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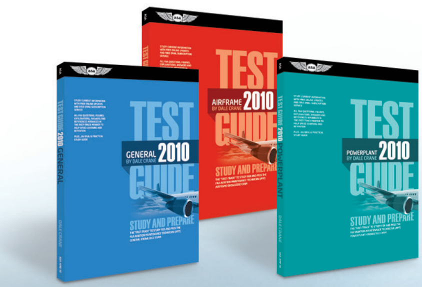

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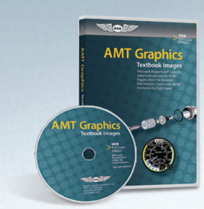

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Digitizing a Reciprocating Engine Testing Platform

Matthew W. Harrison and Dennis R. Hannon
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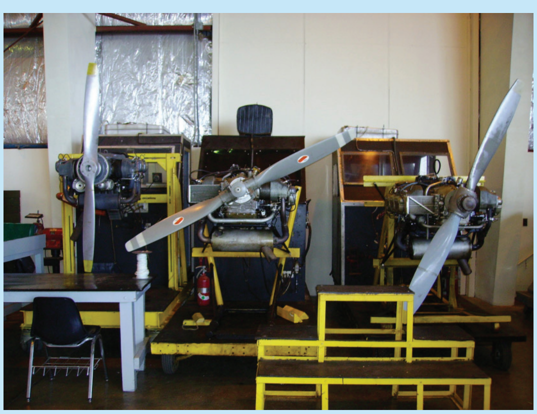
Southern Illinois University Department of Aviation Technologies

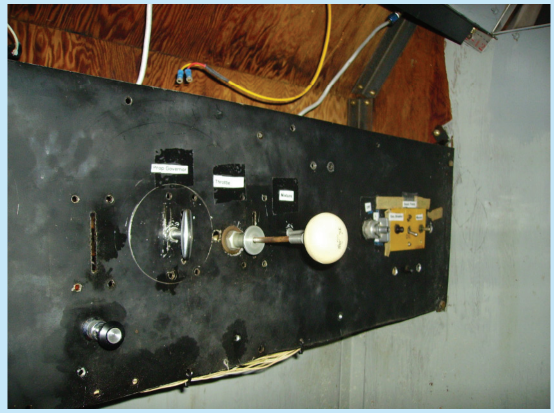
ABSTRACT
As aircraft engine testing, in both reciprocating and turbine, is an essential part of any complete Airframe and Powerplant curriculum, efforts should be undertaken to keep training equipment as up to date as possible with inclusion of the new digital based liquid crystal display engine monitoring systems. As both retrofitting of existing aircraft and new installations of "glass" displays has achieved popularity in both the light and transport aircraft markets, a good understanding of the process is necessary for today's technically proficient airframe and powerplant technician. In pursuit of this necessity and in support of future research, our department has converted a traditional steam gauge equipped reciprocating engine test platform to a liquid crystal display (LCD) type instrumentation system. This effort included cooperation between students of both the advanced aircraft maintenance and avionics specializations and provided those students with valuable experience in both installation and utilization of modern engine monitoring systems, which they will bring to the workplace.

INTRODUCTION
Extensive hands on experience in aircraft powerplant testing, repair and returning aircraft to service is an integral part of the necessary technician training required of a student in pursuit of an FAA Airframe and Powerplant Certificate. In our powerplant testing and inspection courses, students are required to understand the correct procedures and precautions to be observed during engine installation, ground operation, and fuel and oil servicing. They also are required to troubleshoot and inspect reciprocating and jet engines for airworthiness including interpretation of engine instrument readings to diagnose and correct engine malfunctions. The final powerplant course, coupled with knowledge and experience gained from previous training, provides students with the experience and abilities necessary to perform periodic inspections of powerplants while demonstrating an understanding of Federal Aviation Regulations and application of Airworthiness Directives, Service Bulletins and proper use of inspection equipment. In order to accomplish the goals of the program, live and fully functional equipment is used in for inspection, repair and return to service situations. Here students that will be employed by technical industries, not just aviation, gain useful experience working with new and emerging technologies. Lacking an aircraft engine test cell, our department has utilized reciprocating and turbine engine testing platforms as well as both airworthy and for-training-use-only aircraft for this purpose.

For a number of years, our department has been using a number of in-house fabricated reciprocating engine test platforms equipped with Lycoming and Continental engines. Affectionately known as "test buggies", these platforms are versatile in that the engines are readily accessible for inspection and servicing and mobile in that they can be towed out to the ramp for run-up and back to the hangar when run-ups are completed. In the absence of an engine test cell, the platforms have served our students well in many aspects of powerplant training activities for many years.



Figures 1 and 2. Aviation Technologies "test buggy" fleet and an individual engine testing platform



Figures 2 and 3. Typical steam gauge indicators and engine controls

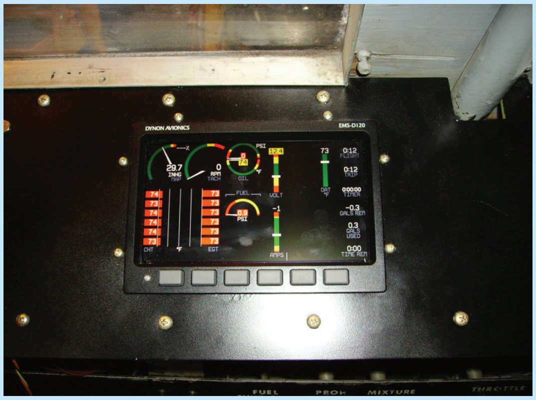
For engine monitoring, each platform was equipped with the usual array of mechanical gauges and controls generally consisting of RPM, fuel flow, fuel pressure, manifold pressure, throttle, pitch and mixture controls, etc. While these gauges and controls have proved adequate, but with the availability of new, relatively inexpensive FADEC and digital engine monitoring systems has necessitated the upgrade of at least one of these platforms to a digital engine monitoring system. The initial intent of the project was to replace an entire exhaust gas temperature (EGT) harness and indicator, however, after reviewing available options to upgrade the EGT system and upgrading to a fully digital package, the expense was only several hundred dollars more. Thus we included upgrading EGT system to a digital package in the development of this test stand. The advantages of upgrading to glass instrumentation, with all probes and sensors included to monitor a healthy array of parameters, plus giving the students much needed digital experience, the extra few hundred dollars for "glass" was quickly seen as being required. In addition to this upgrade, one of the authors1 is in the process of fabricating a completely new digital engine monitoring system equipped test platform for alternative fuels research. In support of these projects, two Dynon EMS-D120 Engine Monitor Systems were purchased; one to upgrade an existing engine test platform and the second to serve as the engine monitoring instrumentation in the new alternative fuels research platform. As Dynon designed their EMS-D120s exclusively for light sport and experimental aircraft, the cost was relatively low and within our budget requirements. As such, the units were chosen for their reasonable cost as well as features in meeting our needs. Dynon also offers significant educational discounts on purchases for equipment such as this.

The initial installation project provided valuable experience for the avionics and advanced maintenance specialization students who undertook the process as well as serving as a prototype installation for the new alternative fuels platform. The purpose of this paper is to relate the conversion process and hopefully provide some insight into the aspects of such an undertaking.

BACKGROUND

The Dynon Avionics Corporation markets flight control, autopilot, engine monitoring and combination display systems. For engine monitoring, exclusive of other functions, the EMS-D120 Engine Monitoring System consists of a liquid crystal display and control unit normally mounted in the control panel of an aircraft which monitors various engine parameters with inputs provided by sensors installed at various positions on the aircraft engine and its components. Its cost is approximately $2000.00 (Dynon, 2009). The unit and it peripherals can typically operate on either a 14 or 28 volt power supply permitting suitability for use in most light sport and experimental aircraft. Designed to be compatible with different manufacturers' engines, the EMS-D120 can be used in a variety of aircraft. The available sensors provide input information to the display/control unit for manifold pressure, RPM, oil pressure, oil temperature, exhaust gas temperature, cylinder head temperature, carburetor air temperature, outside air temperature, power supply voltage and current, fuel quantity, pressure and flow rate. For water cooled engines such as the Rotax 912 series, coolant temperature and pressure can also be displayed. EMS-D120 (Dynon, 2008). In addition to the display, the display control unit contains six user operable buttons which control on and off functions, permit cycling between screens, scroll through menus and adjustment of instrument parameters. While not a full fledged Full Authority Digital Engine Control Unit, its extensive monitoring points can greatly assist the operator in proper engine operation, control and trouble-shooting. The powered up display as it appears with the engine off and running appears below:

The Dynon EMS-D120 design and fabrication team consisted of several students, all seniors in the Department of Aviation Technologies Avionics Specialization curriculum and planning to graduate in the summer or fall of 2009. Each student worked on the project as part of their laboratory requirements for the spring 2009 inter-session Avionics Flight Line Maintenance class. The students had varying professional experience in electrical systems either as the result of military service or private sector employment. All had completed the technology course curriculum for the avionics specialization with the exception of the Avionics Flight Line Maintenance course.



Figures 4 and 5. Depiction of Dynon EMS-D120 display with engine off and engine running

Acquired equipment from Dynon consisted of the EMS-D120 Engine Monitoring System display/controller unit, exhaust gas and cylinder head temperature (CHT) probes and corresponding harnesses, manifold pressure sensor, oil temperature and pressure sensors, fuel pressure, fuel flow, ammeter shunt, carburetor air temperature sensor, and a general purpose temperature sensor for outside air temperature pick up or other application. Since many experimental and light sport aircraft engines have an electrical take off for an RPM signal, an RPM transducer was not supplied as part of the installation kit.

