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# The National Center for Aircraft Technician Training Aircraft Electronics Technician Certification and a Case for Standards and Certification

*Jeff Cunion, Indiana State University*

## INTRODUCTION

The National Center for Aircraft Technician Training (NCATT) was funded by the National Science Foundation in the interest of improving aviation technician skills, and ultimately, the safety of the nation's air transportation system. NCATT consists of members from industry, government, and education who are working together to achieve these goals and promote aviation maintenance professionalism. The first task that was undertaken by NCATT was the establishment of an aviation industry recognized certification for aircraft electronics and avionics technicians. The issuance of an NCATT certification was based upon a technician passing an industry developed and endorsed examination. Unlike the Airframe and Powerplant Certification, which was administered by the Federal Aviation Administration (FAA), NCATT certifications, and the related endorsements, were aviation industry certifications that were designed *by* and *for* the industry.

This paper provides an overview of the NCATT AET certification and endorsement system. In addition, the value of certifications and standards in general is presented, addressing often asked questions regarding the value of testing and its relationship to job performance.

## NCATT AET CERTIFICATION OVERVIEW

On March 6th through the 8th of 2006, aviation industry electronics and avionics subject-matter-experts met at a workshop at Tarrant County College in Fort Worth, Texas to establish the first aviation industry knowledge standards for "entry-level" electronics and avionics technicians. Represented were major airlines, avionics manufacturers, FAA Part 145 Repair Stations, Part 91 and 135 operators, the U.S. Air Force, Navy, and Marine Corps along with aviation education and training organizations. The standards that were established during this workshop were validated by the NCATT Standards Committee, and were subsequently adopted by the NCATT Executive Advisory Board. The "NCATT AET Examination" and the "NCATT AET Certification" were based on those standards. The NCATT Certification Committee set the passing grade for the AET exam at 70 percent.

The NCATT AET certification exam is currently available to any interested person at LaserGrade testing centers across the United States and Canada. LaserGrade testing centers can be located through www.lasergrade.com. Textbooks such as Avionics Fundamentals, available through Jeppesen Sandersen, are useful in test preparation as well.

Table 1 identifies the aviation industry identified NCATT AET standards for the basic AET certification. The NCATT AET examination utilizes questions that measure an individual's knowledge in these standards areas. Upon obtaining the basic AET certification, certificate holders are entitled to test for endorsements in areas such as navigation, communication, surveillance, and other areas that are currently under development.

*Table 1 (Sheet 1 of 2). NCATT AET Standards*

| Category | Knowledge Requirement |
|---|---|
| **General Requirements:** | |
| Basic Terminology | Direct Current terms<br>Alternating Current terms |
| Basic Circuits | Theory of operation<br>Circuit troubleshooting |
| Basic Circuit Calculations | DC, AC, DC/AC Measurements |
| Safety Practices | RF energy, noise, hazardous materials |
| Resistors | Color codes, fault isolation |
| Inductors | Theory of operation, fault isolation |
| Capacitors | Theory of operation, fault isolation |
| Transformers | Theory of operation, fault isolation |
| Analog Circuits, Devices and Switches | General operation |
| Power Supply Circuits | Rectifiers, filters |
| Frequency Sensitive Filters | Theory of operation |
| Wave Generation Circuits | Oscillators, wave-shaping circuits |
| Limiter Circuits | Diodes, Zener diodes, transistors |
| Digital Numbering Systems | Binary, octal, hexidecimal |
| Digital Logic Functions | Main logic gates, flip-flops, counters, adders |
| **Common Maintenance Practices:** | |
| Hazards & Safety Practices | RF energy, noise, electrical power, ESD protection, microwave, hazardous liquids, FOD prevention, first aid for electrical shock |
| Hazardous Materials Handling | Types of materials and fluids, handling procedures, storage and labeling, proper disposal, Material Safety Data Sheets |
| Technical Publications | Interpret installation manuals and technical data, locate and blueprints, and equipment list information |
| **Fundamentals of On-Equipment Maintenance:** | |
| Use Common Hand Tools | Wrenches, torque wrenches |
| Handling of Electrostatic Sensitive Devices | Proper grounding |
| Corrosion Control | Identification and repair |
| Use Safety Devices | Safety and shear wire |
| Aircraft Wiring | Multi-conductor, coaxial, twisted pair, single conductor |
| Perform wire maintenance | Continuity checks |
| Use Test Equipment/Special Tools | Analog multi-meter, digital multi-meter, oscilloscope |
| **Aircraft Fundamentals:** | |
| Aviation Terminology | -- |
| Basic Aviation Fundamentals & Safety | -- |
| Basic Troubleshooting Theory | -- |
| Identify Flight Controls | -- |
| Safety | Operational Risk Management, fall protection |
| Theory of Flight | -- |

## THE IMPORTANCE OF STANDARDS AND CERTIFICATION

The establishment and use of industry standards has been a key to greater efficiency and growth ever since the establishment of standards for linear dimensions, such as the size of an inch for example, has precipitated the development of interchangeable parts and the possibility of mass production. In its simplest sense, a standard is an agreed-upon way of doing something (Spivak and Brenner, 2001). Additionally, a standard may denote an agreement, measure, condition, or specification between a manufacturer, service provider, or consumer. Spivak and Brenner go on to note that standards are applied in the use of ratings, management systems, and services, and are applied for the protection of health, safety and consumers. Certification can be defined as validating the authenticity of something or someone (Miller, 2006). Certification and standardization, along with the activities known as accreditation, inspection, registration, and testing all fall under the area of *conformity assessment*, which strives to demonstrate that requirements related to a process, product, system, person, or body are fulfilled (American National Standards Institute, 2006).

For individuals, certifications provided opportunities to demonstrate knowledge and gain credibility. Certifications also increased the likelihood that individuals would be employed. In the information technology industry for instance, Cegielski (2004) found that human resource professionals placed a greater value on job candidates who held an Information Systems Networks (ISN) certification than those who did not, if for no other reason than it provided a basis for selection, minimizing their personal responsibility. In the medical field, certifications were found to improve the quality of work. Byrne, Valentine and Carter (2004) conducted a study of the Certification Board Perioperative Nursing specialty certification in particular. They found that 72 percent of respondents (both certified and non-certified respondents) believed there were one or more benefits of certification, including error and mishap reduction. In spite of these seemingly obvious advantages for the individual in obtaining certification in a technical field of expertise, many still discounted the value of various certifications. Ray and McCoy (2000) noted that certification was highly regarded in the fields of medicine and accounting, yet other professionals, in Information Technology (IT) for instance, struggled with the value of certifications. They cited a lack of an unbiased group that determines exam content (as in Microsoft and Novell certifications), a rapidly changing IT field, a reluctance of educators to maintain their own proficiency levels in certification exams, and a feeling that exams, instead of theory, may drive class curriculums. In spite of these pitfalls, Ray and McCoy's research found that employers enjoyed improved productivity, morale and quality, educators benefit from receiving additional assessment tools for their courseware, and students benefit by improving their marketability.

