from Europe, and at the same time, provides an added opportunity for aviation technicians to devise modifications to aircraft that reduce fuel consumption and emissions. As aviation is a global business, it is important for students to be prepared to participate in discussions that include regulations from US and other nations.

REFERENCES

Airbus. (2012). Winglets. Retrieved 3 25, 2012, from http://www.airbus.com/innovation/proven-concepts/in-design/winglets/?contentId=%5B_TABLE%3Att_content%3B_FIELD%3Auid%5D%2C&cHash=22935adfac92fcbbd4ba4e1441d13383

Aviation Partners Boeing. (2011). Program List Prices. Retrieved 11 28, 2011, from http://www.aviationpartnersboeing.com/products_list_prices.php

Duffy, N. (2011). An Update on EU ETS: Are we confident? Airline Fleet Management (AFM) , 74,24-26.

European Commission. (2012). Reducing emissions from the aviation sector. Retrieved 1 19, 2012, from http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm

Federal Aviation Administration. (2012). Electronic Code of Federal Regulations. Retrieved April 4, 2012, from Government Printing Office: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=254d0a9fb7f5e213a9ab065d8da40a81&rgn=div5&view=text&node=14:3.0.1.2.20&idno=14

Freitag, W., & Shulze, T. E. (2009). Blended Winglets Improve Performance. Retrieved 11 28, 2011, from http://www.boeing.com/commercial/aeromagazine/articles/qtr_03_09/article_03_1.html

Intercontinental Exchange. (2012). Emissions. Retrieved 4 2, 2012, from https://www.theice.com/productguide/ProductGroupHierarchy.shtml?groupDetail=&group.groupId=19

International Air Transport Association. (2012). Jet Fuel Price Monitor. Retrieved 3 30, 2012, from http://www.iata.org/whatwedo/economics/fuel_monitor/Pages/index.aspx

International Civil Aviation Organization. (2012). Carbon Emissions Calculator. Retrieved 3 30, 2012, from http://www2.icao.int/en/carbonoffset/Pages/default.aspx

The Commission of the European Communities. (2009). Commission Decision. Official Journal of the European Union , L 103, 10-29.

BIOGRAPHIES

Mary E. Johnson is an Associate Professor in Aeronautical Engineering Technology at Purdue University. Her research interests include aircraft engine emissions, process improvement, and aviation sustainability.

Alan Gonzalez is a graduate student in Aviation and Aerospace Management at Purdue University. He plans to complete his MS in May 2013. His research interests are in emission trading schemes and their effects on US and global airlines.

Your Curriculum - Served Your Way

Print

Aircraft Technical Book Company offers the most extensive in-stock selection of aviation maintenance textbooks, study aids, videos, and instructor support anywhere, including dozens of titles available nowhere else. We offer 100% custom kitting, competitive pricing, liberal support policies, and the best and most innovative service in the business. That's how in 9 years we've grown to nearly 1500 titles from over 80 publishers, managing 27 aviation catalogs, and serving academic customers in more than 40 countries. Aircraft Technical Book Company - Your Professional Source.

eBooks

now compatible with most eReaders

Hundreds of titles (more being added constantly) are available in downloadable format for your PC, Mac, laptop, and now most of the new eReaders. Nothing can be easier or cheaper. Starting a new class? Just download your books right onto your iPad. All eBooks are fully searchable, extensively book-marked and compatible with .pdf type functions. Compatible eReaders include iPad 1&2, and Android version 2.2 or greater readers such as Acer, Dell Streak, Motorola Xoom, Samsung Galaxy, HP Zeen, and upcoming Nooks.

Class in a Flash

These custom USB flashdrives come preloaded with YOUR school's required book list and are packaged to sell in your school's bookstore. Your students can now choose between a heavy stack of textbooks or this simple one ounce drive. Just plug and play in any Windows computer. Class-in-a-Flash drives hold your entire required book list with plenty of room for a student's personal files including notes, assignments, and other school documentation. They are convenient, inexpensive, updatable for future semesters, environmentally correct, and fully guaranteed.

AIRCRAFT TECHNICAL Book Company

Your Professional Source

800 780-4115
www.ACtechBooks.com
www.ACtechBooks.com/wholesale
Tabernash, CO USA

Integration of a College Skills Foundation Course into a Part 147 Airframe and Powerplant Curriculum

Karen J. Sullivan and Dennis R. Hannon
Southern Illinois University, Department of Aviation Technologies
636 Flightline Road, Carbondale, Illinois 62901
ksulliva@siu.edu
dhannon@siu.edu
618-453-9201

ABSTRACT

As the field of airframe and powerplant maintenance technology evolves, we have found that a greater volume of highly complex material needs to be incorporated into the limited amount of instruction hours available in a typical FAA Part 147 A & P curriculum. In order to prepare students for what has by necessity become a faster pace of learning, good foundations in college skills, which involve everything from proper study habits to efficient use of information technology, are essential. To accomplish this our department has, in conjunction with a university-wide initiative, developed a stand-alone course in College Skills and Learning Foundations. To incorporate this aspect of learning into our existing curriculum, a number of conditions had to be satisfied. Initially, an appropriate time slot for the course needed to be identified, the available course material adapted, and finally the material packaged and integrated into the program. A set of learning objectives were established to encompass not only general aspects of college study skills but also a means to relate those skills to the mission of our program; specifically acquiring a working knowledge of the responsibilities, proficiencies and dedication required for a successful career in the field of aviation technologies. This paper examines that process and comments on its methods and results.