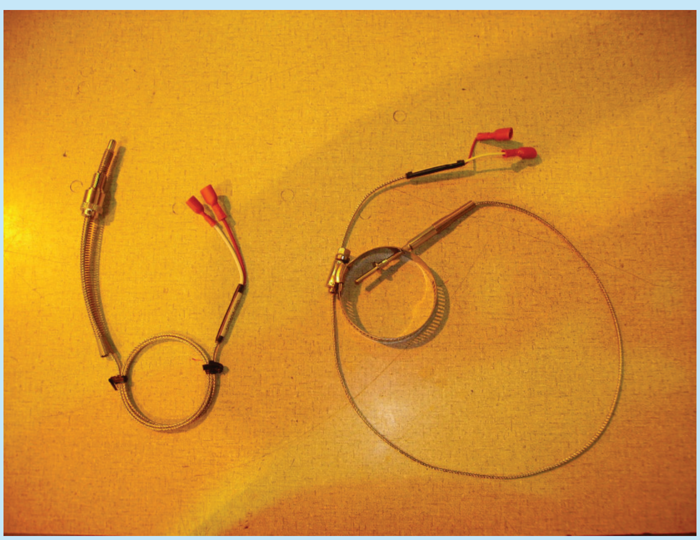


Figure 6. D120 CHT/EGT Harness with D-Sub Connector

We were limiting our expenses and keeping the installation simple so ours will be taking the signal for RPM off of the magneto primary circuit. In addition, the manufacturer provided installation and operator's manuals for the system consisting of wiring diagrams and instructions as well as bench testing procedures. Each component was designed for operation on a typical 14/28 volt d.c. general aircraft electrical system with a power drain rated at about 1 amp on either 14 or 28 volt d.c. shop's power. As all the switches, connectors, transducers, sensors, harnesses and wiring (with the exception of an RPM transducer) were supplied, the required fabrication by the students was greatly simplified and connection instructions from the wiring diagrams contained in the manual were adequate to complete the build up.

Figure 7. CHT/EGT Probes

As a prelude to the installation process, the working group of avionics students was provided with both an operating and installation manual for the EMS-D120. As has been noted through one of the author's experiences2 in such matters, it is important for students to become familiar with the operation of a new unit prior to initiating any installation process. We have found that with a thorough understanding of a unit's operating characteristics and procedures the inevitable troubleshooting required during an installation process is greatly simplified.

Following the familiarization phase with the equipment, the students were divided up into small groups. One group was created for the harness and probe installation, while the second group worked towards the modifications to the test buggy instrument panel. The final group worked to set up and bench check the EMS-D120. All of the students carefully unpacked the avionics system together, taking inventory of all the necessary parts and supplies. For the purposes of instruction we had the foresight to order units with pre-built harnesses to shorten the installation time. It should be noted that while gathering knowledge and experience in avionics harness construction is an important learning activity for an avionics technician, the time allotted for the installation precluded the inclusion of that activity. As such, it was felt the additional expense for pre-built harnesses was justified.

Once an inventory was conducted, the equipment and its peripherals were temporarily assembled and powered up for a bench test. Careful attention was paid to isolating connections so as not to short or cross any leads which had the potential to cause damage or malfunction in the equipment. This aspect of the process was straightforward in that the multiple leads in the pre-built harness were color coded and even stripped to bare wire at the ends. An excellent wiring diagram included in the installation manual further facilitated the process.

Fabrication of the system was begun with completion of the wiring terminations and connections to the various sensors and transducers. A moderate amount of soldering was required providing the students with experience in enhancing their soldering skills. Continuity or "ring out" testing with an Ohmmeter was performed at each stage of harness completion and following the final assembly to assure proper connection and routing of each wire segment. Following application of harness termination connections, temporary interconnections to the display/control unit were made to permit testing of each sensor and transducer to assure proper operation.

As engine monitoring systems operate on a system of inputs, outputs and feedback signals which can originate from or be transmitted to a variety of sources or devices, each of these aspects needed to be tested prior to the final assembly of the unit for bench testing. As many of these parameters could be checked with the sensors and transducers free standing, the students set each up with its respective connections and manipulated the display/control unit settings to monitor each individual component read out. In addition to the display/control unit sensors and transducers, ignition and control switches were employed and placed, as they would appear in an actual aircraft. Simulated battery and alternator master switches were set up and tested.

Final bench testing of the engine monitoring system was accomplished with all the components in place and demonstrated the system operated well with one or two exceptions. A wiring error was discovered in the factory-fabricated harness, which the students identified and corrected. During the test, one CHT sensor was indicating temperature changes but in the opposite direction. When heated, instead of rising on the indication it decreased. After checking resistances of the sensors, which were in spec, we found that wires on the factory harness for that CHT probe were reversed. After seeing that the factory harness had two incorrectly routed wires, it reinforces the axiom that better the problems be identified on the test bench than in the aircraft. Following rearranging of the sensors wire connections and a double check to assure proper equipment operation, the temporary assembly was disassembled and the unit repackaged pending the final installation in the engine test platform. While this aspect of the process required some extensive troubleshooting, it provided valuable lessons reinforcing the importance of bench testing prior to installation of a system in an aircraft and enhancement of troubleshooting skills.

With the bench testing completed and problems corrected, the system was ready to be installed in a modified engine test platform. The actual installation into the test buggy is very straightforward. Included with the EMS-D120 was a template for the hole that had to be made into the instrument panel to accommodate the display. Since our installation was an upgrade to an instrument panel containing many instruments, we opted to cut the hole in the existing panel and overlay it with a piece of 0.032 aluminum to cover the old instrument holes giving it a sleek single instrument look.

Due to the lengths of the prefabricated sensor wires, the instrument panel group decided to centrally mount the display. While they were altering the current instrument panel, the harness group carefully mounted each sensor and connected the respective harness wires to each sensor. The students, even though working on a test buggy, had the opportunity to follow standard wiring techniques that are used in aircraft wiring such as; using Adel clamps to support wiring harnesses, crimp fittings and correct wire routing. Any excess wire from the harness was neatly rolled up and affixed to the underside of the instrument panel.

Once each group completed their respective tasks for the installation the unit was powered up without the engine running. All parameters seemed to be in order and registering, as we believed they should. The group then towed the test buggy to the run-up area for the true test. "Clear prop" and with that each instrument within the Dynon EMS-D120 came alive.

CONCLUSION

Being able to upgrade outdated equipment is always an exciting time. The students are always eager to participate in anyway they can. It is, however, critical that during any installation of any equipment that the proper steps are taken to minimize potential problems or find any discrepancies prior to installation of that equipment into the aircraft. As professors training future technicians, we need to lead by example showing that it is important to approach any equipment installation with some caution. We spent the extra few dollars to buy a premade harness to save us time. What if we had installed this avionic system into an aircraft without a full bench check? While this step is not required, our training taught students the value of this practice: taking a little time in the early stages to operationally check the system before installation will save a lot of wasted time and effort once the system is installed. The students also learned practical knowledge relevant to the job market; for example, how much time would have been lost trying to solve the wiring issue after it was installed in an aircraft, which is far less accessible than the test stands. The students were able to see first hand that even the factory makes mistakes and we must do all we can to ensure the installation is correct 100 percent of the time, even if it requires a little bit more front end work. Situations like this are as hands on and authentic as training for an FAA Airframe and Powerplant certificate can be.

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Safety and Process Improvement using PFMEA in Aviation Courses and Laboratories

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Improving safety and process performance is sought-after knowledge and skills for aviation students entering aerospace or aviation career fields. Widely used in industry, Process Failure Modes and Effects Analysis (PFMEA) is a structured method to analyze the process steps and the associated risks. By conducting an initial PFMEA, students may identify and quantify risks then prioritize process steps to concentrate improvement efforts. Students identify risk elimination and mitigation actions for the high priority process steps. After implementing risk elimination or mitigation actions, the students then reassess the process. By comparing the 'before' and 'after' processes, students have a greater understanding of risk assessment and improvement techniques that lead to measureable improvements. This paper introduces PFMEA, presents the PFMEA method, and discusses PFMEA inclusion in two senior aviation technology courses.

INTRODUCTION

Failure Modes and Effects Analysis (FMEA) is widely used in aerospace by NASA, aircraft companies, and airlines, in addition to automotive, health care, and other industries to identify risks in products or processes and take action to mitigate or eliminate the risks. FMEA is useful in achieving high quality such as Six Sigma and is useful throughout the product life cycle (Gollomp, 2008). The history of FMEA goes back to the 1960s, and is defined in Mil-Std 1629A and SAE J1739 (Gollomp, 2008). The FAA has a different approach to FMEA. This paper introduces PFMEA, presents the PFMEA method and discusses the inclusion of PFMEA in two senior aviation technology courses.

The *FAA System Safety Handbook* (Chapter 9: Analysis Techniques, December 30, 2000) describes an FMEA that examines the functions of a system and the occurrence and severity of failures, and a separate FMECA that adds Criticality (C) to the FMEA analysis. The FMEA prescribed by the FAA uses a form shown in Figure 1. The criticality analysis is included using the risk levels determined by the combined levels of severity and probability. The complete definitions of severity levels I, II, III, and IV, and the definitions for probability levels A-E are found in the handbook.

Another approach to FMEA is the subject of SAE standard, SAE J1739 (SAE, 2009). While the FMEA is a continuous improvement tool, its intended use is "before-the-event" to reduce the probability of needing corrective action after the process or product is implemented [SAE J1739]. The FMEA is a living document that is useful in new designs or processes, changing existing designs or processes, and using existing

	Probability				
Severity	**Frequent A**	**Likely B**	**Occasional C**	**Seldom D**	**Unlikely E**
Catastrophic I	**Extremely High**				
Critical II			**High**		
Moderate III			**Medium**		
Negligible IV					**Low**
Risk Levels					

Figure 1. FMEA classification
(adapted from Appendix F of** FAA System Safety Handbook**).

designs or processes in new environments or applications [SAE J1739]. FMEA techniques may be divided into three major types: function, process, and machinery [SAE J1739]. Function FMEA examines the product functions and analyzes the risks associated with each function. Process FMEA (PFMEA) examines the process in a step-by-step manner to analyze the risks associated with each step. Machinery FMEA (MFMEA) applies the FMEA technique to plant machinery and equipment. PFMEA is discussed in this paper as it is implemented in senior level aviation technology courses at Purdue University.

Figure 2 contains a form modified from SAE J1739. In each column there is a number that identifies the question being asked of the team when completing the form. The SAE J1739 poses questions similar to questions 1-8 and 10. Questions 9 and 11-13 are added here to provide additional details. When conducting the PFMEA, the analyst is challenged to answer questions that are used to fill in the PFMEA analysis form:

1. What are the functions, features, or requirements?
2. What can go wrong (failure modes)?
3. What are the effects?
4. How bad is it (severity)?
5. What are the causes?
6. How often does it happen (occurrence)?
7. How is this cause prevented or detected?
8. How good is this method at detecting and/or preventing (detection)?
9. What is the risk priority number (RPN)?
10. What can be product or process changes can be made or special controls added?
11. Who is going to make the changes happen and by when?
12. What actions were taken?
13. What are the new severity, occurrence, detection ratings, and RPN?