Perhaps more importantly than for the individual, there are economic and safety reasons for adopting a regimented system of standards and certifications for our country. On a macroeconomic level, standards and certifications allow for the developers and suppliers of products and services to select systems based on widely accepted specifications (International Organization for Standardization, 2006). This means that businesses and corporations using common standards are free to compete in worldwide markets. For customers and society, increased competition brings lower prices, since manufacturers and service providers can compete utilizing the same methods of manufacturing and compatibility. The Institute of Electrical and Electronic Engineers Standards Association (IEEE-SA) (2006) advocates the uses of standards as well, noting that standards help solve everything from product compatibility issues to consumer health and safety issues. IEEE-SA goes on to state that standards are fundamental building blocks of international trade, allowing for interoperability and interconnectivity of systems and products. The U.S. government has a keen interest in standards and supports organizations such as The American National Standards Institute (ANSI) which is a non-profit organization that administers and coordinates the United States voluntary standardization and conformity assessment system. ANSI and similar groups are active in both national and international standards, seeking to facilitate the United States global competitiveness. ANSI has developed a national strategic plan for addressing concerns regarding health, safety, the environment, and our economy. Finally, standards are being increasingly applied in global trade, and their effect has become more obvious as trade liberalization has brought down tariffs in many parts of the world (World Trade Organization, 2005).

## RAMIFICATIONS FOR AVIATION

From an aircraft electronics technician standpoint, the same advantages of standards and certifications found in other professions and industries can be realized in the aviation industry as well. Certainly attainment of a certification can provide a frame of reference for employers and a means for individuals to demonstrate knowledge and achievement. For our aircraft industry, the NCATT certification system can allow our entire workforce to display a level of expertise, making our manufacturers, repair facilities, and part manufacturers a more attractive alternative for both national and international customers. That is, by providing high-quality aircraft production and service, our industry producers, suppliers, and maintainers can remain competitive with the rest of the world.

Ultimately, the safety of the nation's air system is a primary justification for the continuous pursuit of a highly trained and skilled workforce. The 2005 Nall Report notes that 15.6 percent of general aviation related accidents, including 29 fatalities, were attributable to the failure of mechanical components or errors in maintenance (Krey, Niel C., 2006). In the commercial sector, Boeing (2006) reports that three percent of all hull loss accidents related to the worldwide commercial jet fleet from 1996 through 2005 were attributable to maintenance. This should be a concern to the aircraft maintenance industry.

Though detailed data related to specific causes of maintenance related accidents remains elusive, and is topic for further research, one study of human factors related to incidents in aircraft maintenance in Australia has been accomplished. Hobbs and Williamson (2003) have found that thirteen percent of all aircraft maintenance errors, whether they resulted in accidents or not, are knowledge-based. As described earlier, certification has improved quality and reduced mishaps in the medical and IT fields. Perhaps if the NCATT AET certification system, with its focus on endorsements and continuing education had been adopter earlier, many of these knowledge-based maintenance errors would have been eliminated, providing a safer air transportation system.

## CONCLUSION

Standard procedures and processes, and the validation of procedures, processes, and individuals via certification, are beneficial to individuals as well as our economy. The rigorous testing, certification, and endorsement system for aircraft electronics and avionics technicians that is being developed by NCATT are beneficial to individual technicians, the aviation industry, and the public as well, through increased safety. This system helps ensure our workforce remains skilled and competitive with the world's developing aviation industry. The endorsement system is a particularly attractive since it provides a means for continuous learning, achievement, and improvement. It is wise for aviation technician educators to be aware of the NCATT system of certification and endorsements, as are already many in the aviation industry.

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# Turbine Powerplants: Using the A&P Course to Fulfill Engineering Needs

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The Department of Aviation Technology at Purdue University has been offering courses in its A&P program to students from Purdue Engineering programs. Engineering students have been able to take individual courses, several courses to build a minor in selected areas, take the entire A&P certificate program, or do double major in both Engineering and in Aviation Technology.

The current study was prompted when and the authors were providing engineering students with support in terms of detailed technical information regarding the construction, maintenance, and operation of aircraft systems for the engineering design courses. It became evident that the engineering students did not have knowledge of the details of aircraft construction and systems at a level necessary to successfully complete their engineering analysis. While there was no problem with their engineering ability, and while they did have a desire to learn, they lacked a level of detail knowledge that was required to perform detailed design work. The support provided to engineering at the time was in regard to turbine powerplant systems. It therefore became a natural question to determine what kind of course in turbine engine powerplants could be useful to both engineering students and senior level technology students.

In order to do the study a structured data collection and analysis method was needed. The method chosen was a system used in industry known as the Quality Functional Deployment (QFD) system: House of Quality (HOQ). The QFD was a method of incorporating the voice of the stakeholders into the decision making process. The HOQ was then used as a graphical data collection and analysis system which allowed for multiple dimensions of a problem to be viewed and studied at once.

The number of people asked to provide input for this study was small because the questions to be answered were specific enough that it required only the most relevant of participants; industry professionals, students, and academic instructors. Surveys with n's of between 5 and 10 were acceptable because the QFD/HOQ process was designed as a customer input device not a statistical survey. The QFD/HOQ process provided the researchers with a structured way of getting information from all relevant parties, and provided a way to manage the diverse inputs.

The Japanese used the QFD/HOQ approach since its development in the late 1960s, and organizations in the United States discovered it in the 1980s to better meet customers' requirements throughout the design process (QFD Institute website, 2003). The QFD/HOQ process was recognized as a key decision making tool for Six Sigma organizations throughout the world (ReVelle, J.B., Moran, J.W., Cox, C.A., 1998, p.1). Through QFD, every design and manufacturing decision made was to meet the expressed needs of the customers (Evans, J.R., Lindsay, W.M., 2002, p.386).

HOQ uses a matrix diagram to present data. An example of the House of Quality can be seen in Figure 1. The HOQ is a set of matrices that helps the user identify and analyze customer inputs to achieve customer satisfaction. In the HOQ, a set of matrixes relate the voice of the customer to a product's technical requirements, process control plans, and production/service operations. Each cell in the matrix provides the opportunity to seek inputs from all the stakeholders involved in the outcome, and allows stakeholders inputs to be recorded, and deliberated, in a structured and orderly fashion. It also drives the committee to seek further data where there is insufficient information to make a decision.

The QFD/HOQ was deemed an acceptable data organization tool for the current study because of the QFD/HOQ use in industry. A literature review found that a survey was conducted through a collaboration of Tamagawa University and the University of Michigan, on recent trends of QFD/HOQ applications. The sample of the survey consisted of 400 Japanese companies and 400 United States companies. 146 Japanese companies responded and 147

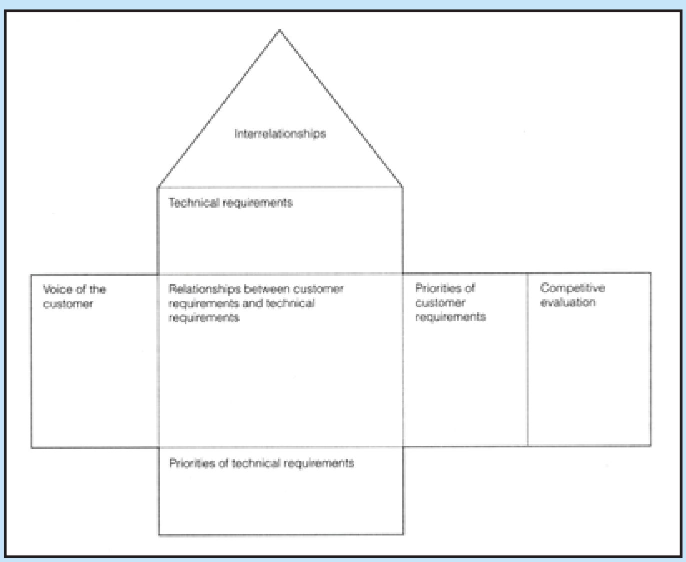

Figure 1 (House of Quality matrix)

United States companies responded. 31.5% of the Japanese companies used QFD/HOQ in their design process, while 68.5% of the U.S. companies did the same (Akao, Y., 1997, p.5). Over half of the U.S. companies that responded used QFD/HOQ in their design process.