INTRODUCTION

The Department of Aviation Technologies curriculum at Southern Illinois University Carbondale, while built around preparing students for successful completion of the FAA airframe and powerplant oral and practical examinations, has traditionally included extensive additional instruction in one of three specializations beyond the 1900-hour basic A & P requirements. Ultimately leading to a baccalaureate degree, these concentrations include advanced aviation maintenance, aviation electronics and helicopter technology. In addition to the FAA tasking required of a certificated A & P program, students in the baccalaureate program are required to take university core courses in English, technical mathematics, humanities, multicultural studies and management as well as advanced courses in their specializations. The program also offers a minor in aircraft product support to students interested in pursuing careers relating to aviation logistics, reliability and maintainability, or management information systems. In addition to the above offerings, the department was tasked with the integration of a mandatory three credit hour college skills course as part of the university's first year student initiative. Overall, the mission of first year program as developed by the University Department identified as *Saluki First Year* is to guide new first year incoming students through their transition to campus life (Saluki First Year, 2011) and provide them with a foundation for pursuit of the knowledge and skills required for success in their chosen field. This particular course was designed to prepare students for the extremely fast learning pace required of them over the next four or five years in a university learning environment. While the core objectives of the skills course are by no means unique to the field of aviation maintenance, integration of the learning objectives set forth in the mandate into an existing A & P curriculum certainly was. Below are course learning objectives along with their sample indicators provided by the Saluki First Year Initiative staff in their course initiation and planning document (Amos, 2011):

LEARNING OBJECTIVES AND SAMPLE INDICATORS

1. Students will begin to develop a broad, comprehensive perspective on higher education. Students will
    - Explain the value of a university education and of the University Core Curriculum;
    - Explain the value of a university education received at a research institution;

- Summarize the expectations of the academic community, including the open exchange of ideas, knowledge and respect for diversity among constituents;
- Demonstrate an accurate understanding of the university's organizational structure and of connections among academic disciplines and courses;
- Demonstrate an understanding that scholarship is part of a dialog that requires cultural, societal, religious, and economic awareness;
- Demonstrate a knowledge of policies and practices of academic integrity;
- Demonstrate appropriate academic behavior, including regular class attendance and active participation.

2. Students will contribute to and help maintain a safe, supportive and positive university learning experience for themselves and their academic peers. Students will be able to

    - Identify campus resources and services that are available to support learning and student well being, including tutoring programs and supplemental instruction, Office of University College, Financial Aid, Wellness Center, Student Health Center and others.
    - Locate institutional documents such as the Schedule of Classes, Undergraduate Catalog, and the Student Conduct Code;
    - Connect with peers through student organizations and co-curricular activities;
    - Identify facilities, resources, or organizations that value and promote inclusive excellence among communities, cultures and worldviews;
    - Communicate and interact with faculty on matters related to their course work, academic plans and career paths;
    - Communicate and interact with library staff on matters related to research information and technical literacy.

3. Students will understand and begin to practice basic communication skills appropriate to the University setting. The student will be able to

    - Satisfactorily complete written class assignments;
    - Effectively participate in group- or team-based activities;
    - Communicate with faculty, advisors, and peer mentors, if applicable, on issues related to their own academic progress;
    - Demonstrate civility in interpersonal interactions in the academic setting;
    - Communicate and interact with peers from diverse backgrounds.

4. Students will begin the process of understanding critical thinking in the university context. The student will be able to

    - Approach academic problems and issues from multiple perspectives, including multi-national, multi-ethnic, multi-racial, and multi-religious;
    - Apply analytical strategies to analyze issues in specific fields or disciplines;
    - Apply critical thinking strategies in multiple contexts;
    - Understand the social, political, cultural, ethical, and environmental consequences of choices and behaviors.

5. Students will understand and apply information technology in support of their academic work. The student will be able to

    - Locate and use appropriate campus computer facilities;
    - Communicate effectively and properly using e-mail;
    - Identify resources for utilizing both general and specific software skills required by their course work and majors.

6. Students should begin to develop knowledge of their own abilities, skills, and life demands so that they can develop these more effectively in pursuit of their academic goals. The student will be able to

    - Understand and make use of multiple ways of seeing and knowing about the world;
    - Be reflective about their own learning styles and about how their background and environment may influence how they approach their education;
    - Evaluate and monitor their own academic progress, including the periodic evaluation of grade point average and progress with respect to an overall curricular plan;
    - Understand the importance and elements of a syllabus;
    - Understand and utilize strategies for preparing for examinations, completing assignments, note taking, and classroom participation;
    - Develop effective strategies for time management;
    - Understand the importance of fiscal management in both their personal life and in their professional career;
    - Explain the contribution of health and wellness to overall quality of life.

7. Students should begin to develop an understanding of career opportunities available to them and the professional responsibility associated with that career. Students will

   - Explore potential major and career paths, including job opportunities in those fields of study;
   - Demonstrate familiarity with professional organizations within their anticipated discipline;
   - Demonstrate an understanding of professional ethics and responsibility for one or more potential career paths;
   - Understand the importance of professional etiquette and civility within our community;
   - Develop a professional resume;
   - Understand the benefits of student internships and cooperative education opportunities.

8. Students will become information literate, using critical thinking and problem solving skills to build an intellectual framework for discovering, using and evaluating information. The student will be able to

   - Differentiate between popular and scholarly information, understanding when each is applicable in the context of academic scholarship;
   - Apply evaluation criteria to assess the reliability, validity, accuracy, authority, currency, and bias of information;
   - Demonstrate knowledge of intellectual property rights and plagiarism, as well as an understanding of proper attribution of information;
   - Distinguish among various formats of information and demonstrate awareness and effective use of search and retrieval aids;
   - Identify key services provided by Morris Library;
   - Recognize their role as contributors to scholarly discourse on campus, in the community, and within their profession.

The ninth and last objective was left to the initiative of the individual program to be designed to meld with their unique requirements and in this case stated in line with the primary goal of our Aviation Technologies Department. Along with the objectives, we were tasked with establishing indicators to relate the effectiveness of the program either by an appropriate metric or other subjective means.

9. Students will gain a working knowledge of the responsibilities, skills and dedication required in the field of aviation technologies. Students will

   - Demonstrate their awareness of proper work ethics in an aviation maintenance setting;
   - Gain knowledge of the research required to develop coursework in the field of aviation;
   - Understand and demonstrate the importance of networking within the aviation community;
   - Develop their ability to utilize aviation maintenance based computer software and other online aviation sites;
   - Demonstrate a higher understanding and the implications of the human factors involved in aviation maintenance;
   - Demonstrate a clear understanding of the process that leads to the implementation of aviation regulations.

THE MILLENNIAL STUDENT

The introduction of this UCOL course into an FAA Part 147 curriculum is greatly welcomed. By now, most teaching institutions are aware of the new influx of students that demonstrate the traits of the "Millennial Student". These students have been characterized by words like Special, Sheltered, Confident, Conventional, Team-Oriented, Achieving and Pressured (DeBard, ####). The faculty in the Department of Aviation Technologies at SIUC have been noticing some less than desirable trends in the attitudes and behaviors of the student body that seem to fit these traits of the Millennial Student. Students are becoming less willing to accept the traditional lecture style classes, attempting to negotiate their way through courses, being less agreeable to subjective evaluations, satisfied by average performances rather than striving to excel. Recently, these issues have prompted discussions among the faculty about developing a course designed to address this type of behavior among our aviation technology students. This faculty sees this UCOL course as an opportunity to do just that. With a substantial amount of developmental material in hand, we were ready to begin the process of course structuring and integration into our program.