Process	Potential Failure Mode	Potential Effects of Failure	Severity	Potential Causes of Failure	Occurrence	Current Controls	Detection	RPN	Recommended actions	Responsibility/ Date	Actions Taken	Severity	Occurrence	Detection	RPN
1	2	3	4	5	6	7	8	9	10	11	12				13
Focuses on the Current Process									**Focuses on Improving the Process**						

Figure 2. PFEMA format

When conducting the PFMEA, there are three major divisions in thinking about the process: current process, analysis, and improvements (see Figure 3). The first division focuses on the current process in questions 1-9. The team should complete questions 1-9 for the current process before proceeding to the analysis of the process. In the second division, during analysis, the team identifies the process steps to focus on. In the third division of thinking, the team focuses on improvements to be made to the process in questions 10-13.

Questions	Focus
1. What are the functions, features, or requirements? 2. What can go wrong (failure modes)? 3. What are the effects? 4. How bad is it (severity)? 5. What are the causes? 6. How often does it happen (occurrence)? 7. How is this cause prevented or detected? 8. How good is this method at detecting and/or preventing (detection)? 9. What is the risk priority number (RPN)?	Current Process (on FMEA form)
Which steps have the highest RPN? Which steps are the most severe?	Analysis (answered off the form)
10. What can be product or process changes can be made or special controls added? 11. Who is going to make the changes happen and by when? 12. What actions were taken? 13. What are the new severity, occurrence, detection ratings, and RPN?	Improvements (on the FMEA form)

Figure 3. Three Major Divisions of Thinking in PFMEA

To conduct the PFMEA, the team is formed of people that have the information to solve the problem. The team is chartered with the boundaries, scope, budget, and deadlines to conduct the PFMEA.

FOCUS ON THE CURRENT PROCESS

Question 1. PFMEA focuses on the process. PFMEA begins with identifying the process and developing a high level process map. This step is important to gain agreement and focus the team and stakeholders. The team documents the process name, process starting event and process ending event. Once these boundaries are established, the team identifies each step in the process. These steps are listed down the left hand side of the PFMEA table.

Questions 2 and 3. List the ways each step can fail. To answer this, the team identifies ways each step may fail to be completed or produce the wrong results. Failures would be listed if these failures could occur, not necessarily that the failures have occurred. The failures should be believable and usually do not include acts of God (NASA, 2003).

Questions 5 and 7. Identify the causes of each failure and the current controls in place. The causes are the typical conditions that bring about the failure. Controls are the devices, procedures, or sensors that may be used to detect if a failure has occurred. Poka-yoke techniques are used in design and manufacturing to either prevent the failure condition or to make it easy to detect the failure condition, should it occur.

Questions 4, 6, 8. Severity is assigned a level based on the impact to the customer or next process, and should be considered as if no controls were in place. Occurrence is the relative frequency of the failure mode, and is considered independent of Severity or Detection. Detection is the likelihood that the failure would be detected before moving on to the next step. When assigning the scale values, the team must establish ground rules to assure consistency and objectivity. While these scales may be developed for each industry, when beginning FMEA many teams chose to adopt an existing scale or modify an existing scale. These scales are typically 1 (lowest) to 10 (highest), with each level in the scale defined. These scales are arbitrary, but must make sense to the decision-maker and be applied consistently. SAE has defined scales from 1 to 10 for severity, occurrence and detection that may be used as a starting place for teams using FMEA (SAE, 2009). The FAA has scales for Severity and for Occurrence listed in Chapter 3 of the *System Safety Handbook* (FAA, 2008). It would be up to the team or industry to assign scale numbers to each of the categories. For instance, the team may choose to assign Hazardous a 9-10, Major a 6-8, Minor a 2-5, and No safety effect a 1.

Question 9. Criticality is assessed by examining the risk priority number (RPN) of each step. RPN is found by multiplying the ratings for S (severity) by O (occurrence) by D (detection). RPN = S x O x D.

ANALYSIS

With the RPN calculated for each process step, the analysis begins. To determine criticality, two questions are asked: Which steps have the highest RPN? Which steps are the most severe? By answering these two questions, the safety and process improvement teams may focus their efforts on the specific process steps that have the highest risk priority numbers and the highest severity ratings. Assuming limited resources and capacity, it is beneficial to set the priorities of the improvement team's efforts to have the greatest effect. To focus on the steps with the highest RPNs is an obvious approach to have a greater effect on the overall risk. By answering the second question, the team may also focus on the steps with the highest severity ratings, indicating the steps with the highest level of potential injury.

FOCUS ON THE IMPROVING THE PROCESS

Questions 10-13. The team answers these questions to develop a plan to improve safety and assess the impact of the improvements to safety. Based on the criticality, the team develops a plan to reduce or eliminate the risks for a subset of the steps. Specific actions are planned to lower the RPN for these steps. The actions must be doable in a timely manner in order to have an effect on RPN. After the actions are taken, the team reassesses the PFMEA to record the new RPN. Whenever process changes are made, it is important to take action to sustain the improved safety level to prevent backsliding into old habits. The process owner or supervisor must periodically monitor the process to insure that the new methods are being used and that controls are not being circumvented.

PFMEA IN AT497

In the AT 497 Applied Research Project course, teams of students use Lean Six Sigma methods to improve aviation and aerospace processes or products (Johnson and Dubikovsky, 2008). For the process improvement projects, the goal is to improve a performance measure such as cycle time or first-time yield. In addition to these improvements, the teams must provide an analysis showing that the improvements to the process also improve safety. The teams use PFMEA to assess the safety of the current process, analyze the process for improvements, and assess the impact to safety after the improvements. By comparing the risk priority number (RPN) of the current process to the RPN of the improved process, the teams demonstrate the improvement in safety of the processes.

As an example, the following PFMEA is modified from a student project submission. The project focused on process improvement of a fiberglass product in the Aviation Technology composites laboratory. Figure 4 shows a partial PFMEA for the current process.

Process	Potential Failure Mode	Potential Effects of Failure	Severity	Potential Causes of Failure	Occurrence	Current Controls	Detection	RPN
Lay-up fiberglass	Resin sets too fast	Scrap part and redo layup	6	bad mix	1	Training	4	24
	Resin does not set	Scrap part and redo layup	6	bad mix; out of date materials	4	Training	4	96
	Impurities in material	Rework to remove impurities	2	poor housekeeping	4	Training	4	32
	Voids in material	Rework to fill voids	2	poor layup practices	4	Training	4	32

Figure 4. PFMEA for a Step in the Current Process

In analysis of the PFMEA for the current process, the highest RPN is 96 for this step. To mitigate the risk, the team improved the process by writing procedures for the layup that include the proper steps to assuring a good mix and a step to check the shelf life of materials.

The improved PFMEA is shown in Figure 5. For clarity, only the highest RPN number is addressed. The figure shows the recommended actions, person responsible, actions taken, and the new RPN. The RPN dropped from 96 to 6 after the improvements were implemented. In the student project, the team addressed many process steps, resulting in a several page PFMEA. The figures shown here illustrate the process and thinking used.

RPN	Recommended actions	Responsibility/Date	Actions Taken	Severity	Occurrence	Detection	RPN
24							
96	**Check Shelf life; follow written procedures**	**Pete**	**Visual procedures prepared; added shelf life check to inventory procedures**	**6**	**1**	**1**	**6**
32							
32							

Figure 5. Improved partial PFMEA focusing on the improvement of one process step.

PFMEA IN AT402

An active learning approach for integrating the concept of risk management and PFMEA assessment by front line personnel was applied in an advanced aircraft maintenance laboratory in the Aeronautical Engineering Technology program. The laboratory portion of the course utilizes Purdue University's two large transport category aircraft, a Boeing 737 and Boeing 727 on which students simulate large scale aircraft maintenance operations. Students act as both managers and technicians performing real maintenance tasks and system operational checks as part of their laboratory assignments.

Both aircraft have fully functional systems and are excellent platforms for practicing industry standard maintenance procedures and processes. Students also use the aircraft to participate in research and development of innovative maintenance process and technologies under the department's Hangar of the Future research area, as well as Safety Management System (SMS) and risk analysis applications (Ropp, 2008) oriented to aircraft maintenance and engineering operations.

As part of a focus on system safety integration, student project teams were assigned a project with three deliverables. First, create an operational hazard profile of lab maintenance operations occurring on the aircraft. Second, for each hazard identified perform a risk evaluation for likelihood and severity. From this evaluation, they were to produce an online risk assessment tool for use within the lab maintenance operations. This final tool was to have the capability of receiving and displaying real-time hazard inputs entered by front line maintenance personnel (students) via hand-held devices (laptop or PDA computers) while working on the aircraft, be transmitted wirelessly to a central computer, and presented in a highly visual and intuitive format.

Students first used a Process Hazard Analysis or "Bow-Tie" diagramming evaluation method to identify the most prominent operational hazards, followed by a PFMEA evaluation on each hazard identified. Figure one shows an example of a Process Hazard Analysis conducted by students assessing potential for ground damage incurred to an aircraft during taxi or towing operations.