Building the House of Quality consisted of six basic steps:

- Identify customer requirements (what's).
- Identify technical requirements (how's).
- Relate the customer requirements to the technical requirements.
- Conduct an evaluation of competing products of services.
- Evaluate technical requirements and develop targets.
- Determine which technical requirements to deploy in the remainder of the production/delivery process.

*(Evans, J.R. & Lindsay, W.M., 2003, p.388)*

There were four surveys conducted in this study to gather inputs for the HOQ model. The analysis began with customer inputs that were general and through repeated survey evaluations the requirements were made progressively more and more specific. This progressive specificity of the evaluations was required in order to make the customer desires accomplishable. The researcher wanted the technical requirements to achieve total customer satisfaction, but not be ambiguous.

Typically when a survey is conducted to determine what a customer wants, the customer specifies satisfying factors that are too vague to be useful. For example an employer may say that they want graduates to be able to "communicate". A car buyer may wish the car to be "comfortable". While these are important satisfying factors, the customer response is too vague to be useful. By using a series of surveys the plan was to be able to mine the specifics out of otherwise potentially vague customer wants. In this study the researchers determined after the fourth survey, that the technical requirements were precise enough to devise a basic course outline for a turbine engine course.

Each survey was connected to the preceding survey by way of objectives or technical requirements rated for importance by academic and industrial personnel. Not all of the objectives from the first survey were deemed acceptable enough to make it through all four surveys.

Six initial objectives in this survey were created from a brainstorming session with the researcher and a faculty advisor. The six objectives were based on the academic experiences of the student researcher and the industry professional experiences of the Technology faculty member. The six objectives chosen were:

1. To provide a better understanding and communication between engineers and technologists.
2. To give the Engineering students a hands-on approach to understanding propulsion design, theory, and manufacturing.
3. To provide a better understanding of the design and manufacturing process.
4. To allow an opportunity for engineers and technologists to work as a cohesive team in a real world environment.
5. To give the Engineering and Technology students the chance to learn industry standards and common practices in powerplant design and manufacturing.
6. To provide an understanding the how's and why's engines are built the way they are.

The survey was distributed to Engineering faculty, Engineering students, Aviation Technology faculty, and industry representatives, and was also completed by this researcher and the Technology faculty member. The QFD/HOQ model allowed the parties gathering the data to also participate in the data input. For each objective in the survey a selection criterion was developed in order to determine whether the objective should be used in the next survey to be conducted or whether that objective should be dropped. Only objectives that were determined to be of value to the stakeholders progressed to the next survey. The selection criteria for this first survey was simple; any objective that was scored as a three, on a three point scale, by more than half of the customers in any subset group was selected for the next section. Any criterion that was rated a one out of three, by any of the subset groups was eliminated from that objective. Using this method, only the items that the groups felt strongly positively about were passed and any that a customer group felt strongly negatively about were dropped. In the end, only objectives 3 and 6 were important enough to progress to the next level of study:

1. Better understanding of the design and manufacturing process. (3)
2. How's and whys engines are built the way they are. (6)

Next it was next necessary to develop several possible alternatives, or "how's", to find ways to fulfill "what" the customer's wanted. Various ways of fulfilling the customer's requirements were developed. The 11 technical requirements listed below were developed by the researcher with the aid of the participants to the study.

1. Provide lectures on what engines are used for with discussions of purposes and various applications.
2. Provide lectures on the different materials used in engines, including metals, composite resins, and consumables.
3. Provide labs where students could gain hands-on experience in seeing and handling various materials including evaluation of defects and materials performance.

4. Provide lectures regarding the application of Design for Manufacture (DFM), Design for Assembly (DFA), and Life-Cycle Engineering.

5. Provide practical projects where students for DFM, DFA, and Life-Cycle Engineering analysis.

6. Provide lectures on Integrated Product Teams and Integrated Product Design, and explain the structures of Integrated Product Design (IPD)'s in industry.

7. Set up projects involving IPDs.

8. Discuss options and design trade-offs of turbine engines going through the engine module by module, including major accessories.

9. Provide options of the standard "Rules of Thumb" used by engineers, technologists, and users of turbine engines.

10. Teach the computation of turbine engine performance parameters including things like: thrust, Thrust Specific Fuel Consumption, Horsepower, etc.

11. Provide the student with the opportunity to see detailed assemblies and components of turbine engines and to perform common assembly and test activities.

The purpose of the second survey was for the customers to rate how well the 11 listed technical requirements, or "how's", satisfied the two customer requirements defined in the first survey. The second survey yielded the following three customer requirements from that previous list:

1. Provide lectures regarding the application of DFM, DFA, and Life-Cycle Engineering.

2. Discuss options and design trade-offs of turbine engines going through the engine module by module, including major accessories.

3. Provide the student with the opportunity to see detailed assemblies and components of turbine engines and to perform common assembly and test activities.

It was necessary next to develop several possible alternatives, or "how's", to find ways to fulfill the customer's requirements defined by the second survey. Various ways of fulfilling the customer's requirements were developed. The 22 technical requirements listed below were developed by the researchers with the aid of the participants to the current study as means of fulfilling the customer's requirements as defined by the second survey. The technical requirements of this section were adequate at describing the needs and wants of the customer because the participants of the technical requirements were not only experts in their respective fields; they were also the end customer.

1. Variations and applications of the gas turbine engine.

2. Turbine engine nomenclature.

3. Operational turbine engine theory.

4. Internal and external turbine engine component comparisons and compatibility.

5. Turbine engine accessories comparisons and compatibility.

6. Turbine engine application environment.

7. Turbine parts and accessory fabrication limitations.

8. Common inspection and maintenance practices.

9. Variety of turbine engines available for inspection and assembly/disassembly.

10. Variety of cut-aways of turbine engines, components, and accessories.

11. Testing and inspection equipment.

12. Common and specialty tools.

13. Instruction on the use of the tools.

14. Manufacturing methods.

15. Guidelines for a more user friendly assembly design.

16. Maintainability.

17. Supportability.

18. Deployability.

19. Serviceability.

20. Compatibility.

21. Affordability.

22. Dependability.

Based on the information gathered in the third survey there were 10 out of the 22 listed suggestions that progressed onto Part 4 of this study. They were, in succession of priority:

1. Variations and applications of the gas turbine engine. (1)

2. Guidelines for a more user friendly assembly design. (15)

3. Internal and external turbine engine component comparisons and compatibility. (4)

4. Turbine engine accessories comparisons and compatibility. (5)

5. Maintainability. (16)

6. Turbine engine nomenclature. (2)

7. Manufacturing methods. (14)

8. Serviceability. (19)

9. Operational turbine engine theory. (3)

10. Supportability. (17)

Part 4 was used to determine the capabilities of the Department of Aviation Technology in achieving customer satisfaction by being able to teach the concepts desired by the customers. There were 10 technical requirements moved on from survey three, which four Aviation Technology Faculty members rated as a one, two, or three. Number one represented "least capable in achieving" which meant the amount of equipment and funding needed were impractical or unattainable. Number two represented "capable of achieving with equipment acquisition", which meant that with a minimum of funding and equipment acquisition the requirement was attainable. Number three represented "capable of achieving", which meant that with no funding or equipment acquisition was needed and the requirement could still be obtained. The following shows what the Aviation Technology faculty indicated were achievable given their resources and expertise:

1. Variations and applications of the gas turbine engine.
2. Turbine engine nomenclature.
3. Operational turbine engine theory.
4. Internal and external turbine engine component comparisons and compatibility.
5. Turbine engine accessories comparisons and compatibility.
6. Manufacturing methods.
7. Guidelines for a more user friendly assembly design.
8. Maintainability.
9. Supportability.
10. Serviceability

The professors were asked to answer "YES" or "NO" if the department was able to teach the required subject. If the answer was "YES", they were then asked to describe the difficulties that they expected to experience in the acquisition of funds and equipment. Based on the findings of the final survey the Department of Aviation Technology would have no difficulty in performing the desired functions.