IMPLEMENTATION

The path to course structuring was initiated in conjunction with the Department Chair and Aviation Technologies' Curriculum Committee through discussion, suggestion and volunteer assignment. One of the faculty and coauthors agreed to put together a course development plan, formalize a syllabus, and begin the process of establishing individual units of study with appropriate means of assessing students' understanding of the material covered.

COURSE DEVELOPMENT

The course structure for all versions of the class university-wide was defined by the Saluki First Year staff to require a roughly 2/3 emphasis on student success skills as outlined in the material provided and the remaining 1/3 emphasis on content relating directly to the discipline of the department offering the course as part of its core curriculum.

With the required tasking in place, a plan for accomplishing its charges needed to be considered. A one and one half month deadline was imposed on the department to ensure appearance of the course summary, level and credit hour changes to the Undergraduate Course Catalog in a timely manner. This short time frame left limited opportunity for the extensive discussion, compromise and approval sessions that are often associated with such endeavors. To minimize the potential for delay, an "add course" submission date was set in advance and adhered to with a workable syllabus serving as an outline for more extensive development. With the basics in place, the course was given a designation of UCOL 101 to distinguish it from an existing Aviation Technologies' AVT 101 course in Applied Science. Since the course constitutes a preparation for learning endeavor, it was decided to offer it in the first semester of the first year of study, typically in the fall.

This course will be required for University credit but will not be added into the FAR 147 curriculum. The discipline specific content in the course is in addition to the FAR 147 required content in our program.

FORMALIZING A SYLLABUS

The Saluki First Year Staff provided the requirements for the development of the course syllabus in the form of a checklist. This checklist included; course information, discussion/lab sections (if applicable), instructor information, discussion/lab assistants (if applicable), student learning objectives, course materials, attendance policy, grading, course expectations, university policies student services, and detailed course schedule. A copy of this developed syllabus is in included in Appendix A.

UNITS OF STUDY

In order to follow the course guidelines of 2/3 university student skills and 1/3 discipline specific skills, an aviation technologies related assignment was developed into each of the eight learning objectives, along with the university skills requirement. These assignments are meant to cover the ninth, discipline specific learning objective. For course approval, the following Discussion of Learning Objectives, including course assignments, was required to be submitted in the proposal:

1. Develop a broad, comprehensive perspective on higher education.
   - UCOL Assignment: Reading assignment from Chapter 1 Research and the Research University (including chapter assignments) from Britt Andreatta's textbook. This chapter includes topics on our University's mission and campus community, and begins an overview on what attending a research university means to students.
   - AvTech Assignment: Conduct a survey of the research projects/papers being worked on by the departmental faculty. This project is intended to let students begin to understand the amount of academic research involved in aviation technology course development. Also, the students are introduced to aspects of aviation they may have never previously been aware of, which could foster ideas of future career paths.

2. Contribute to help maintain a safe, supportive and positive university learning experience for themselves and their academic peers.
   - UCOL Assignment: Reading assignment from Chapter 2 The First Year Experience at the Research University (including chapter assignments) from Britt Andreatta's textbook. This chapter includes information on social and personal issues that first year students can expect during their college experience. Included, are four student development theories designed to provide guidance to first year students.
   - UCOL Assignment: Identification of SIUC student services opportunities, SIUC online and the SIUC Student Handbook. The Saluki First Year Initiative Staff is utilizing this course to introduce students to the many online and real-world services available to support them during their academic career at SIUC.
   - AvTech Assignment: Review of AvTech Departmental Student Handbook and AvTech online. Similarly, this department chose to include discussion of the departmental Student Handbook, which includes information specific to student conduct and expectations in the AvTech environment.

3. Understanding and beginning to practice basic communication skills appropriate to the university setting.
   - UCOL Assignment: Reading assignment from Chapter 7 The Diverse University Community (including chapter assignments) from Britt Andreatta's textbook. The Saluki First Year Initiative Staff wanted to put an emphasis on working with diversity. This chapter deals with the dynamics of working closely in the classroom with peers of different race, ethnicity, sexual orientation, spirituality, and political ideology.
   - AvTech Assignment: Group projects involving student organizations with an emphasis on aviation clubs (RWAA, Alpha Eta Rho, WIA…). Since this objective is designed to expose students to the diverse student community, and historically AvTech's student body is not-quite-so diverse, this section is being used to introduce our students to a wider variety of peers by encouraging involvement in SIUC Registered Student Organizations.

4. Beginning the process of understanding critical thinking in the university context.
   - UCOL Assignment: Reading Assignment from Chapter 3 Skills for Academic Success at the Research University (including chapter assignments) from Britt Andreatta's textbook. This chapter emphasizes the importance of the student's academic skills such as managing workload, and studying, analytical and communication skills.
   - AvTech Assignment: Writing/Research assignment on Aviation Maintenance Dirty Dozen Human Factors. With this course being one of the first courses that students will take, it seemed appropriate to include

a simple, beginner-level research paper. The Dirty Dozen Human Factors of Aviation Maintenance is a topic that all aviation technicians must be aware of in order to be a successful employee but unfortunately is not currently included in the FAA Part 147 required curriculum. This course is a suitable opportunity to add this content.

5. Understanding and applying information technology in support of their academic work.

    - UCOL Assignment: Introduction of SIUC Desire2Learn Learning Management System. Many university courses, including SIUC, utilize an online LMS for coursework. The plan for this section is to introduce the new Desire2Learn system to first year Saluki students.
    - AvTech Assignment: Involvement in an aviation forum. There are many online aviation related forums that can be helpful to the aviation technologies student by allowing them to discover the usefulness of networking with the aviation community. This assignment is meant to be continuous throughout the entire semester.
    - AvTech Assignment: Using www.faa.gov and www.regulations.gov and ATP software. These two particular websites and software are widely used by aviation technicians and can also easily be incorporated into many FAR 147 courses. However, by initially introducing them in this first year course, any time constraints that may exist in upper level A&P courses due to teaching their use may be alleviated. In addition, introducing these tools in this earlier course may allow for more in-depth assignments.