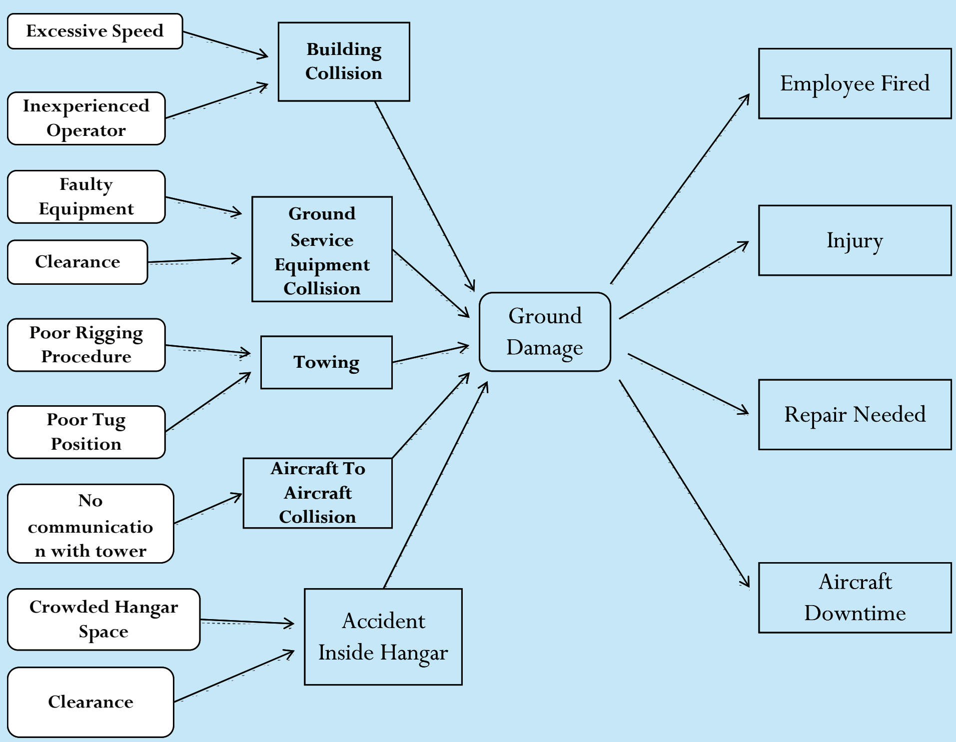


Figure 1: Bow Tie analysis: ground damage to aircraft

Once the hazard profile for operations was created, students utilized a Process Failure Mode and Effects Analysis (PFMEA) style risk severity assessment from the FAA's Advisory Circular AC 120-92 (FAA, 2006 pp.13-15) for Safety Management Systems, to assess each of the identified activities or perceived hazards, assigning a weighted risk number. They then placed assessments on a standard risk assessment grid (Figure 2).

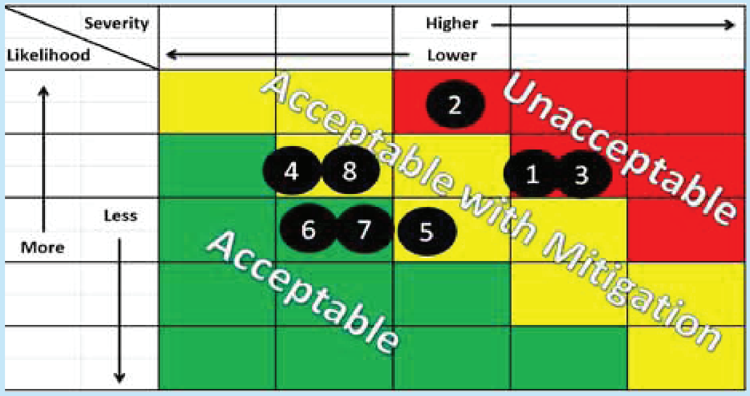


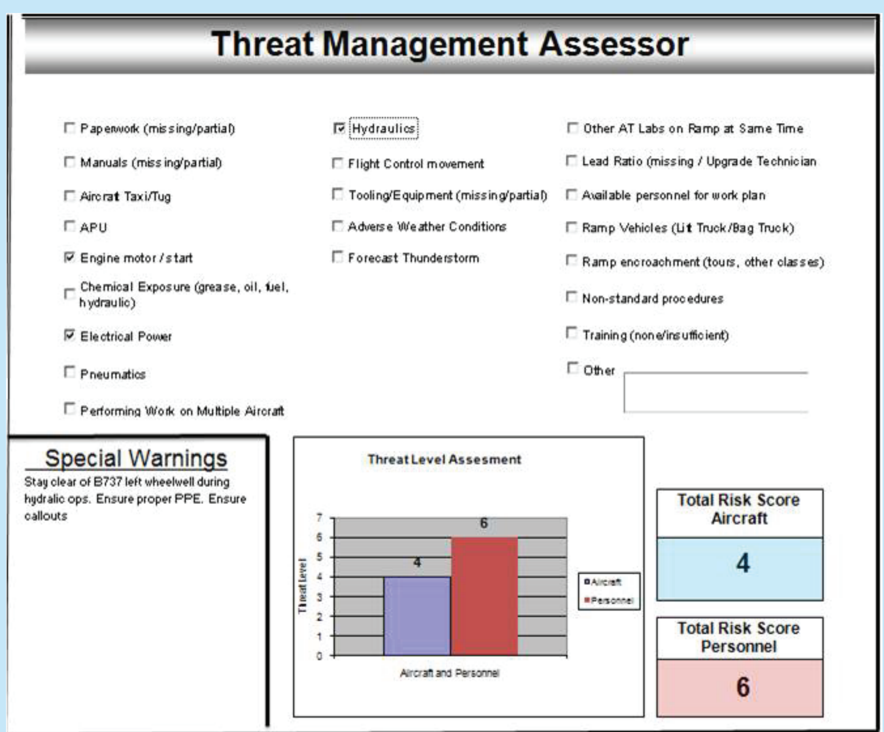
Figure 2: PFMEA assessment using standard risk assessment grid. From: FAA AC120-92.

SMS integration into AT 402 laboratory operations began in Fall 2008, using student projects within course to accomplish assessment and integration steps. Students began by using a process hazard analysis technique to create a hazard profile of AT 402 laboratory operations. The student teams identified 22 routine activities and influencing factors encountered during laboratory operations they believed represented varying levels of hazard and risk potentials. While existing laboratory safety protocols were already in place, students were tasked with evaluating activities for hazards regardless of existing protocols or safeguards to assess the potential for an injury or accident occurring if existing protocols were not followed, were insufficient or nonexistent.

It is important to note that the goal of this particular project was creation of a visible indicator of hazards and their perceived levels of risk as they arose, and to relay this data rapidly to a team leader and among a crew. Mitigating controls and re-evaluation steps occurred as separate exercises. A standard FMEA matrix ranking of 1-2 very minor, 3-6 minor-moderate and 7-10 high-extremely high severity was used to create what was termed an Online Threat Management Assessor (Figure 3). This tool was created by the students using Microsoft Excel with interactive design controls within the Excel program, in which a user selects an applicable condition or variable by clicking a box.

Each variable was weighted with a predetermined number based on assessed FMEA severity.

Figure 3: Online Threat Management Assessor. T. Ropp, 2008



A front line technician (student) or the assigned student Team Leader planning and overseeing that lab's maintenance activities is provided a visual representation of risk via a bar graph and numerical readouts which grow or shrink with variable user inputs. Special warnings or briefing reminders for the crew for a given activity appear in a visible text box when it is selected, while the total risk scores for both aircraft damage potential and personnel injury potential risks are shown as cumulative risk scores.

Thorough development and implementation of this risk tool, students experienced the rigor required to manage a maintenance process in general with safety as an integral component, not just an afterthought. Students are continuing to develop and test the Threat Management Assessor as part of an overall SMS implementation within the AT 402 laboratory. The online risk assessment project is also a part of the Aviation Technology Department's larger "Hangar of the Future" and SMS research initiatives.

DISCUSSION

Early evaluation on student use of PFMEA approach and associated risk evaluation tools resulted in two notable observations in the laboratory work culture of particular interest. First, after basic instruction and practice, students incorporated explicit use of risk and safety management tools and equipment, assertive communication and reporting unsafe conditions, willingly engaging others who did not follow established safety protocols. These were same students who only several weeks prior had largely never heard of SMS and exhibited a normative acceptance of hazards as just "part of the job".

Second, these observable behaviors can be easily related to safety culture attributes understood by researchers and aviation regulatory agencies to be essential for an organizational safety culture: a reporting culture, a just culture, a flexible culture and a learning culture, interacting to create an overall informed culture that manages hazards and risk effectively (Reason, 1997; FAA-AC120-92, 2006 pp.19-20).

CONCLUSION

Introducing aviation technology students to PFMEA resulted in an observed increase in knowledge, application and overall awareness of process hazard and safety analysis in general. By using recognized standards, the students gained experience in PFMEA techniques used in aviation and aerospace industries. At present, the PFMEA is introduced in the senior year of study in aviation technology. The authors are working with other faculty teaching junior level courses to incorporate process mapping, hazard profiling and safety assessment skills into other courses in a consistent manner.

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ATEC 2010
50TH ANNIVERSARY

Agenda to be released in November

Highlights:

- Sunday afternoon (April 11) classroom specific presentations 1:00-5:00 PM
- Sunday Ice Breaker Reception in exhibit area 5:00-6:00 PM
- Eight technical presentations on Monday, April 12
- Awards and Scholarship Luncheon on April 12
- Networking Reception in exhibit area April 12 4:45-5:45 PM
- Tuesday – 147 NPRM and FAA Update plus additional presentations
- Tuesday afternoon bus tour of maintenance facility and/or museum – TBD
- All breakfasts, breaks and receptions in the exhibit area

Hotel:

The conference hotel is the newly renovated Marriott Mesa Resort, 200 North Centennial Way. Mesa, Arizona is 15-20 minutes from the Phoenix Airport.

Attractions:

- Walking distance to Old-Town Mesa Main Street with over 200 shops, restaurants, museums, theaters and cultural attractions
- Close to hiking and biking at nearby Superstition Mountain, Camelback Mountain and Four Peaks
- Close to Mesa Riverview Shopping Center

Hotel Amenities:

- High speed internet in guestrooms
- Full service business center
- Fitness Center
- Outdoor pool and spa
- Airline reservation desk
- Near golf courses
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The group lodging for the ATEC 50th Anniversary Conference is $129/night available 3 days pre and 3 days post conference. No extra charge for double, triple or four in a room.

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Tracking Program Outcomes for the ABET Criteria

(Second in a series of articles for setting up an ABET accredited program)

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INTRODUCTION

In the previous article on ABET accreditation, a background was developed of the engineering field and the legacy issues that have surfaced over the years and the benefits of acquiring ABET accreditation for FAA Part 147 schools. This article develops one of the first of many concurrent tasks that needs to be in place from the beginning of the first group of students. ABET, Inc. is the body formerly known as the Accrediting Board for Engineering and Technology.