THE RESULTING COURSE OUTLINE

**Week one:**

- Variations and applications of the gas turbine engine
  - **Lecture:** Turboprops, turbojets, turbofans, and turboshafts, operating parameters (TSFC, SFC, hp, thrust, shaft hp, etc)
  - **Lab:** Orientation on engines and industry standard practices and safety

**Week two:**

- Turbine engine nomenclature
  - **Lecture:** Abbreviations, terms, and symbols
  - **Lab:** Begin set up to run turbofan or turbojet engine

**Week three:**

- Operational turbine engine theory-Turbofan or Turbojet
  - **Lecture:** Fundamentals of jet propulsion and parts of a turbine engine Turbojet and turboshaft operations:
    - History and modern applications
    - Operation limitations
    - Standard components and accessories
    - Operation limitations (shaft horsepower)
  - **Lab:** Finish set up and run Turbofan or Turbojet engine
    - Discuss and observe standard disassembled components and accessories (turbine wheel, power takeoff fixed shaft, power takeoff free turbine)
  - Discuss operation limitations (BPR, EPR, CPR).

**Week four:**

- Operational turbine engine theory-Turboprop operations
  - **Lecture:** Operation limitations (equivalent shaft horsepower)
  - **Lab:** Observe operations and operate Turboprop

**Week five:**

- Internal and external turbine engine component comparisons and compatibility.
  - **Lecture:** Discussion on fan blades and discussion on compressors and burners
  - **Lab:** Finish set up and run Turbofan or Turbojet engine
    - Discuss and observe standard disassembled components and accessories

**Week six:**

- Internal and external turbine engine component comparisons and compatibility.
  - **Lecture:** Discussion on turbines types
  - **Lab:** The principles of line maintenance and heavy maintenance

**Week seven:**

- Accessories
  - **Lecture:** Turbine engine accessories comparisons and compatibility
  - **Lab:** Compressor and turbine wash

**Week eight:**

- Maintainability
  - **Lecture:** Turbine engine accessories comparisons and compatibility;
    - Maintainability.
    - The principles of line maintenance and heavy maintenance.
  - **Lab:** Compressor blades: Review maintenance manual and remove nick or scratch
    - Fuel nozzle testing
    - Component maintenance
    - Turbine nozzle and vanes, review maintenance manual, inspect determine serviceability limits

**Week ten:**

- Serviceability
  - **Lecture:** Lubrication system, review maintenance manual and change oil and filter and analyze.
    - Operational inspection
  - **Lab:** Non-routine inspections
    - Borescope, fiberscope, and electronic imaging
    - Review operating procedures for borescope and examine turbine engine for evidence of fatigue

**Week eleven:**

- Supportability
  - **Lecture:** Specialized personnel. Standard and non-standard components, accessories, and hardware
  - **Lab:** Specialized tools and equipment

**Week twelve:**

- Manufacturing methods
  - **Lecture/Lab:** demonstration: Design for Manufacturability (DFM)and Design for Assembly (DFA)

**Week thirteen:**

- **Lecture/Lab:** Manufacturing methods
- **Life-Cycle Engineering:** review LCE principles and develop a rough methodology for a simple machine.
  - Lean Manufacturing/Agile Manufacturing

**Week fourteen:**

- **Lecture/Lab:** student exercise: Guidelines for a more user-friendly design assembly
- Evaluation of the overall assembly
  - Using DFA guidelines as a template evaluate a simple machine Determine improvement potential
  - Evaluation of component retrieval
  - Using DFA guidelines as a template evaluate a simple machine Determine ways of designing fasteners and components for easy and simple use within the design
  - Guidelines for a more user-friendly design assembly

**Week fifteen:**

- **Lecture:** Evaluation of component handling using DFA guidelines as a template, evaluate a simple machine. Determine ways to improve the handling characteristics of components within the design
- **Lab:** Evaluation of component mating using DFA guidelines as a template to evaluate a simple machine. Determine ways to improve mating of components and fasteners within the design

## *CONCLUSIONS*

This survey revealed four important things. First, it was possible to apply an industry acceptable analysis to an educational question and to perform a structured analysis with reasonable effort. Second, it was revealing how much of what was already taught at a Technology level was of interest and considered useful to both Engineering and the industry it served. Third, the material taught in the propulsion course studied here was virtually identical to material that could be taught in a 14 CFR Part 147 course in advanced turbine engines. And finally, it was encouraging that the Technology based programs possessed the skills, abilities, and resources to teach information of value to engineers.

While not all A&P schools posses the equipment and faculty to offer this material to engineering students, there are 14 CFR Part 147 programs at four year colleges and universities where opportunities exist for interaction with engineering programs. Such interactions can be healthy in that they enhance the credibility of the A&P program as a profession in the eyes of academic administrations, they add to enrollments in Part 147 courses, they lead to a percentage of engineering students deciding to pursue the A&P along with engineering, and can lead to further collaboration between the technical programs and engineering on research and other funded programs.

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# Turbine Engine Dynamometer Development

***By Mike Leasure***

The following article is a summary of the efforts of the faculty and students within the Purdue Aeronautical Technology Department to construct and operate a turbine engine dynamometer installation.

The powerplant courses in AOT have objectives to introduce the concepts of horsepower measurement and data acquisition to students. Previously, a small piston aircraft engine was utilized to drive a liquid cooled eddy current dynamometer. The engine was instrumented for multiple value measurements including CHT, EGT, various pressures, and of course horsepower and RPM measurements. The installation had large requirements for water cooling equipment and blower fan power. The cell in which the installation was housed was exposed to the weather and this made repairs, operation, and service very unpleasant during the winter.

It was decided that a newer installation would better suit the needs of our students and potential research project sponsors. The installation should be portable, easily maintained and operated, and flexible enough to allow various engines to be installed without major modifications. A movable installation with a turbine engine APU and onboard dynamometer cooling capability would fill our needs well. The installation is moveable to allow positioning for outdoor operation and then bringing it into the heated laboratory for repairs or modifications.

A Honeywell GTP-30 auxiliary power unit was selected as the engine to drive the dynamometer. This 100 horsepower turbine allowed us to eliminate the cooling requirements of a piston engine that requires either air or liquid cooling. This eliminated unnecessary and elaborate systems for powering, and ducting, air for a blower or installing pumps, hoses, and additional radiators for liquid cooling. It is light, of moderate horsepower, has minimal fuel consumption, and has a convenient spline drive output on the accessory housing for power output.

The dynamometer itself is a water brake system produced by Land & Sea of North Salem New Hampshire. They produce dynamometers for a myriad of applications and offered the best package for our needs. This dynamometer basically converts horsepower to hot water so the rest of the installation dealt with dissipating the heat produced by the absorption of horsepower through a large reservoir tank, radiator, and cooling fan. The system required the use of two 110 volt power cords through a central power distribution box to supply power to the computer, fuel pump, pressure water pump, fan, and water return pump. The pictures show much more effectively than my written description how this is all attached together. The use of only two common power cords, with all water and fuel requirements being onboard the trailer, resulted in an installation that was as self-contained as possible.