6. Begin to develop knowledge of their own abilities, skills and life demands.

    - UCOL Assignment: Reading assignment from Chapters 4 Independence, Family, Values and Campus Safety, 8 Leadership Development at the Research University, and 9 Planning for Your Future (including chapter assignments) from Britt Andreatta's textbook. All of these chapters address life lessons that college students face as they continue on through their academic years such as newfound independence, developing leadership and teamwork abilities, and planning for their future.
    - UCOL Assignment: MAP-Works assessment and understanding outcomes of a Learning Styles Inventory. The Saluki First Year Initiative Staff requires that each student take a learning style assessment. Again, with this being a first semester course, the discussion of the results from the inventory is intended to help the student to identify their individual strengths and weaknesses so they can be more effective learners during the rest of their academic career.

7. Begin to develop an understanding of career opportunities available to them and the professional responsibility associated with that career.

    - UCOL Assignment: Reading Assignment from Chapter 5 Degrees, Majors and Careers at the Research University (including chapter assignments) from Britt Andreatta's textbook. The connection between university majors and careers is illustrated in this chapter.
    - AvTech Assignment: Identification of AvTech Advisory Committee and other aviation professional organizations. SIUCs Aviation Technologies Department has an Advisory Committee that includes approximately 12 members from the aviation industry, including some that are departmental alumni. The introduction of this group is an attempt to emphasize the many career paths that are available to the graduates of our program and also provides to our students critical networking skills and industry connections.
    - AvTech Assignments: Introduction of FAA FAASTeam and Wings. It is necessary for aviation technology students to understand a technician's relationship with the FAA, our regulating agency. Occasionally, in the work place, there can be an unnecessary "fear" of the FAA, but if this assignment can demonstrate the benefits of a working relationship with the agency, then that "fear" may be diminished before it has a chance to grow.

8. Become information literate, using critical thinking and problem solving skills to build an intellectual framework for discovering, using and evaluating information.

    - AvTech Assignment: Research paper involving a current Notice of Proposed Rule Making pertaining to aviation maintenance. The intent of this research assignment is to involve the student in the development process of the rules and regulations that aviation technicians must abide by. This assignment will potentially allow students to become a part of this process as well.

The Saluki First Year Initiative staff had originally offered 3 possible textbooks to be used for the UCOL courses: *Navigating the Research University: A Guide for First-Year Students* by Britt Andreatta, *Power Learning: Strategies for Success in College and Life* by Robert S. Feldman, and a customized book used in SIUC's ENGR 101 course. Later, it was also decided to utilize the University's new Learning Management System, SIU Online powered by Desire2Learn along with the textbook. SIU Online will provide each UCOL course with a standard course shell, designed by the Saluki First Year Initiative staff, which will offer a repository of links to the required course content.

ASSESSMENT

Guidelines for assessment were provided in that instructors would administer a 25 question pre-test during the first week of classes and a similar post-test during the last week of classes with the results of these tests being be submitted to Saluki First Year as part of an Assessment Packet (Saluki First Year, 2011). Further, instructors were tasked with ensuring their students complete the MAP-Works® Student Profile instrument to inventory their strengths and learning styles and discussing the results with each student individually. Instructors were also required to have their students complete a much shorter follow-up MAP-Works® survey at the end of the semester (MapWorks, 2011). In addition, Saluki First Year Initiative encourages instructors to administer a short reflective essay at the end of the semester. Finally, a comprehensive proficiency exam will be given at the end of the course. The Saluki First Year Initiative staff will provide a portion of the exam that covers the first eight learning objectives. The remainder is to be developed by the instructor to cover the ninth, discipline specific, learning objective.

CONCLUSION

Considering the Aviation Technologies Program is accountable to both the University and Federal Aviation Administration, satisfying both entities in curriculum development and implementation can be difficult. Coupling this concept with the policy of academic freedom afforded to instructors in course development can provide a potential for conflict. While this in itself is not necessarily undesirable, much time and energy can often be devoted to argument and compromise prior to arrival at consensus. In the development of the UCOL 101 course, time available to formulate the course for aviation technologies students and implement its addition to the curriculum was limited. Fortunately, the basic structure of the course was provided by the Saluki First Year Initiative staff and the department chair left the responsibility to two faculty members, one of whom accepted the bulk of the task. This arrangement alleviated the need or perceived aspiration for extensive and time-consuming discussion leading to final course implementation.

In summary, it is firmly believed that our students will demonstrate the effectiveness of this course through the acquisition of more productive and successful study habits while instilling a concept of the unique responsibilities and obligations of an airframe and powerplant technician. Hopefully these acquired and/or enhanced skills and concepts will promote higher scores on the written and oral airframe and powerplant certification examinations and provide the benefit of higher overall grade point averages on behalf of the students while helping to ensure the availability of highly competent entry-level aviation maintenance technicians to the industry.

ACKNOWLEDGEMENT

The development package for the implementation of the University College Skills and Learning Foundations course was completed by Mark Amos and the Saluki First Year Initiative team at Southern Illinois University Carbondale. Dr. Amos and his team performed exhaustive research in this area to develop a basic curriculum that remained flexible enough for specific adaptation to the needs of the many departments in the university. Their hard work and administration of seminars explaining the material is greatly appreciated.

REFERENCE

DeBard, R. (2004). Millennials coming to college. In M.D. Coomes and R. DeBard (Eds.), *Serving the Millennial generation* (pp. 33-46). New York: Wiley Periodicals

UCOL 101-xxx
Foundations of Inquiry
Aviation Technologies Department

Course: UCOL 101-xxx
Foundations of Inquiry-Aviation Technologies

Instructor: Mr. or Mrs. Instructor

Required Textbook: Navigating the Research University. A Guide for First Year Students. Third Edition. Brit Andreatta, Ph. D, Rosemarie Menager-Beeley, Lyn Paulos ISBN: 978-1-133-27604-3

Course Description:
The first year seminar supports the transition of first year students as they enter our research university. Upon completion of this course, students will be able to demonstrate the knowledge, skills and behaviors critical for academic and personal success. Students will acquire the capabilities as they are introduced to the foundations of inquiry-the interests, assumptions, methodologies, and potential academic and career tracks associated with their disciplines of a particular college at SIUC. Sections will be limited to approximately 25 students each.