The process to track program outcomes should be completed soon after the decision to attempt ABET accreditation is determined for your school. This decision should not be taken lightly because there are many details that can absorb a lot of time. Detailed here is the process that has been developed at Purdue University to accomplish this *one component* of ABET accreditation: the ongoing assessment and evaluation of the progress to meet the program outcomes in each course. The process uses a desktop computer and MicroSoft Excel™ , and assumes only a fair working knowledge of its functions. This process follows the basics of "keep it simple" and "get everyone involved".

THE TASK

It should be understood that tracking all the details of accreditation can be a daunting task. It does not happen overnight, nor does it happen in a year. ABET Technology Accreditation Commission guidelines, however, require that a program have graduates from the plan of study to be approved, BEFORE it can be accredited. Starting *ab initio*, how it this possible? There may be courses that need "tweaked" or more radical interventions to the coursework. There may even be some courses or topics that need to be added. Depending on institutional timelines, this may be a four or perhaps five year process. The first ABET "graduating class" is the beginning of the long-term process.

With that said, it need not be as overwhelming as it sounds. There is a lot of understanding of the process and planning that is required, but the end results are all positive and enhances any program, and guarantees continuous improvement as time and industry changes occur. The improvements do not have to be radical departures from current curriculum and processes' as even little changes can have a profound effect on outcomes.

THE GRID

For the tracking of the program outcomes for each course, it was decided to use tools with which most faculty could be expected to be familiar. Using a simple and widely distributed program of MircoSoft Excel ™, a columnar chart was created that could be adapted to any setting. In this case it was discovered that some reports needed certain data, and other reports needed some of that plus additional data. So the plan was to develop a grid or data base that would be adaptable to the many reports that were required in higher education. Using faculty insight, the table shown in Figure 1 turned out to be a ten column chart. The first three columns were designed to ensure the department was in line with the strategic plan of the University, the College it is part of, and any Departmental goals that flowed into these other plans. The intent was to gather the information in one place, so that was available to be used for *any* "reports" that need generated from strategic planning through three tiers of administration. In this way information in one data base was to be available to accreditation boards of every kind (NCA, CAA, ABET, AABI, etc.). These first three columns also demonstrate how the ABET accreditation fits into the bigger picture of governance in an institutional setting.

Proposed format for XXXX Universtiy ABET tracking

University Educational Objectives	College Outcomes	Department/ Program Outcomes	Assessment Criteria	Assessment Procedures	Assessment Results	Use of Assessment Results	Course Number	Identified ABET Outcome	Faculty Member
This is the block for University Strategic goal http://www.XXX.edu	This is the block for College's Strategic goal http://www.XXX.edu/	This is the block for Department strategic goal http://www.XXX.edu	This is the block that you put in your criteria (what you are looking for)	This is where you tell your Assessment procedures (Lab, Test, Practical project, etc.)	This is the reporting of what you found (stats, scores, or observation)	This is the "feedback" into the system (how you will use the results for continuous improvement)	This is course you are assigned grade responsibiliy	This is the ABET A-K outcome(s) you have chosen to track	Your name
Enable better professionals to reach regional companies	*Enable gradutes to better serve their industrial partners*	*Enhance student knowledge and performance*	*Given the appropriate project sheet, the student will construct an operating light panel in which all lights work independently.*	*Lab# 13, Final Project*	*20 out of 25 got it correct on the first attempt (80%)*	*Add an extra homework assignment to reinforce the lecture/reading.*	*XXX*	*H*	*Faculty member*

Figure 1 Proposed format for XXXX University ABET tracking

The remaining columns relate more directly to the detailed ABET concerns. Column Four through Ten (See Figure 1) are the "accreditation" items. For ABET accreditation, Column 9 represents the ABET "a through k" items. The specific ABET Program Outcomes are shown in Appendix A. These Outcomes are broken down into each line item and how they fit best into each course. Not all courses measure each Outcome. Instead the Outcomes are spread across the curriculum. Ideally the knowledge, comprehension, and application related outcomes come early in the curriculum, and the analysis, synthesis, and evaluation outcomes come later in the curriculum. In the Purdue University Aviation Technology program these Outcomes have been distributed to more than one course so there is more flow through the curriculum, and multiple usages of the ABET tasks throughout the entire program.

By distributing the Outcomes across the curriculum, all of the faculty members become involved in assessing and evaluating the Outcomes at a course level. By having all the faculty members involved at this basic level, this follows the recommendations offered at the ABET Best Practices Symposium of involving the entire staff so they can be continually reminded of the ABET influence, and therefore understand the process and why accreditation is important (Mark Thom, ABET Best Practices Symposium 2007). Another benefit of having this distributed assessment is that it lightens the load of any one individual faculty member to demonstrate the use of the line item for accreditation. A mistake often made by academic programs is that they assign one faculty to be the "ABET assessment person." Just as is true with the other accrediting activates for aviation such as ABBI, assigning one person simply overloads that one faculty. Or worse, forces that one faculty who does not fully understand the course contents to have to "create" data for courses with which he or she is not familiar. By making the ABET outcomes ingrained in all courses through the curriculum, there is the attempt to strengthen the concepts within the faculty, for a longer lasting internalization of the items with greater knowledge retention the goal.

Column Five then displays how the a-k objective is "tracked" or documented in each course (See Figure 1). Again this is a simple statement in the Excel file that allows the easy and rapid discovery of how the instructor is observing the outcomes. This can involve tracking anything from a particular test question number, to completion of a segment of a lab. Column 5 very simply is a brief explanation of the activity that the instructor plans to assess the a-k objective. The explanation should be a BRIEF statement with objective goals, stated with action items - e.g. the student will achieve an 80% or better on the item, or given the appropriate manuals and correct tools, the student shall accomplish the task to an airworthy condition within 30 minutes. These criteria then can be used to "grade" the project for more uniform grading system.

Column Six (See Figure 1) shows the actual results of the observation. Simply put, did the student/group accomplish the task within the stated guidelines? For a lab observation there are a variety of considerations concerning success. Did the students complete the task in the allotted time to an airworthy condition? Are multiple attempts to be allowed? If so, how may attempts? Two? Six? Twelve? Your decision, but all those tries must then be documented. This is one place where instructors can find a challenge to improve. In so many cases as aviation instructors, we know airworthy work when we see it. But here we have to sit down and think through the details of exactly what about the work constitutes success. Expect this not to go well the first time it is measured in a class. Most people find that what they thought they were measuring was not exactly what was happening. This can be both fun and humbling. However if a person is even remotely concerned about becoming a better instructor, this process the momentary frustration of realizing that they were not measuring what they intended, can quickly give way to the desire to improve.

Remember the Keep It Simple thought? As far as the tracking of a test question, it seems logical that they be the first or last few questions of the test. This makes it easy to find, and demonstrate the items or questions being tracked for the accreditation team if they ask for it.

Column Seven (See Figure 1) then is the feedback loop. Did the intervention have the desired results? If not, why not? If they did have the desired results it is time to either raise the bar, or change the task. It must be noted that these items do not change every single semester. You may measure an Objective for four or five semesters before you can decide whether the data tells you anything.

The last three columns are administrative for more easily visualizing the course number (Column 8), what "letters" are covered to ensure full coverage in the program (Column 9), and who is the instructor of record (Column 10).

THE PROCESS

By following ABET's advice of not making data collection too much of a burden on any one faculty member, all faculty members can be involved in the assessment/evaluation process. The involvement comes by having all faculty members enter their own course information. Does this have to be a time consuming, contentious affair? No. By having the instructors enter their information on a "single" sheet shown in Figure 2, the information is linked and automatically entered on the master sheet shown in Figure 3. To keep confusion of the faculty to a minimum, the sheets in Figure 2 are color coded green in the areas where the faculty enter the data, and the master summary sheet is color coded yellow. The faculty members enter data for one semester at a time, and it should only take a few minutes to enter the number of students in the class and the number of students who met the assessment criteria. The faculty member is then expected to write a sentence in the spreadsheet that indicates whether the students in the course met the expectation, and what improvement, if any, is to be made in the course for the next time it is taught. This input is referred to as the "intervention". Entering two numbers and a sentence in a spreadsheet is not overwhelming or time consuming.

The spreadsheet then calculates the percentage of students who successfully met the criteria, and transfer these numbers to the cover/master sheet automatically through the linking function in Excel. In this system, the instructors only enter data in the "green" boxes, as shown in Figure 2, and it automatically updates the "yellow sheet" shown in Figure 3. The faculty member never even touches the cover sheet except to select the semester tab (on the bottom of the yellow sheet) to get to the correct green sheet. The yellow summary sheet is locked and only available for upgrades by password override, by the faculty ABET coordinator.