The horsepower measurements may be displayed in many varied ways on the computer monitor. This, combined with the heat and pressure measurements being displayed and recorded simultaneously, makes for an educational demonstration. The development of this project has taken three semesters and the assistance of two professors and three student technicians. The total cost, excluding the turbine engine, was approximately 24 thousand dollars. The Land & Sea engine stand and dynamometer were the most significant cost beyond the value of the turbine.

The installation will be used to introduce students to horsepower measurement, turbine engine installations and service, data acquisition, and dynamometer installation operation. It has already provided a challenging, but educational, experience for the students and faculty alike.

# Maintenance Resource Management in Contemporary FAR 147 Classrooms: From the Toolbox to the Cockpit

*Joe Hawkins, Middle Tennessee State University*

***ABSTRACT***

Discovering aircraft maintenance faults before they become critical is one of the most challenging endeavors in the aerospace industry. Even for specially trained professionals, finding human induced errors can be a time consuming and exhaustive process because most repair and inspection procedures are subsequently concealed by structural members, wire bundles and latched cowls. Through adaptive Maintenance Resource Management (MRM) scenarios and experiential learning activities, aspiring technicians can learn to perform their jobs with more efficiency, increased safety and less stress.

***INTRODUCTION***

With the goal to improve and standardize both personal interaction and operational performance, human factors training has almost always been targeted towards flight crews. In the past decade, human factors training has expanded into the air traffic control environment. Although human factors programs have existed for decades, and Federal Aviation Regulation (FAR) 14CFR 121.373(a) requires oversight of human factors affecting technicians, there remains a limited exposure of human factors for maintenance specialists with a corresponding lack of emphasis in FAR 147 aviation maintenance training curriculums (Patankar, Taylor, 2004).

Since commercial air carriers have long realized the importance of teamwork and effective crew interactions, they along with numerous national training providers have developed their own dedicated MRM training programs. Usually these courses are either initial training for new employees, or offered on a tuition basis by commercial training providers and professional consultants that provide other types of specific systems training.

*Fig. 1 MRM training in colligate FAR 147 curriculums can enhance under-standing and identification of task errors to prevent maintenance related accidents.*

As in any industry, there is a tendency on the part of aerospace managers to resist any interruption to scheduled work flows and completion deadlines. Especially if it involves a measurable amount of lost production and profit not easily recouped. Human factors practitioners have always maintained however, that the diminutive amount of time and money required to participate in human factors training with the expectation of improved interpersonal skills is more than returned in added productivity and safety (Patankar, Taylor, 2004).

Over the course of the past several years, the lack of emphasis on MRM issues has become an even lesser concern because of numerous factors. Among these are the economic pressures to maintain profitability and competitive pricing in an increasing violet market, labor strife and rising fuel costs. Another concern is the disturbing industry trend of maintaining profitability by reducing costs through personnel cutbacks. Several large operators accomplished this by outsourcing inspections and maintenance to private industry and providers located in foreign countries. These maintenance and repair entities, especially those overseas where labor and work conditions are structured quite differently than in the United States, may have little or no MRM emphasis and consequently no appreciation of MRM training benefits.

Fig. 2 MRM discussions stress that accidents are caused by a combination of hazards and unsafe behaviors.

Aging aircraft mishaps involving fuselage fatigue and electrical wiring also provide the impetus to explore MRM issues, and examine how they relate to all types of aviation maintenance, not just geriatric aircraft. In fact, many human factors strategies that apply to other types of industries, such as team development, better communications and job safety have direct and compelling applications in aircraft maintenance operations.

The National Transportation Safety Board (NTSB) along with a variety of professional associations representing aviation maintenance and business interests have repeatedly called for implementation of a MRM program for aircraft technicians, especially on the collegiate level (Patankar, Taylor, 2004). Challenged with the problematical growth of aging aircraft along with the introduction of a new category aircraft such as Very Light Jets, MRM is one of the key areas where qualified improvements in aviation safety can be realized.

### *WHAT IS MRM?*

Since man's first attempts at flight, the human aspect has always figured prominently in aircraft design and efficiencies. The first recognized work in the areas of reducing accidents through a better understanding of human performance was undertaken during World War II. The results of these studies indicated that to be fully effective, the building blocks of human factors training must include technicians as an integrated part of the comprehensive program. Experiencing such a total exposure, technicians not only gain a clearer understanding of their responsibilities and objectives, but the overall business environment as well (Edwards, 1988).

MRM is non-technical experiential training inclusive of any element of instruction and practical exercises that affects a technician in the performance of his or hers job tasks. Among the many human factor topics, MRM typically encompasses situational awareness, error chain recognizition, and improved communication skills. Other factors of MRM include safety, scheduling, regulations, efficiency, comfort, operations and the social synergy component of team work.

The MRM process begins with explaining and understanding various types of induced errors, not just those resulting from repetitive tasks such as repair of wheel and brake assemblies or the mind boring inspection of rivets. MRM training promotes student centered learning experiences with engaging classroom activities that produce student behaviors geared towards safety, airworthiness and professionalism.

### *SITUATION AWARENESS*

Situational awareness is not a vague term nor should it be a difficult concept to teach or for students to grasp. Instead, situational awareness is a developed group of intrinsic skills that when properly recognized and matured, contribute directly to elevated safety levels, increased production and worker confidence. It is the natural often subconscious evolution of normal daily activities, whether driving, in the classroom, reading a technical journal or engaging in social activities (Endsley, 1995).

Perhaps the most important lesson that MRM should impart in a FAR 147 lesson plan is situation awareness: "knowing what is going on around you." A major challenge that MRM instructors will encounter is realizing that people can vary significantly in the degree to which they are able to develop and maintain situational awareness. Age and experience differences, perceptual speed, hand and eye coordination along with short and long term memory contribute to these work force and student diversities (Endsley, 1995).

MRM in collegiate FAR 147 programs can assist aspiring technicians develop better situational awareness by helping to build relevant skills such as good scan patterns, contingency planning and providing a foundation to build their repertoire of relevant memory stores for a variety of maintenance tasks. When performing aircraft maintenance functions in practical labs, MRM scenarios in conjunction with FAA mandated FAR 147 training helps students more keenly develop a number of dynamics that lead to the deployment of heightened situational awareness:

- Why a particular course of action is completed in accordance with manufacturers and federal guidelines for the work being completed,
- Ensuring that only approved procedures and calibrated equipment are used,
- Identify and correct potential conflicts quickly.

To fully develop MRM training and enhance course continuality, students also need to discuss clues to loss of situational awareness. As lab activities progress, situational awareness may decline over a period of time, but often leave clear indicators that could increase the potential for induced errors. Students need to be alert for: poor work quality, a team member not properly focused on the task and needs increased supervision, technical information and equipment ambiguities and airworthiness.

### *ERROR CHAIN*

Aviation maintenance has experienced many changes over the past decade. Modern aircraft are assembled with materials, power plants and electronic systems that did not exist just a few months ago. At the same time, the number of older aircraft continues to multiply. To maintain these new generation aircraft, technicians employ sophisticated equipment along with a variety of contemporary procedures. One aspect of aviation maintenance that has not changed, however, is that most maintenance tasks are still performed by human technicians and inspectors.