Student Learning Objectives:
1. Students will begin to develop broad, comprehensive perspective on higher education.
2. Students will contribute to and help maintain a safe, supportive and positive university learning experience for themselves and their academic peers.
3. Students will understand and begin to practice basic communication skills appropriate to the University setting.
4. Students will begin the process of understanding critical thinking in the university context.
5. Students will understand and apply information technology in support of their academic work.
6. Students will begin to develop knowledge of their own abilities, skills and life demands so that they can develop these more effectively in pursuit of their academic goals.
7. Students will begin to develop an understanding of career opportunities available to them and the professional responsibility associated with that career.
8. Students will become information literate, using critical thinking and problem solving skills to build an intellectual framework for discovering, using and evaluating information.
9. Students will gain a working knowledge of the responsibilities, skills and dedication required in the field of aviation technologies.

Course Work and Grading:

All assignments will be weighted equally. Assignments will be given point values that will be totaled and averaged at the end of the course for a final course grade. A pre-test and post-test will be administered. These tests will not be included in the course grade. Late assignments will receive a deduction of 10 percentage points from the assigned grade. See attached course schedule.

90-100 = A
80-90 = B
70-80 = C
60-70 = D

An INC is assigned when, for reasons beyond their control, students engaged in passing work are unable to complete all class assignments. An INC must be changed to a completed grade within a time period designated by the instructor but not to exceed one year from the close of the term in which the course was taken, or graduation, whichever comes first. Should the student fail to complete the course within the time period designated, not to exceed one year, or graduation, whichever come first, the incomplete will be converted to a grade of F and the grade will be computed in the student's grade point average. Students should not register for courses in which an INC has been assigned with the intent of changing the INC grade. Re-registration will not prevent the INC from being changed to an F.

Attendance Policy:

Attendance is mandatory. As an FAA certified Airframe and Powerplant Mechanic Training Program, we must abide by the FAA's attendance policy. Instructors are required to take roll each class period. It is the student's responsibility to contact the instructor in advance of absences whenever possible or immediately thereafter to arrange make-up time where appropriate and to obtain hand-outs or other material from classes missed.

Students are expected to be in class and lab on time. Three late arrivals will be counted against the student as on unexcused absence. Unexcused absences or habitual tardiness will result in a cumulative reduction of the student's final grade point average: First unexcused absence results in a 1 point reduction of the final grade. Second absences results in a 2 point reduction. Third absence results in a 4 point reduction. Fourth absence results in an 8 point reduction. Fifth absence results in a 16 point reduction. After the fifth unexcused absence the cumulative grade reduction would be 31 points, making it impossible to receive a passing grade for the course.

Make up time may be granted at the discretion of the instructor. Final determination as to whether or not an absence is "excused" rests with the instructor. Performance of make up time does not reinstate points lost due to unexcused absences.

Students absent from classes because of observance of major religious holidays will be excused. Student must notify the instructor at least three regular class periods in advance of an absence from class for a religious holiday and must take the responsibility for making up work missed.

Classroom Environment:
Preparedness for class is required for each class meeting. This includes bringing required textbooks and writing materials to class. Any reading assignments should be completed prior to class meetings with an expectation of extensively discussing said content.
As with any public forum, the classroom is a shared space where consideration and compassion for others are not negotiable. Inappropriate behavior or use of laptops, cell phones, personal music devices, magazines or newspapers will not be tolerated and taking part in any will result in your removal from class. This will be counted as an absence for that class meeting as well.
Acts of academic dishonesty are defined as the following:
1. Plagiarize or represent the work of another as one's own work.
2. Prepare work for another that is to be used as that person's own work.
3. Cheat by any method or means.
4. Knowingly or willfully falsify or manufacture scientific or educational data and represent the same to be the result of scientific or scholarly experiment or research.
5. Knowingly furnish false information to a university official relative to academic matters.
6. Solicit, aid, abet, conceal, or attempt acts of academic dishonesty.
None of these will be tolerated, and will be dealt with in accordance with SIUC policy. Please see the Student Conduct Code for additional information.

Additional Academic Assistance:
SIUC has an official email policy that can be accessed at
http://policies.siuc.edu/policies.email.htm

Disability Support Services http://disabilityservices.siuc.edu/
DSS provides federally mandated academic and programmatic support services to student with permanent and temporary disabilities. Disability services are located throughout the University in integrated settings. DSS provides centralized coordination and referral services. In order to utilize DSS services, students must come to the disability office to open cases. The process involves interviews, reviews of student-supplied documentation, and completing Disability Accommodation Agreements.

Notice: If you have any type of special needs(s) or disability for which you require accommodations to promote your learning in this class, please contact me as soon as possible. The Office of Disability Support Services (DDS) offers various support services and can help you with special accommodations. You may wish to contact DDS at 453-5738 or go to Room 150 at Woody Hall to verify your eligibility and options for accommodations related to your special need(s) or disability.

Writing Center http://write.siuc.edu/
The Writing Center offers free tutoring services to all SIUC undergraduate and graduate students and faculty. Come on in for a Writing Center session and improve your writing skills.

Learning Support Services http://tutoring.siu.edu/about.html
The Center for Learning Support Services (C.L.S.S.) assists students of all cultures, abilities, backgrounds and identities with enhancing their self-management and interdependent learning skills.

Saluki Cares www.salukicares.siuc.edu
The purpose of Saluki Cares is to develop, facilitate and coordinate a university wide program of care and support for students in any type of distress – physical, emotional, financial or personal. By working with faculty, staff, students and their families, SIUC will continue to display a culture of care and demonstrate to our students and their families that they are an important part of the community. To make a referral to Saluki Care call 618-453-5714 or email siucares@siu.edu

Emergency Procedures:
Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on the BERT's website at www.bert.siu.edu, Department of Public Safety's website www.dps.siu.edu (disaster drop down) and in the Emergency Response Guidelines pamphlet. Know how to respond to each type of emergency.
Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. **It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency.** The Building Emergency Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.