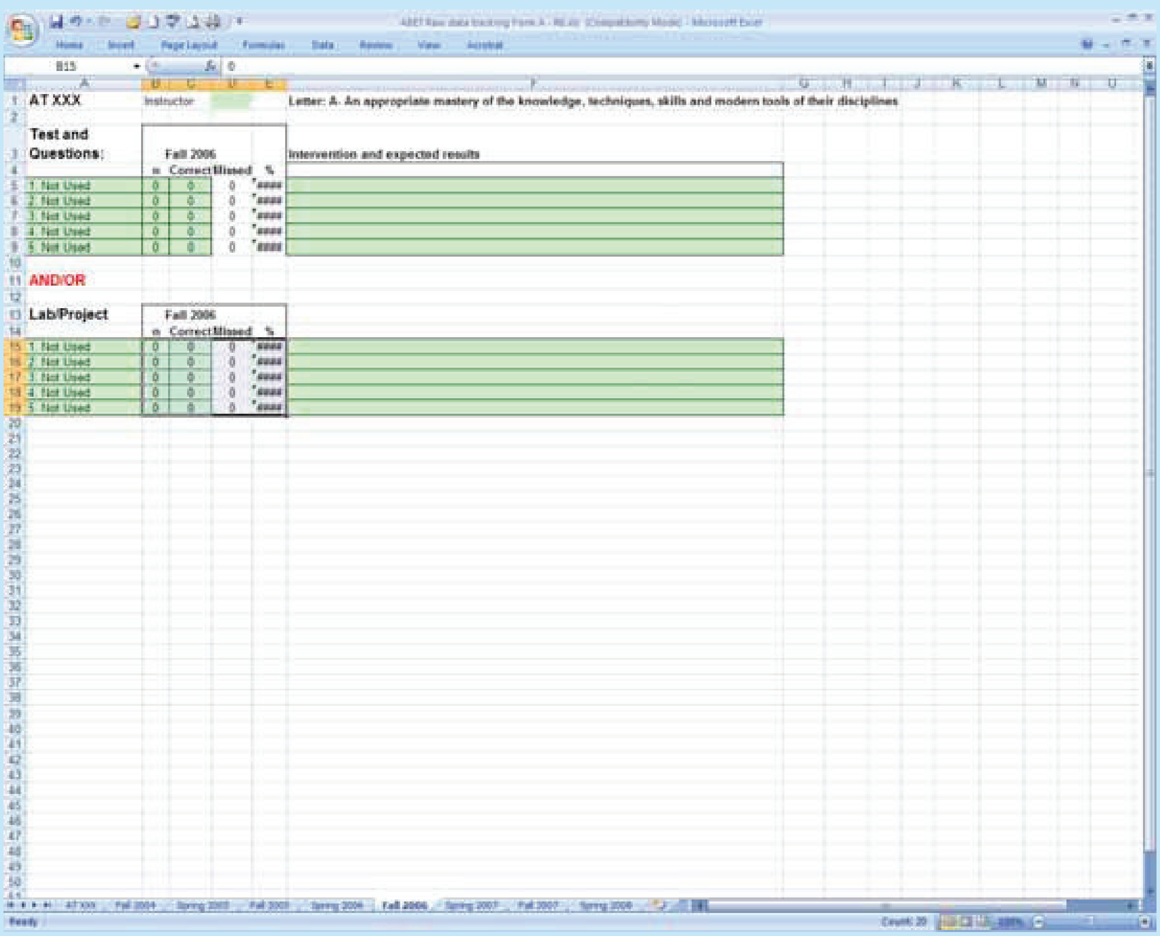

Figure 2 Sample of "raw" data sheet

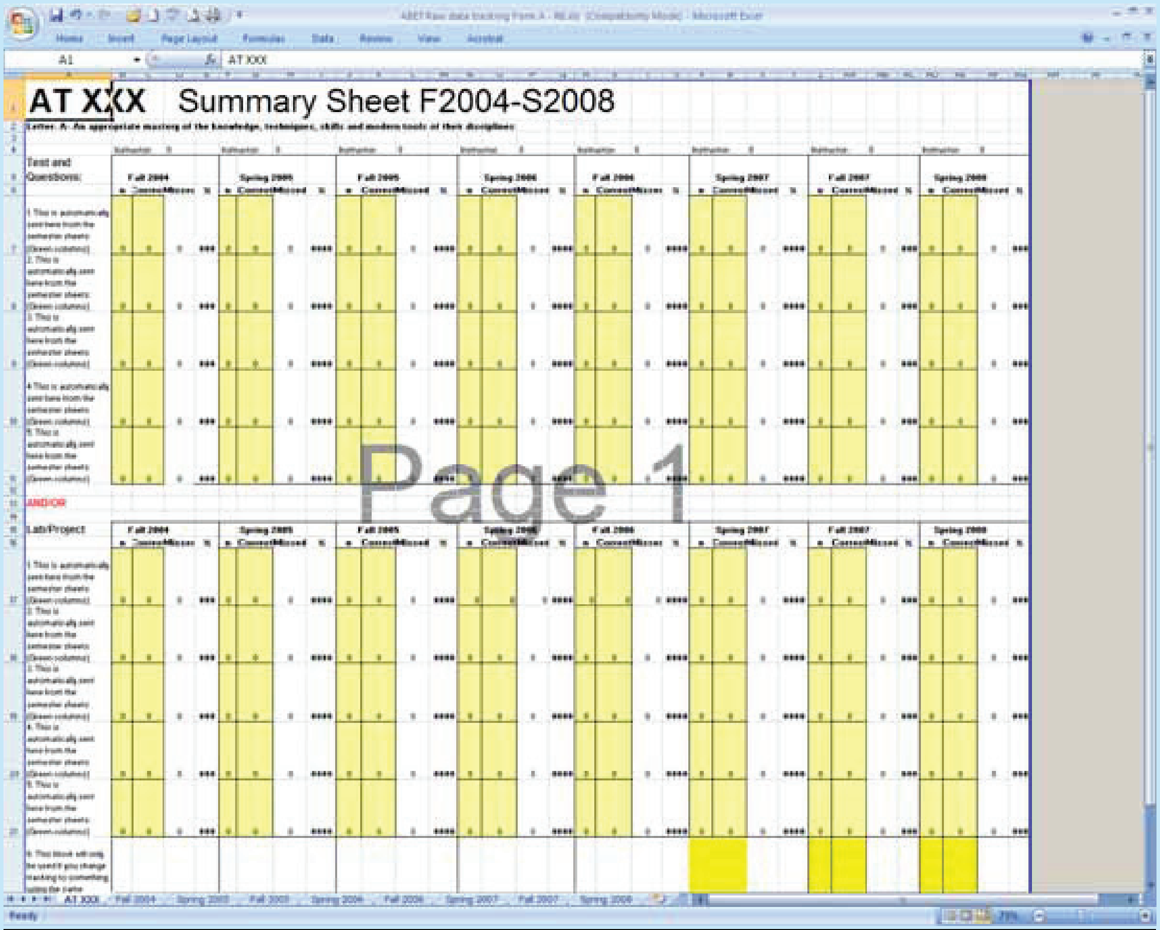

Figure 3 Sample of cover/master sheet

Since the faculty members really only see the sheets at the beginning and end of the semester, they tend to not get confused and enter the information in the wrong place. If they try to put data in the wrong place, the program reminds them that they do not have access to that particular page, and that the person must go to the data entry page. The external ABET evaluator need only review the yellow cover sheet to see if there are any issues they want to look into. If the evaluator wishes to take a detailed look at a course, they simply need to open the link to the "green sheet" by using the tab on the bottom of the "yellow sheet". The link takes the evaluator to the raw data; the numbers, intervention and results, that have been transferred to the cover sheet.

The plan detailed here designates time allotted during a "faculty retreat" for reviewing the courses and sharing the information with other faculty. The instructor either comes to the retreat with their information already entered, or he or she may choose to make their updates to the data base as a group. Regardless of the method of getting the data into the sheets the faculty members need to take time sit down together and review the results. Any discussion of changing a-k items assigned to the course, changing the items within an individual class is reviewed at this time. This is the place to make this determination since the data are assessed at that time. The faculty retreat is also the time when individual faculty can ask for some guidance on how to gather data, how to assess data, and any unusual results can be discussed as a group. The information gleaned from this meeting then is entered quickly and efficiently by the most knowledgeable person for each course – the individual faculty member teaching that course! Faculty members are also reminded and refreshed of the things they should be looking for during the semester. It is also probably be wise to have an end of the semester session. This should only take 20-30 minutes to complete the data entry for all courses just taught. It is just enough time to fill in the spreadsheet boxes before any long breaks or external influences arise, causing the instructor to forget what he or she was doing.

Using this method for gathering the data, the information is always up to date, and any accreditation team member can quickly scan the cover/master sheet (Figure 3) to look for issues and then look at the raw data (Figure 2) if they so choose. It is easily retrievable and standardized across the entire curriculum, or more accurately across the courses. Formulas can be entered to track the percentages, plot the results or many other methods of using the data. Many of the current office suite programs have at least some rudimentary statistics available for this purpose. There is probably a location on your campus, whether it be an Office of Institutional Research or the place you take your "bubble sheets" (if you are still using that method), that can track many of these items for you. If you let them know the items that need tracked (test and question numbers), it should be easy to do. Of course if your school wants more or different information, the Excel sheets can be configured to meet your needs.

CONCURRENT ISSUES

This was only one of the tasks required for ABET accreditation. There were others that needed to be done concurrently. This program decided to make ABET Technology Accreditation Commission (ABET TAC) accreditation a priority for the BS program that contained the Part 147 related curriculum. The goal was to maintain the Part 147 certification and to obtain the ABET accreditation for engineering technology. This meant that many other things had to come together for the ABET TAC requirements to be met in four years. The a-k criteria needed to be defined for the rest of the faculty members. The course "flow" needed looked at and adjusted. A capstone course needed more definition. This meant the curriculum committee needed to be involved, which was a year long process in itself.

There was also the issue of how to keep oversight of the a-k criteria within the Department. What this meant was some of the basic ABET a-k topics had to be taught in non-Part 147 courses on main campus (math, basic electricity, etc.). To make the entire system work, and to be able to verify to an ABET accreditation team, it was necessary to know where the students would be using that information taught on the main campus within the Part 147 coursework. If the student took English on the main campus, it would be necessary to measure the English they learned *within* the Part 147 courses controlled by the department. If the students learned algebra or calculus on the main campus it was necessary to show where this knowledge was being applied in the Part 147 courses. So for these courses the information taught had to be measured in courses delivered within the Department so there was control of the outcomes to meet ABET and FAA scrutiny.

It was also necessary to create some courses within the Aviation Technology program to deliver some additional material suitable to engineering technology that was over and above the Part 147 basic information. It was also necessary to develop capstone courses to allow the students to pull together much of the information learned from their Part 147 studies and their engineering technology studies. For courses taught away from the Aviation Technology Department, there is no feasible way at this university to monitor the delivery and assessment of the a through k objectives.

So ABET accreditation is not an easy task, and does not happen without a lot of thought, planning, and organization done within the unit. As stated earlier, this needs to be a department wide commitment, not the efforts of a few. The benefits of the accreditation must be worth the continuing efforts.

CLOSING THOUGHTS

It is up to the individual schools to determine if this is a course they may want to follow. Depending on precedent, where the students normally go to work and their career paths may be the most important factor. Is ABET accreditation right for a two-year A&P school who produces graduates who go directly to hands-on maintenance? .(Vaughn College has an ABET TAC two-year degree in AET) These schools would need to determine if the engineering technology direction might prevent them from being able to deliver excellence in maintenance education for their end users. Is ABET accreditation right for a four-year maintenance program at a larger college or university where the department wishes to retain the A&P activities, but needs to expand its program to an engineering technology program? Perhaps.