In the chain of events leading to an accident, maintenance errors generally present many opportunities to interrupt the chain and prevent the accident. In searching for the cause of an error, we can typically move in the reverse chronological order of the process or "chain" until the critical action or condition is identified. By reviewing the human factors involved in this series of procedures, the events or links in the error chain can be identified more easily.

*Fig. 4 MRM training includes experiential learning activities with computer based maintenance and troubleshooting programs.*

Identifying any of the “weak” links or incorrect events in a maintenance procedure most likely will have prevented the error. An excellent way for the MRM instructor to present an error chain and how simple it is to break the sequence would be an exercise that examines the factual reports of recent aircraft accidents related to maintenance errors. Through review and discussion, the instructor can encourage the class to list and detail as many “weak links” in the error chain as they can find.

Two maintenance related aircraft accidents highlight the tragic connection between loss of situational awareness and error chains. The first is the US Air Express Beechcraft 1900D that was not able to recover from extreme nose up attitude and crashed on takeoff in Charlotte, North Carolina (NTSB, AAR 04/01). The second is the in-flight breakup of a Continental Express EMB-120 near Eagle Lake, Texas caused by separation of the leading edge cap of the left-hand horizontal stabilizer (NTSB, AAR 92-004).

Both investigations uncovered numerous problems in both aircraft maintenance operations and human factors. Among the human factors common to these accidents included visual and operational inspections not properly conducted, maintenance manual procedural steps not completed, work cards improperly endorsed and weak verbal communications between turnover crews.

### *COMMUNICATIONS*

In a period when aviation organizations increasingly expect employees to work with minimal supervision, competent communication skills are a necessity. In the maintenance environment, well-organized communication among various crew members has received a great deal of emphasis as operators, regulators, and technicians are exposed to new aircraft types and gain experience with emerging technologies (Patankar, Taylor, 2004) .

In aircraft maintenance, communications are often formal, such as written repair station manuals, engineering orders and work cards. As illustrated by the Charlotte and Eagle Lake accidents, a tremendous amount of informal communications also occurs in the form of verbal turnover briefings between shifts. Aspiring technicians need to understand the importance of both printed and verbal communications during maintenance operations and their resulting safety implications.

Fig. 3 Correct and effective communication, whether printed, oral, or visual is the thread that binds aviation safety and airworthiness.

For example, during a routine shift turnover conference in the maintenance hangar, usually the information transfer between a lead technician and other crew members is a direct person-to-person consultation using speech as the medium of communication. When a crew chief looks for technical information on a microfiche or when an inspector looks for the next step of a task on a work-card, the communication transfer is from the microfiche or the printed work-card to the person.

Similarly, when an inspector visually inspects an aircraft fuselage the information transfer is from the aircraft or accessory itself. Finally, when a technician uses an eddy current oscilloscope to detect cracks, the information transfer is from the instrument display.

MRM training in FAR 147 classrooms can incorporate each of these examples as a communication interface, either conceptual or physical, that facilitated the proper information. During person-to-person communication the interface was conceptual, that is verbal speech. The other examples were of physical interfaces. Thus, in the case of the operator-machine system the interface consisted of the control knobs and informational displays. In the case of the inspector using a task card the interface is the work-card itself. Finally, in the case of the inspector using eddy-current equipment, the communications were the visual indicators and aural tones basic to the oscilloscope design.

During the communications portion of the MRM session, each student should practice how to recognize weak and strong points of his or her communication style, and how to more effectively speak and listen. Instructor lead dialogue could include questions such as: Do you complete the communications loop in most of your conversations? Do you and the person to whom you are speaking with have the same understanding of your conversation? Are your verbal and written instructions directed to the responsible task leader? Is feedback whether written or oral, clear, concise and correct?

### *CLASSROOM AND LAB ACTIVITIES*

In a FAR 147 curriculum, MRM classroom topics can also include discussions and group projects explaining how various maintenance organizations operate and how situational awareness affects the successful completion of any task. Understanding the critical links in an error chain and how to recognize procedural mistakes before they become critical will ensure the highest degree of safety is obtained.

MRM training is not designed nor intended to be a set of "feel good" exercises students complete to booster self esteem. On the contrary, MRM stresses that the task be completed on schedule and in full compliance with federal regulations. It is important that students realize that continuous communication is essential and how feedback prevents incidents and accidents caused by improperly written task cards, misunderstood instructions from the shift turnover briefing and incomplete or improper paperwork. Besides the possible loss of life, students must be conscious of possible FAR violations due to improper logbook signoffs and why poor discrepancy write-ups must be avoided (NTSB, AAR-04-01).

Simple MRM maintenance situations easily identified in a normal academic course in conjunction with student activities may include:

- Using unsuitable support stands,
- Improper lifting of heavy components,
- Lack of tool control allowing the potential for leaving tools inside structures when work is complete,
- Failure to ensure the correct closure of cowls, panels and doors after maintenance.

As colligate FAR 147 students come to understand early on, the inspection and maintenance of aircraft systems is unquestionably the most documented segment of the aviation industry. The overwhelming responsibility aircraft technicians assume for aircraft safety, regulatory requirements and airworthiness demands that some type of written paperwork or computer database accompany every task related to maintenance or inspection.

Another method of identifying errors and undesirable trends in FAR 147 experiential learning activities involves looking at a variety of different procedures in which something went wrong and then lists the top two or three contributing factors in each case. The analysis is lead by the instructor and includes the student groups or teams involved in the operation so they can provide various interpretations of the actions taken and why. Using a team approach eliminates the problem of using only one person's interpretation of facts or terminology and develops group synergy. The process also provides an opportunity for each team member to improve upon his or hers written and verbal communication skills.

The team approach also allows for discussion concerning which elements to include in the analysis. For example, should we include the top 3 causal elements or the top 5? Which incidents should we include? Is this a procedural problem or a communication problem?

Using written reports, students are encouraged to report small errors and situations that afford conditions supporting human errors. Intentionally designed to be uncomplicated, the reporting form does contain fields that will help the instructor identify the major causal factors of the error or the significant conditions of the situation. An example of a small error reporting form is shown below:

**Inspection & Maintenance Error Report**

| | |
|---|---|
| Report Date: | Class: |
| Team Members: | Aircraft: |
| Procedure: | |
| Describe the incident: | |
| Explain how to avoid this error: | |

*Table 1. Error Reporting Form*

### CONCLUSION

The technological advances of the last 20 years have introduced aircraft systems increasing immune against single catastrophic failures, either human or mechanical. Despite superior engineering and manufacturing processes, modern aircraft systems still also afford dangerous opportunities for the human induced maintenance errors. As evidence by the Eagle Lake and Charlotte accidents, breaching systems redundancy requires an unlikely combination of several contributing factors, each necessary but none sufficient by itself to cause the accident. Introducing MRM training and induced error awareness in FAR 147 curriculums may well be "the last great frontier" in air transportation.

### BIO

Joe Hawkins joined the aerospace faculty at Middle Tennessee State University in 2004. He has been a federally certificated Airframe & Powerplant Technician since 1979 and has held an Inspection Authorization since 1991. He is an U.S. Army veteran and served as a CH-47 Chinook helicopter Flight Engineer with the 101st Airborne Division. He began his aviation career with Stevens Aviation in South Carolina in 1979 and became the Chief Aviation Maintenance Technician for the State of Tennessee in 1991. In March of 2006, he received the Federal Aviation Administration's National Aviation Maintenance Technician of the Yea Award.