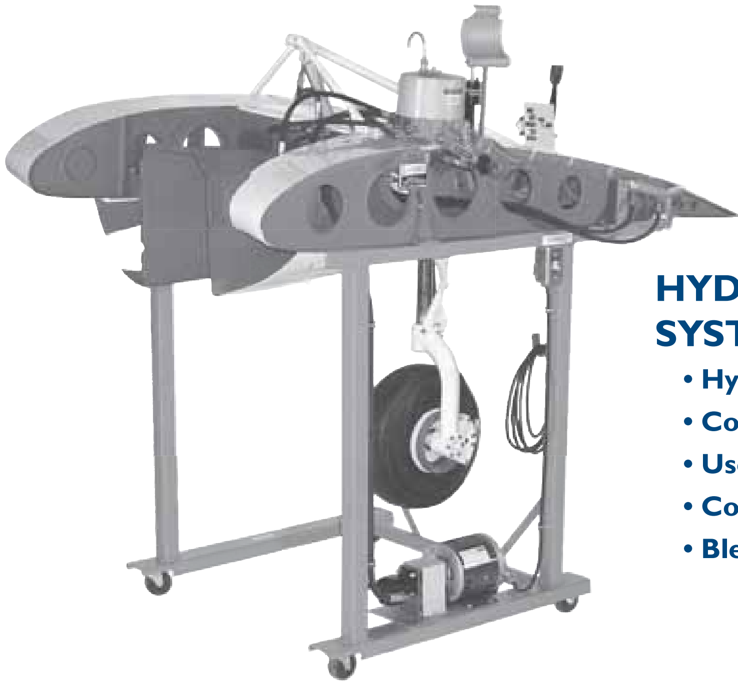
Course Schedule

UCOL 101-xxx Course Work

Week	
	All reading assignments include "So how does this affect you?" exercises.
1,2	UCOL Pre-test LECT: Review of SIUC/AvTech Student Handbooks Discussion of chapter 1 **Assignment**: Read Chapter 1
3,4	LECT: Identification of SIUC/AvTech online and student services Discussion of chapter 2 & 7 **Assignment**: Begin group RSO project **Assignment**: Read Chapters 2 & 7
5,6	LECT: Discussion of chapters 4 & 8 MAP-Works Student Profile and discussion of results **Assignment**: Read Chapters 4 & 8 *RSO Group Project due*
7,8	LECT: Design2Learn LMS and ATP software **Assignment**: ATP assignment *(due in Week 8)* *Week 7 – Student grade/performance reports from instructor*
9,10	LECT: FAA.gov and Regulations.gov review **Assignment**: Involvement in aviation online forum **Assignment**: Research Paper on NPRM
11,12	LECT: Discussion of Chapter 3; Skills for Academic Success Discussion of Aviation Dirty Dozen Human Factors **Assignment**: Written assignment on Dirty Dozen
13,14	LECT: Aviation professional organizations and FAA FASTeam Discussion of chapters of 5 & 9 **Assignment**: Read Chapters 5 & 9 *Dirty Dozen Assignment due*
15	UCOL Post test Reflective Essay *NPRM Research Paper due*
16	UCOL Proficiency Exam (Final) AvTech Proficiency Exam (Final)

• TEXTBOOKS • CUTAWAYS • PROPELLERS • GOVERNORS • CUSTOM MACHINE WORK • POWERPLANT SYSTEMS • MANUALS • COMPONENTS • SYSTEM TRAINERS • MULTIMEDIA RESOURCES • PROPELLERS • GOVERNORS • CUTAWAYS •

• SYSTEM TRAINERS • CD-ROMS • POWERPLANT SYSTEMS • MULTIMEDIA RESOURCES • SHOP EQUIPMENT • MANUALS • COMPONENTS



Special Discount 20% off

HYDRAULIC LANDING GEAR SYSTEM TRAINER

Offer ends June 30
call us for details

- Hydraulic flap system
- Completely functional
- Use for hydraulic system
- Complete your airframe lab
- Bleed brakes and service strut

MOVE AHEAD WITH AVOTEK®

SYSTEMS TRAINING

- Students get hands-on training
- Visible interactions between components
- Aircraft components, not simulations
- Builds on concepts developed for airline and military training

QUALITY

- Time tested: 36 years of product development
- Rigorous, multiple-point burn-in and testing
- Proven designs using high-quality components
- More than 75% of typical trainer made from new materials
- Airline quality at general aviation prices

SERVICE

- Full-time service and support staff
- Friendly assistance available by phone every working day
- Detailed records and documentation on every unit produced today
- Experienced staff takes pride in craftsmanship

AVOTEK® **800.828.6835**
www.avoteksuppliers.com

P.O. Box 219 • Weyers Cave, VA 24486
Int'l **540.234.9090**
fax **540.234.9399**

2012
SCHOLARSHIPS AND AWARDS

AERONAUTICAL REPAIR STATION ASSOCIATION STUDENT TUITION SCHOLARSHIP

1. Emmanuel Gonzales – Emily Griffith Technical College

AVOTEK BOOK AWARDS

2. Jason M. Hairrell – Aviation Institute of Maintenance
3. Drew K. Decker – Teterboro School of Aeronautics
4. Anthony Morgan – Aviation Institute of Maintenance
5. Scott Barton - Michigan Institute of Aviation & Technology
6. Daniel Ortega – Aviation Institute of Maintenance

AVOTEK DALE HURST MEMORIAL SCHOLARSHIP

7. Terry Michmerhuizen – Western Michigan University

SNAP-ON TOOL CORPORATION – TOOL AWARDS

1. Andrew Csonder – Western Michigan University
2. Jezail June – Michigan Institute of Aviation & Technology
3. Leon Cholakis – Embry Riddle Aeronautical University
4. Kyle Schneider – Southern Illinois University
5. Aaron O'Hara – Michigan Institute of Aviation & Technology

NORTHROP RICE FOUNDATION TUITION SCHOLARSHIPS

1. Denis Bulfoni – Teterboro School of Aeronautics
2. Chris Deller – Michigan Institute of Aviation & Technology
3. Alexander Pascoe – Aviation Institute of Maintenance
4. Nicholas Reyer – Columbus State Community College