The ability to organize the process, and continue the process in training new faculty when they arrive, updating the sheets, and remaining in touch with the latest ABET and FAA guidance, should all be considered. If faculty at a school decides to follow this path, it is extremely important that they plan and organize the multitude of details. Get started early, as there always seems to be another issue pop-up, even if they thought they had planned for it. Expect the ripple effect and allow time to fix the next problem caused by fixing the last problem. It is a very fluid and dynamic process that needs continuous monitoring and adjustments.

This is not an insurmountable task, nor does it have to be an uncontrolled many headed beast. Using the KISS method (Keep It Simple, Stupid), a simple ubiquitous program like Excel™, and an hour or two each semester, the documentation can be updated in an easy, timely process and ready when the application or report is needed long before the accreditation team arrives. Keep it as simple and user friendly as possible. There may be way to integrate many elaborate programs and ways to build in "automatic" steps, but a caveat, they can get cumbersome at the worst possible moments.

Following with this same thought of as simple as possible to get the job done, incorporate the entire faculty to do a small part. This keeps them informed and included which means the burden does not fall on one faculty member that is already loaded down with daily/semester tasks. Faculty already have full time jobs, don't make it a scramble at the end to pull all the details together. A half an hour to an hour each semester should be all that is needed. Slow and steady, continuous entry and improvement is surely easier than a year of frantic data entry and preparation for a visiting accreditation team.

REFERENCES

Thom, J.M., personal observations from attendance at the ABET Best Practices Seminar IX, Terre Haute Indiana, April 2007

ABET web site, (October 2009). http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/T001%2008-09%20TAC%20Criteria%2011-30-07.pdf, p.6

APPENDIX A

ABET PROGRAM OUTCOMES

An engineering technology program must demonstrate that graduates have:

a. an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines,

b. an ability to apply current knowledge and adapt to emerging applications of mathematics, science, engineering and technology,

c. an ability to conduct, analyze and interpret experiments and apply experimental results to improve processes,

d. an ability to apply creativity in the design of systems, components or processes appropriate to program objectives,

e. an ability to function effectively on teams,

f. an ability to identify, analyze and solve technical problems,

g. an ability to communicate effectively,

h. a recognition of the need for, and an ability to engage in lifelong learning,

i. an ability to understand professional, ethical and social responsibilities,

j. a respect for diversity and a knowledge of contemporary professional, societal and global issues, and

k. a commitment to quality, timeliness, and continuous improvement.

(ABET Website, 2009)

CALL FOR NOMINATIONS

ATEC BOARD OF DIRECTORS AND OFFICERS

At the Annual Convention, April 11-13, 2009 at Mesa, AZ, an election will be held to fill three Board of Director positions that will become vacant. Because of the By-Law changes approved by the General Membership at the 2009 Annual Conference which changed the term of office from three years to four, a fourth Board member will be appointed by the President with approval of the Board to serve a one-year term. This is necessary to create a smooth future transition of vacancies on the Board.

The term of office of those elected to the Board at this Conference (and in the future) will be four years. An elected Board member may serve up to two consecutive terms of office and then be eligible for further election to the Board after a waiting period of one year.

The President and Vice President positions will also be filled at the 2010 Conference. According to the By-Laws: Officers shall be elected by the ATEC board at the annual conference. Candidates must be nominated by a seated board member and elected with a majority vote of the board members.

The term of office for the President and Vice President shall be two years, from annual conference to annual conference. The President shall not serve more than two elected consecutive terms as President. The Vice President shall not serve more than two elected consecutive terms as Vice President

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

If interested, please contact the Business Office at ccdq@aol.com no later than March 1, 2010.

ATEC BOARD OF DIRECTOR'S NOMINATION FORM

Several seats are open on the ATEC Board of Directors for 2010

If you would like to have your name placed in nomination for the ATEC Board, please complete the form below by **January 8, 2010** and mail to:

ATEC
2090 Wexford Court

Harrisburg, PA 17112

or

FAX to: (717) 540-7121

Name: ____

Institution: ____

Address: ____

Phone: ______________ Fax: ______________ E-mail: ______________

NOTE: Your institution must be an institutional member in order for you to run for the Board.

For those who place their name in nomination, we will be asking you in February to send a picture and a brief write-up of your background and what you would like to accomplish on the Board. This will be shared with all conference attendees in Mesa in April.

DEADLINE: January 8, 2010

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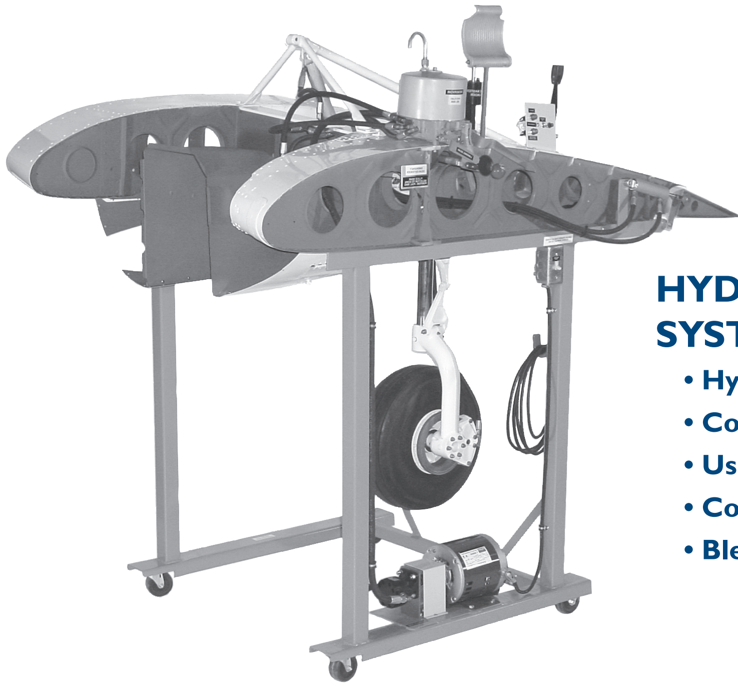

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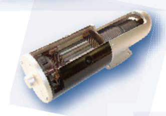

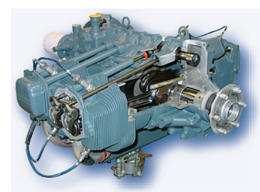

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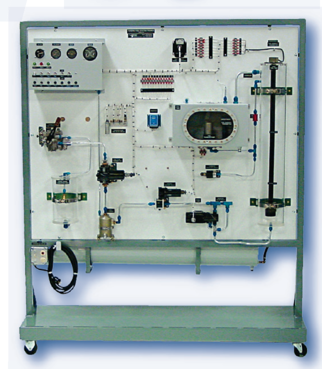

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ATEC Update

147 NPRM

While the ARAC was successful in paving the way for the completion of a Proposed Rule in May 2009, the actual finished NPRM has been delayed because of some emergency projects that have taken precedence. Staff and legal resources were removed from work on the Part 147 Rule and placed on these emergencies.

ATEC will be meeting with senior FAA staff in an effort to move the Rule forward by requesting a reallocation of staff resources.

MEETING WITH FAA STAFF

On September 18, ten ATEC Board members met with Carol Giles, Ed Hall and others from the AFS300 section to discuss the following issues:

1. ATEC is lobbying to transition Form 8610-2 into the electronic IACRA system or some other e-service.
2. Explored ideas to reduce the Oral & Practical testing process to less than the average 20 hours for General, Airframe and Powerplant.
3. ATEC thanked the FAA for the new FAA H 8083-30-(ATB) which is the General Textbook AC 65-9A.
4. ATEC requested relief to allow a DME to test two applicants simultaneously.
5. The FAA is researching the report that someone was able to secure an A&P certificate for unsupervised work on LSAs. It has been suggested that this is a loophole that allows a backdoor method of achieving an A&P. FAA staff were concerned and will check it out.
6. ATEC will continue to follow-up with these issues.

SERVE ON THE ATEC BOARD

The ATEC Board Nomination Form is attached. Several seats are open for April 2010. If you are interested in placing your name in nomination, complete the form and fax or mail it as indicated on the form. Voting will take place at the 50th Anniversary Conference in Mesa, Arizona, April 11-13, 2010.

CALL FOR PAPER PRESENTATIONS

If you have a technical presentation that you would like to present at the April 11-13 Conference, see the attached application information and return it by December 4.

SCHOLARSHIPS ON THE WEBSITE

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

INSTRUCTIONAL DVD'S

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

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

YOUR INSTITUTIONAL LISTING NEEDS TO BE UPDATED

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

Review your listing for accuracy. If it needs to be changed, print it out, make changes and fax it to 717-540-7121 by December 4. Be sure to check contacts and contact information.

EDUCATOR AND STUDENT OF THE YEAR AWARD NOMINATIONS

Included in this Update are the letters announcing the two major ATEC awards to be presented at the 50th Anniversary Conference, April 11-13, 2010 in Mesa, Arizona (adjacent to Phoenix).

To download the application materials, go to www.atec-amt.org. Click on Livi (Educator) and Rardon (Student) award. **The deadline is December 4, 2009**.

50 YEARS OLD IN 2010

ATEC will celebrate 50 years of service to AMT schools and students at its Annual Conference, April 11-13, 2010 in Mesa, Arizona. **MARK YOUR CALENDAR!**

For Conference general information, see the attached information or go to the website www.atec.amt.org and click on 2010 Conference.

The Agenda will be finalized and distributed in November 2009.

CLIFF BALLWING STUDENT SCHOLARSHIPS

The Western Pennsylvania Cliff Ball Wing – OX5 is conducting their 2009 fundraiser. The proceeds will be donated to the Northrop Rice Foundation which administers the scholarship programs. Last year the CBW's donation made possible the awarding of ten $600.00 scholarships to students attending ATEC Institutional Member Schools.

A list of other NRF and ATEC scholarships and awards for 2010 are attached. Details and applications can be found at www.atec-amt.org.