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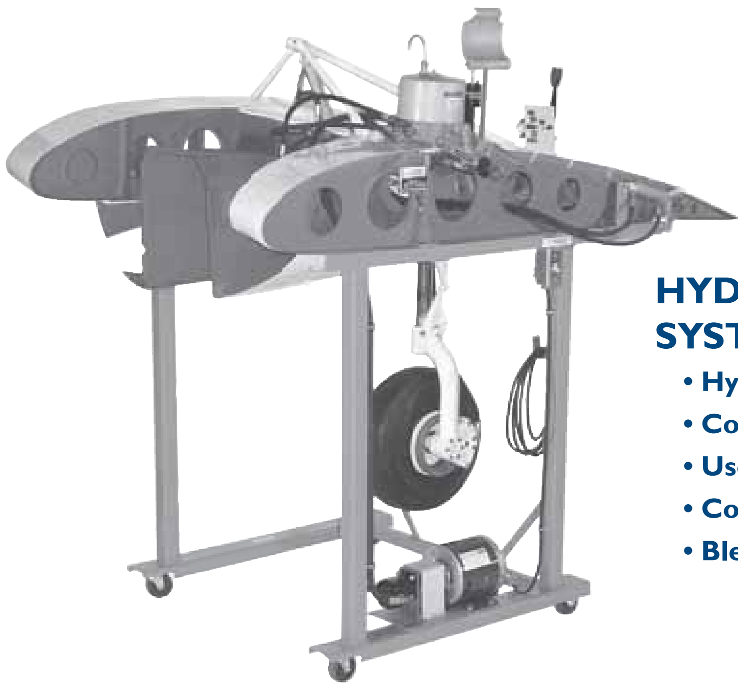

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# Back to the Future: A survey of Engineering and Technology Education over the Last Century

*M.A. Thom and J. M. Thom*

The role of education in the 21st century is undoubtedly changing. Discussions by these authors with faculty at four year institutions across the U.S. indicates an evolution toward more funded research and less emphasis on teaching. At the two year institutions there seems to be more interest by various industries in developing close partnerships in order to develop the highly trained. There are indications that many companies are abandoning there long standing policy of hiring engineers for a "one size fits all" mentality, and are looking to graduates from technology schools to perform the applications tasks formerly assigned to engineers. The realization by many industries that the engineers educated at the end of the 20th century do not have the applications skills has forced industries to take a new look at the role of the technology student for many application functions and has forced the engineering education community to take a hard look at the product of the engineering curriculums. Changes in these engineering curriculums have occurred as a result of radically revamped engineering educations curricula guidelines under what is known as the ABET 2000 standards. These standards for engineering and engineering technology recognized the changes in the industry needs for graduates and now more fully recognizes the technology graduate's contribution to the engineering discipline.

In an ironic way this has lead engineering and technology full very nearly full circle back to where it was at the turn of the 20th century. In 1900 the discipline of engineering was much more like what would be considered technology in today's world. Like today, technology and technical schools, educators struggled with the concepts of being taken seriously as a course of study worthy of being present at the college or university level. In the early 1900's engineering was not considered to be a course of study that was a truly scholarly pursuit. In those days the universities considered education, law, and religion to be the truly scholarly pursuits. Even medicine was only grudgingly accepted as an academic endeavor. Engineering was simply a training ground for labor that went of to work in the great industrial complex of the industrial revolution. The "enlightened" society of the early 1900's also served to downplay the importance engineering since, the role of the engineer was not enhance the enlightenment of society but rather simply to work for industry to expand the industrial movement.

All of this sounds familiar to those who work in technology education at the end of the 20th century and the beginning of the 21st century. It sounds especially familiar to those who have worked in areas of Aviation Technology and have seen the changes in that discipline as it evolved in the post WWII era. Many of the same arguments made about engineering in the 1900's have been made about Aviation Technology in the 2000's. Some universities do not consider Aviation Technology to be on scholarly par with other disciplines at the universities and in many cases the Aviation departments have not been able to evolve to show their place in the universities. The result has been a decline in aviation schools in the United States over the past 30 years and stagnation in the efforts to get the Aviation Technician recognized as the skilled professionals that they are.

In the post ABET 2000 environment there may be a chance to allow the Aviation Technologies to evolve to engineering technology programs. By taking the skills and knowledge taught in the four year Aviation Technology programs and to get those programs accredited as engineering technology programs, the discipline of aviation maintenance move forward in the 21st century just as the discipline of engineering did in the 20th century.

Before any serious attempts can be made to venture into the discussions of evolving Aviation Technology into Aviation Engineering Technology, there are some basic foundational reports that one must be familiar with. These reports are frequently cited by engineering educators since they detail the roadmap of engineering education as it evolved in the 20th century. These reports include: the Mann Report, 1918; the Wickenden Report, 1930; the Report on Technical Institutes, 1930; the Hammond Report, 1945; and the Grinter Report, 1955. While these reports my seem ancient to many, these are the foundational philosophical underpinnings of the evolution of engineering from its beginnings as a supplier of trade school apprentices for industry, to unquestioned center of all technical knowledge for modern society. In order to discuss aviation technical education with university administrators and traditional engineering educators a working knowledge of these reports is essential.

### *THE MANN REPORT*

In 1918 Charles Riborg Mann offered the first formal survey of engineering education, *A Study of Engineering Education*. This bulletin covered many of the same concerns still being dealt with today. In this document, the seeds for many of the contemporary challenges could be observed, as well as explanations for why some things in engineering education have become the way they are. At the time of the report, engineering as a discipline was about 50 years old. Mann explained that "...significant characteristics of the report are found in the discussions of the general failure to recognize such factors as ' the values and cost', the importance of teaching technical subjects so as to develop character, the necessity for laboratory and industrial training throughout the Courses and the use of good English". These are some of the same challenges facing contemporary educators. Mann also points out the difficulties in "establishing standards by which to measure successes and failures of their efforts to provide proper training for engineers".

> *Under these conditions numerous fundamental questions concerning engineering education have of necessity emerged. Do we need fewer or more schools? Is the curriculum too long or too short? Should the engineering school be made a graduate professional school? What are the present demands of science, of industry, and of education? How well are schools meeting these demands? What changes, if any, seem desirable? The answers to questions like these are at present both vague and unconvincing. This study endeavors to define a number of the more important problems of engineering education, and to suggest policies and methods that promise to be fruitful in working towards more satisfactory solutions.*

Mann's report was the first salvo in the battle regarding the humanistic content of the engineering curriculum. At the time of this report, there was a feeling at the colleges that science and engineering were not appropriate pursuits for institutions of higher learning. The engineering educators responded that the conventional forms of instruction at literary colleges were not suitable for industrial training. Mann quotes J.B. Turner "Book learning alone does not suffice but must be supplemented with the study of things. The former produces laborious thinkers the latter thinking laborers."

In 1918 the country was recently out of the American Civil War.  There was still much expansion, building and laboring to do, and the industrial segment of the nation was still in its infancy. Mann states, "From the beginning the engineering schools have had a clear conception of their functions. They themselves understood that their ultimate aim was increased industrial production, and that their special contribution to this end was systematic instruction in applied science. In addition they believed that if this instruction were given with the proper spirit, engineering would become a learned profession and scientific research a recognized necessity."

It was observed by these authors that over the next 100 years scientific research rose to the top in importance and the application aims of engineering education were diluted and lost.