2012
SCHOLARSHIPS AND AWARDS cont.

WING AERO BOOK AWARDS

Christine Yazzie – Clover Park Technical College

Rhys Yoder – Vincennes University

NIDA CORPORATION SCHOOL TRAINING EQUIPMENT

Salt Lake Community College – Todd Baird

ROTORCRAFT ENTERPRISES SCHOOL TRAINING EQUIPMENT

Teterboro School of Aeronautics – Edward Bennett

FLIGHTSAFETY INTERNATIONAL INSTRUCTOR SCHOLARSHIP

Harkamaldeep Hanzara – Michigan Institute of Aviation & Technology

AMERICAN EUROCOPTER INSTRUCTOR SCHOLARSHIP

Jeffrey Hope – Michigan Institute of Aviation & Technology

SOUTHWEST AIRLINES INSTRUCTOR SCHOLARSHIP

No Applicants

NORTHROP RICE FOUNDATION VETERAN BOOK AWARD

Joseph Oliver – United States Navy – Aviation Institute of Maintenance

IVAN D. LIVI EDUCATOR OF THE YEAR

Not awarded this year

2012
SCHOLARSHIPS AND AWARDS cont.

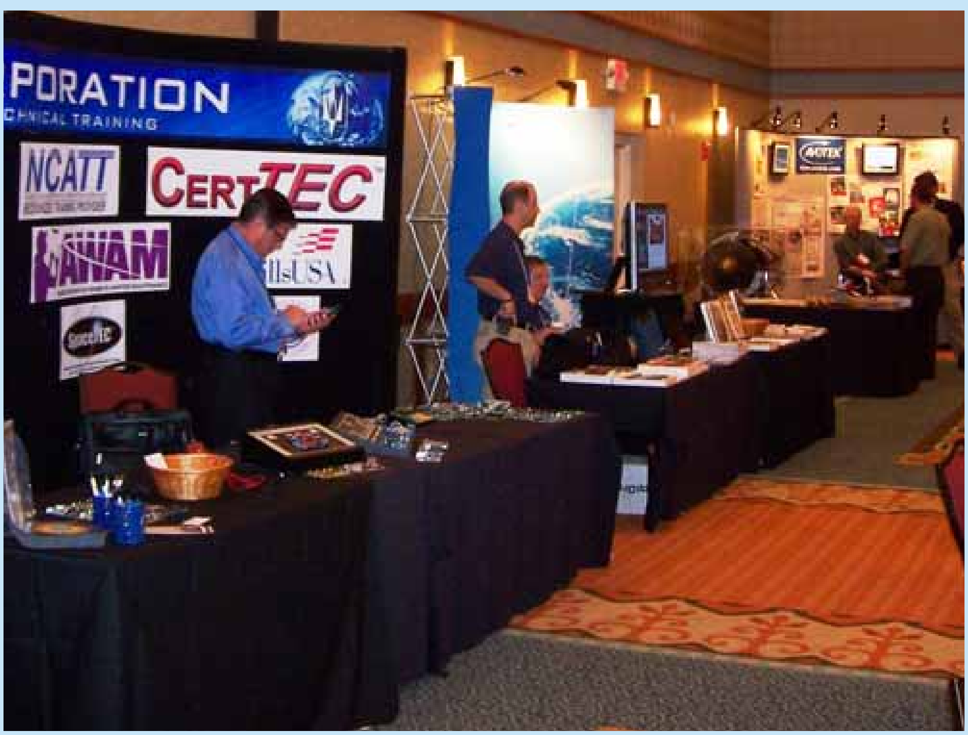
JAMES RARDON AMT STUDENT OF THE YEAR

Karen Knewtson –Salt Lake Community College

Joe Dudek, Karen Knewtson, Ivan Livi, and Todd Baird at Salt Lake Community College

CONFERENCE VENDORS

Youngest Vendor ever at ATEC



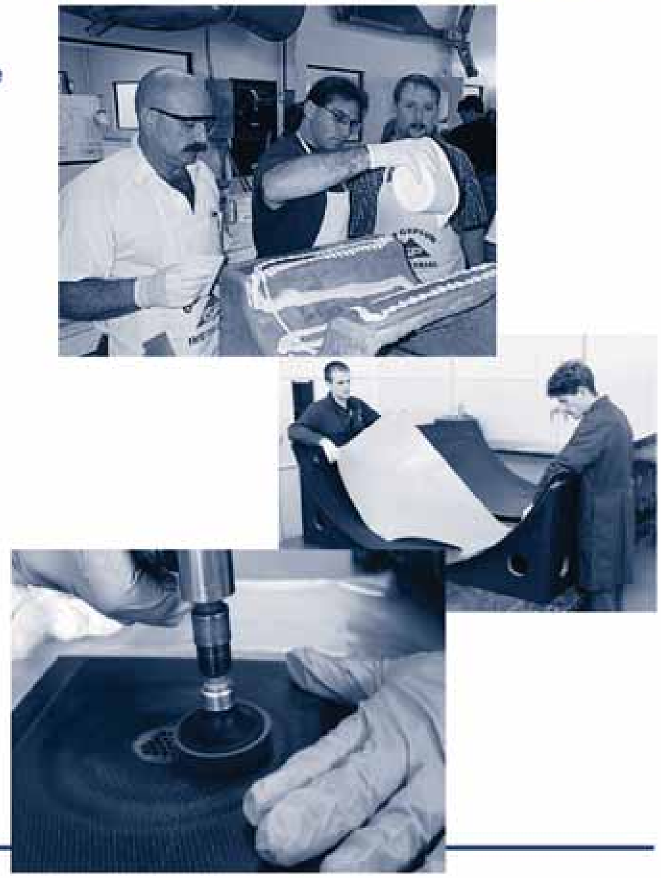
2012 Conference Vendor

CONFERENCE PRESENTATIONS

President Thompson welcomes everyone to the conference.

Mark Tayor presented a very useful and interesting program.

Let Abaris be Your Key to the World of Composite Training



Abaris has been specializing in advanced composite training in all industries since 1983. Our courses are hands-on as well as theoretical, supplying students with troubleshooting techniques that save both time and money. We provide strong foundations in the classroom, and then go to workshops where students fabricate and repair actual parts. Students are also encouraged to bring practical problems to class.

You come to us

20 courses to choose from at our facilities in Reno, Nevada or Griffin, Georgia.

We come to you

Abaris Onsite: Quality training conveniently held at your facility for multiple students.

Abaris Direct: Consulting services aimed at finding solutions for your specific problems.

Abaris Training Resources, Inc.
5401 Longley Lane, Suite 49
Reno, NV 89511 USA
e-mail: info@abaris.com

ABARIS TRAINING

Training at our Nevada or Georgia facility or on-site at your location.

Call or visit us on the web for a complete course catalog.

www.abaris.com
(800) 638-8441

Composite Educational Services
CES Composites

For 20 years, CES has been training supplying materials and equipment to Aviation Maintenance Schools. Our ability to provide high quality tools and equipment is preceded by our reputation for providing high quality training and expertise to our customer base. Thank you to the 93 schools that have helped us reach the 20 year mark. We look forward to working with you in the next 20 years.

Contact us for more information on how you can expand your composite program in the future.
Composite Educational Services, Inc.