EDUCATOR OF THE YEAR AWARD

September 2009

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 21st annual Ivan D. Livi Aviation Maintenance Educator of the Year Award. You will find the criteria for eligibility and appropriate forms on the ATEC Website at www.atec-amt.org. Click on Livi (Educator) Award. Or, request a form from ATEC fax (717) 540-7121. I sincerely encourage each member institution to carefully review these forms and forward a nomination to the selection committee as specified in the instructions.

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

ATEC pays all the travel expenses "and a free conference registration" to the ATEC Conference for the winner. The twenty-first annual award will be presented on April 12, 2010 at our Mesa Conference. Forward your nomination by **December 4, 2009** to the ATEC Business Office, 2090 Wexford Court, Harrisburg, PA 17112.

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

Sincerely,

Laurie Johns

ATEC President

ATEC

AVIATION TECHNICIAN EDUCATION COUNCIL

2010

IVAN D. LIVI AVIATION MAINTENANCE EDUCATOR OF THE YEAR AWARD

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

This award will be presented at the annual ATEC Conference April 11-13, 2010 in Mesa.

The winner will be contacted in late February.

CRITERIA FOR ELIGIBILITY

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

1. Be employed by an institution and/or organization that is a member of the Aviation Technician Education Council.
2. Be an active instructor of Airframe and/or Powerplant Technicians. The applicant's workload must be of such a nature that they spend 80% of their workload time in contact with students teaching actual aviation maintenance technology classes.
3. Present a completed application with appropriate signatures by December 4, 2009 to ATEC, Awards Committee, 2090 Wexford Court, Harrisburg, PA 17112.
4. Nominations may be made for one particular outstanding achievement by a person. They may also be made for a person who has consistently contributed above average performance.
5. Nominees are not eligible if they are a current member of the Executive Board or, as regular members, they are serving on the Public Relations Committee.

CRITERIA USED FOR EVALUATION

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

   Total value in per cent...45%

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

   Total value in per cent...25%

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

   Total value in per cent...15%

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

   Total value in per cent...15%

STUDENT OF THE YEAR AWARD

September 2009

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 11th annual award of the James Rardon Aviation Maintenance Technician Student of the Year. You will find the criteria for eligibility and appropriate forms on the ATEC Website at www.atec-amt.org. Click on Rardon (Student) Award. Or, request a form from ATEC fax (717) 540-7121. I sincerely encourage each member institution to review carefully these forms and forward a nomination to the selection committee as specified in the instructions.

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

ATEC and Northrop Rice Foundation pays coach airfare, lodging for three nights, $75 stipend "and a free conference registration" to the ATEC Conference for the winner. The eleventh annual award will be presented on April 12, 2010 at our Mesa Conference. Forward your nomination by **December 4, 2009** to the ATEC Business Office, 2090 Wexford Court, Harrisburg, PA 17112.

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

Sincerely,

Laurie Johns

ATEC President

JAMES RARDON AVIATION MAINTENANCE TECHNICIAN STUDENT OF THE YEAR AWARDS

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

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

Nomination Process: Nominators must complete a Nomination Form with appropriate signatures by **December 4, 2009** and forward it to ATEC, Awards Committee, 2090 Wexford Court, Harrisburg, PA 17112.

Review Process: Following receipt of the nominations, they will be reviewed by the ATEC Awards Committee and Northrop Rice Foundation Board of Directors to determine ten (10) finalists. The ATEC Awards Committee will then select the James Rardon AMT Student of the Year award winner from the finalists. The winner will be contacted in late February 2010.

Selection Criteria:

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

   Total value in per cent. 35%

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

   Total value in per cent. 30%

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

   Total value in per cent. 25%

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

   Total value in per cent. 10%

Awards: The 2010 James Rardon AMT Student of the Year award winner will receive transportation costs (airfare, hotel, meals, etc.) to attend the ATEC Annual Conference in Mesa on April 11-13, 2010. The recipient will be honored during the Awards Luncheon and will receive the "James Rardon Aviation Maintenance Technician Student of the Year" plaque. The other nine (9) finalists will receive by mail a "James Rardon Outstanding AMT Student" certificate. These ATEC awards are sponsored and funded by the **Northrop Rice Foundation**. Registration at the ATEC Annual Conference for the James Rardon award winner is provided by ATEC.

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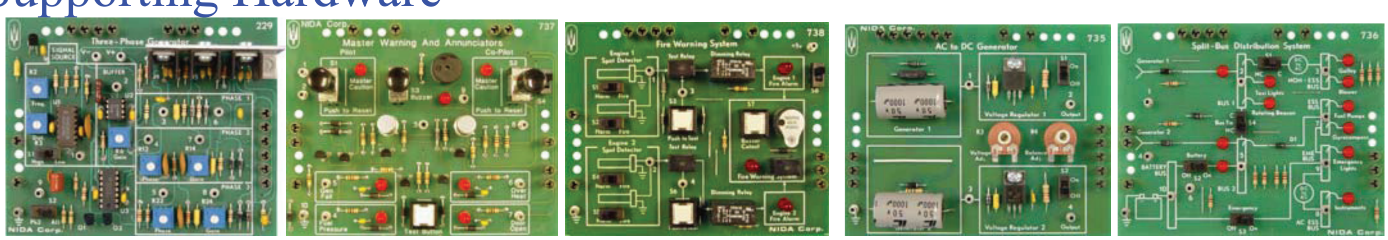

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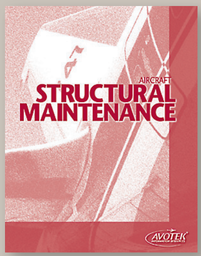
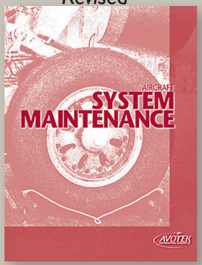
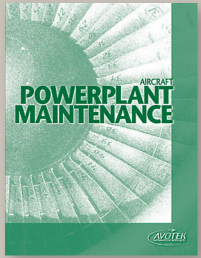


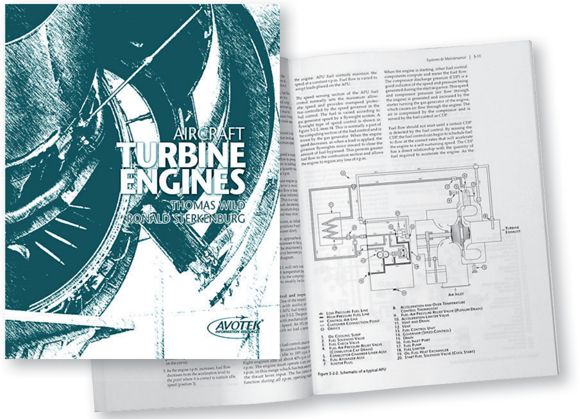
Aircraft Structural Maintenance
Revised



Aircraft System Maintenance
Revised

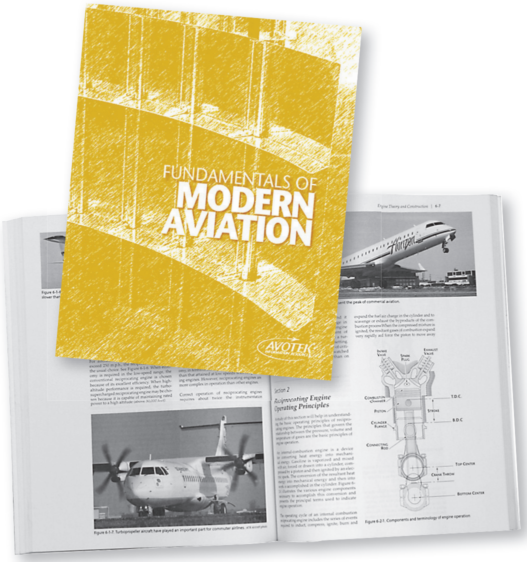


Aircraft Powerplant Maintenance
Revised



Aircraft Turbine Engines

- Fundamentals, engine types, theory, nomenclature
- Detailed diagrams and illustrations



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- Introductory text for aviation maintenance students
- Overview of curriculum in FAA certified schools

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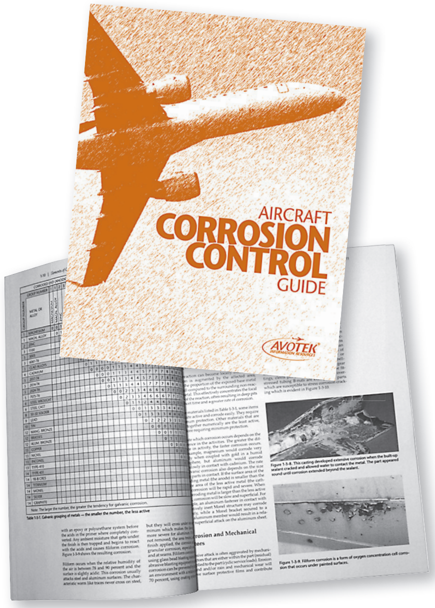
- Details annual condition inspection
- Covers regulations and inspections



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Call For Papers

The Aviation Technician Education Council is seeking papers for presentation at ATEC 2010, Mesa, AZ, April 11-13, 2010. Papers for presentation on the following topics with the general theme of "**Best Practices: Present and Future**" are sought as they relate to the instruction and administration of FAR Part 147 programs:

Capstone Experiences

Development (fund raising)

Distance Education/ Computer Based Education

Industry Advisory Boards

Innovative Laboratory Projects

Multimedia in the Classroom

New Trends in Airframes & Powerplants

Outcome Based Assessment

Professional Development

Program Assessment

Recruitment & Retention

Strategic Planning

Abstracts (400 words maximum) must be electronically submitted in Microsoft Word by December 1, 2009. All abstracts will be reviewed and authors of accepted abstracts will be invited to submit a full paper. Authors must supply their own laptop computer or make other arrangements with ATEC prior to the convention. Authors must register for and present their work at Mesa, AZ, April 12 (as scheduled), at the Marriott Mesa Resort.

Deadlines

December 1, 2009: Abstract Submission

January 26, 2010: Notification of Acceptance/ Rejection

February 23, 2010: Submission of Draft Full Paper/ Audio and Video requirements

March 14, 2010: Electronic Submission of Final Paper

Please direct any questions and or submissions to:

Harry Whitehead
Aviation Center
Lansing Community College
3428 W. Hangar Dr.
Lansing, MI 48906
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Fax 517-886-0530
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