CES Composites

719-487-1795

www.cescomposites.com

1986-2006
20 years of Service

ATEC Update

PRESIDENT'S REPORT

Part 147 Working Group

Mr. Steve Douglas, the new head of AFS-300, had taken leadership in moving forward with as many of the 147 ARAC recommendations as possible that do not require rule change now, as well as begin to review and prepare for those recommendations that do require rule change when the NPRM comes forward in the near future. Four subgroups have been formed: 1) creating an operating specification model for 147 schools; 2) piloting distance education at three institutions; 3) providing guidance on 8900 and AC 147 updates; and 4) providing an outline of topics for a dedicated 147 training course for PMI's. ATEC members are co-chairing each of these subgroups with an FAA counter-part.

Aeronautical Repair Station Association & ATEC

Part 145 operations are one of the best entry points for our graduates and ARSA is the best vehicle for connecting with 145's on a large scale. ARSA is operating a project called the Positive Publicity Campaign, to raise awareness of aviation maintenance operations. As a result of working with ATEC, ARSA is considering adding workforce development issues to the campaign and their legislative agenda. ARSA invited your president to be a keynote speaker at their leadership symposium in October 2011 and Ryan Goertzen and I to present at a panel on workforce development and working with schools at their annual conference in March 2012. A further result of our growing relationship is that I am writing a monthly article for their electronic newsletter on all aspects of 147 schools – from recruiting to hiring our graduates.

Upping Our Game

Over the next 12 months, ATEC will be working hard to provide improved services to the membership. Some of our initiatives will be:

- Improved website and content area
- Crafting a legislative message that supports schools
- Increased collaboration with ARSA
- Review of internal processes and structure to improve operations
- Increasing committee level work and involving more ATEC members
- Gather new school data to assess our segment of aviation education

As someone who has worked with ATEC in varying capacities for many years, I don't recall a time when your organization has been as involved on the national level as we are today. Part of that is maturity of the organization of course, but most of that is the hard work by dedicated Board members and ATEC members. I appreciate the time and service from all of you who work on behalf of ATEC.

ATEC CONFERENCE RECAP – APRIL 14-17

Over 115 participants from 66 schools, 28 exhibitors from 15 companies and 8 speakers attended the 2012 ATEC Conference in Tempe, Arizona.

This was the first attendance increase since the start of the recession when we saw our first drop in attendance.

GOVERNMENT RELATIONS COMMITTEE (GRC) AND 147 ISSUES

The top issue for GRC is the 147 Final Report where ATEC is taking the lead and encouraging the FAA to move forward with recommendations not requiring regulation change. ATEC members and other industry volunteers are now working as part of an FAA Work Group broken down into four Sub-Groups as listed:

Sub Group 1 – Development of the 147 Operations (Training) Specifications
Point of Contact – Chuck Horning

Sub Group 2 – Distance Education, beta testing and guidance for surveillance
Point of Contact – Ryan Goertzen

Sub Group 3 – 147 PMI Standardization Training Course
Point of contact – Tim Guerrero

Sub Group 4 – Maintenance Training Review Board and AC 147-3A revision
Point of Contact – Andrew Smith

Schools needing assistance with FAA inspector issues, contact Andrew Smith at atsmith@ksu.edu.

INSTRUCTIONAL MATERIALS COMMITTEE

AMT Instructional DVDs

The entire (almost 200) ATEC 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.

While ATEC has almost 200 DVDs for purchase, the ATEC Board of Directors and the membership recognize that there is a wealth of information available from our own membership. This type of curriculum sharing can benefit everyone. This year's emphasis has been on determining a process where the rights of contributors can be protected, and a method that the material can be made available via electronic distribution to our membership.

This summer, we hope to begin loading our new ATEC website with a wide range of classroom materials in a password protected section for ATEC member schools only.

MEMBER RELATIONS COMMITTEE

The main goal was to re-define the focus of several committees that served various areas of ATEC membership. After much discussion, there was a decision to combine three committees (member services, industry relations, and scholarships) to create an all-encompassing committee called *Member Relations*. With the creation of this new committee, eight goals were defined for the upcoming year. Due to the aggressive goal structure of the committee, Amy and Ryan have volunteered to co-chair this group.

The eight goals are:

1. Develop 10 new industry partners
2. Increase vendor participation with ATEC and the conference
3. Create new marketing materials to promote ATEC
4. Assist with a content management portal system
5. Develop four educational webinars
6. Research and define a more efficient membership contact system
7. Increase industry-based scholarships
8. Develop an industry advisory board

We are looking for additional ATEC members to take an active role in the Member Relations Committee and help move the eight goals to successful outcomes. Contact Amy at akienast@miat.edu or Ryan at rgoertzen@mail.spartan.edu.

NEW ATEC WEBSITE

The Communications Committee of ATEC has been primarily working to improve the organization's web presence. A beta site was unveiled at the Conference for comment.

The Committee, with Board approval, chose Weebly web design services to develop the new website. Weebly is an online design platform which allows the user to employ web design tools to create and manage their own website. The functionality and features of Weebly, along with its ease of use have shown that it meets the organization's needs and should improve both external and internal service, plus allow for instructional material file sharing.

The Committee has developed the framework for the new website and has begun placing content. It is planned that the site will be available by late summer.

ATEC COMMITTEES

The following are the Board Committee Chairs and their contact information:

Committee	(Co-) Chair	Email
Finance	Bret Johnson	bjohnson@hallmarkcollege.edu
Communications	Tom Hagovsky Paul Herrick	hagovsky@purdue.edu afpeh@uss.alaska.edu
Government Relations	Andrew Smith	atsmith@ksu.edu
Instructional Materials	David Jones	directoredaim@aviationmaintenance.edu
Member Relations	Ryan Goertzen	rgoertzen@mail.spartan.edu
(Blending Industry Relations & Member Services)	Amy Kienast	akienast@miat.edu

For a complete list of all committee members, go to www.atec-amt.org and click on Committees.

STRETCH YOUR TRAVEL DOLLAR IN 2013

Mark your calendar for April 13-17, 2013. The ATEC Conference at the Orlando Wyndham Resort, adjacent to downtown Disney, on Buena Vista Drive will be the central focus for several professional development opportunities.

April 13 – IA Renewal – Wyndham

April 14-16 – ATEC Conference – Wyndham

April 17 – DME Renewal – Wyndham

April 17-20 – WATS Conference in Orlando