The concerns over the level of subdivision and specialization were already being noted in 1918. Mann pointed out that the profession had grown from one engineering degree, civil, at engineering's inception to two degrees, civil and mechanical in 1820, to fifteen degrees plus specialties in 1918. At Harvard and the University of Missouri it was attempted to expand the program to six years to relieve congestion and raise the discipline to a professional rank like that of law and medicine. The attempt was abandoned. It was realized that "this pressure to keep up-to-date, combined with the natural reluctance of every teacher to abandon material he has once worked up for presentation to the class, is fairly certain to produce congestion even after it has been temporarily relieved". It was suggested that "the conception underlying this and all later curricula is that engineering was an applied science; and therefore, to teach engineering, it was necessary first to teach science and then apply it". This angered the students who found the coursework structure too abstract and boring. This is the same discussion being held now with respect to retention and recruitment. Mann reported that the University of Washington switched to teaching the applications first and providing the science as needed and found that it worked quite well. This was the same conclusion reached by contemporary academic researchers. But like today, there was a bias against shop work. It was not considered as being university grade coursework. Teachers of mechanical arts were rarely granted the title professor. Yet no one denied it was an essential element in the education of every engineer.

Much the same as contemporary criticisms, Mann stated "the neglect of the possibilities of shop work was responsible in large measure for the professional criticisms that graduates cannot apply theory to practice... On the other hand, the neglect of shop work was not a result of carelessness or of chance. It was due to a consistent effort to meet the professional demand that emphasis in school be placed on the fundamentals of engineering science". Mann also provided a list of traits deemed necessary for success: common sense, integrity, resourcefulness, initiative, thoroughness, accuracy, an understanding of men, technological knowledge and skill. This list is similar to the intrinsic traits identified in this study. "The spirit of investigation accomplishes valuable results only when the investigator is resourceful, accurate and efficient in mastering the facts and when he has judgment, common sense, and perspective. These qualities depend on the ability to put things in their proper relationships."

This is as true today as it was 100 years ago. More over, if one did not know that this report was written in 1918, it could well be assumed that Mann was talking about the modern Aviation Technology programs of the 21st century.

### *THE WICKENDEN REPORT*

The next major survey of engineering education occurred between 1923 and 1929. *The Report of the Investigation of Engineering Education* was authored by Wickenden for the Society for the Promotion of Engineering Education (SPEE). The report was published as two volumes, volume I in 1930 and II in 1934. This survey was prepared during the 'roaring 20's' and was published during the Depression. Like the Mann report, many of the concerns expressed were the same as contemporary concerns: Students were not prepared either in extent or quality as a foundation for engineering, they did not know what engineering is or requires. Jobs did not live up to graduates expectations, because the bulk of the beginning of the curriculum was to make up for inadequacies in the secondary schools and, with a four-year time limit, it made a heavy load of subjects and subject matter.

The Wickenden report also found that, except in mechanical engineering, the amount of hands on shop training was decreasing, and that there were a lot of minor subjects of good content which were destructive to the whole and should not be included. It was determined that schools should teach fundamentals as opposed to specialized degrees. The instructors indicated only chemical engineering and mining needed foreign languages. Treatment of economics was deemed as necessary but lacking. Teachers felt shop classes were only relevant for manufacturing engineering, mechanical and electrical engineering in particular. Here the beginning of the shift in value and importance placed on applications in favor of science was seen. Over 80% of the teachers replied that mathematics and physical science should not be taught as an end unto themselves but rather as tools. As the report progressed, the beginnings of the 'cerebral' versus 'laborer' dichotomy could be observed.

This observation should be tempered with the understanding that at this point in history to be a laborer versus a professional had significantly different meaning than it did in 1918 or it does today.

The laborer was truly an uneducated individual with few prospects. Even though Wickenden bemoaned "our difficulty is not that we have too much technical education but that we have yielded to the temptation to make a fetish of the standard college degree," the indications of academic snobbery were observed. This perceived snobbery was observed in the belief that colleges were the realm of great thought as opposed to institutions of rote learning. In the small steps of evolution and the historical frame of the report, this belief in elevation of thought over labor appeared to be positive. It was with the hindsight of time that the danger to the knowledge and skills provided to the students could be seen. Wickenden's report suggested the role of education should be to open the mind not train it.

The report observed that the program should be "coherent and integral structures, directed to the grounding of the student in the principles and methods of engineering and to those elements of liberal culture which serve to fit the engineer for a worthy place in society and enrich his personal life". Statements such as these suggest a shift in the philosophy of teaching engineers how to do something to a philosophy of teaching how to be something. With respect to the argument that engineering should be a professional pursuit on par with the law and medicine, the report observed that engineering was different from these professions because these professions had defined activities and distinctive social and legal responsibilities. "These considerations tended to fix the forms of professional education into a series of standard patterns. In contrast, engineering – concerned with the economic use materials and energy – was one of the very general functions in social economy, and not the exclusive function of a well-defined professional group. It had many levels of responsibility and no clear distinction between the professional and auxiliary levels." In Vol. II, the report went on to note, "We have characterized the college curriculum in engineering as functional rather than professional. That is not to minimize its value to the professional engineer, but to emphasize its broader utility. The majority of engineering graduates do not enter a profession unless we use that term in the loosest sense. Instead they enter upon business and industrial careers in which technical knowledge is known to be useful if not indispensable to those expecting to advance to executive positions."

With regard to shop work, the report found that it was considered to be important. It was concluded that the purpose of the shop work was to give students exposure to principles of shop management and operations, not to result in shop proficiency. What should be noted is that it was this lack of proficiency which was eventually used to defend the elimination of shop work in the 1950s and '60s.

Other observations made from the report included a feeling that engineering colleges focused on disciplines, --mechanical engineering, chemical engineering, electrical engineering etc.--, while industry was more interested in functions, i.e. research, design, operations. It was noted that this report showed more references to moral aspects of the student and the students' education than had been seen in the Mann report. It is believed this is due in part to the reports place in history, when the belief was that the university was responsible for instilling students with morals and ethics. The report also shows the first step in the evolution of the aims of engineering education. The Wickenden report now suggested the aims should be to provide: 1) a scientific technique for the control of the forces, materials and energy of nature, 2) technique for organizing human effort, and 3) technique for appraising the resulting benefits to mankind. Note that these goals were more complicated than Mann's, his being to make manufacturing more productive and efficient.

### *THE REPORT ON TECHNICAL INSTITUTES*

The Study of Technical Institutes was published in 1931 as its own document and in 1934 in Vol. II of the Wickenden report. The purpose of this study was to answer the question: Should there be more engineering schools or more kinds of schools in order to meet the shortage of technical graduates? The principal conclusion presented in the report included the assessment that a need existed in the postsecondary scheme of education for large number of technical schools giving more intensive and practical training than provided by the engineering colleges. The role for the schools was to train individuals principally for supervisory and technical positions in industry and for engineering work of general character. Simply speaking, if the goal was to learn science, then attend an engineering college, if the goal was to work in industry at a level of responsibility, attend a Technical Institute.

In general, with the exception of land grant colleges, the Technical Institutes grew out of specialized needs from local industries as opposed to a formal, comprehensive plan.

Wickenden compared the U.S. system to the national system of technical education in Europe and found it more ad hoc. One of the observations made during this comparison was that in Europe higher, middle, and lower were distinctions of type, whereas in the U.S. the terms conveyed a level of excellence. This difference in meaning may have been one reason for the negative response seen to repeated recommendations for distinctions between education institutions. While the authors may have been recommending delineation of type, the audience interpreted them as distinctions in excellence.

Another observation was that the automation being increasingly incorporated into manufacturing facilities reduced the overall workforce needs but increased the need for professional and staff employees. Furthermore, organizations were finding that young people were going to school and staying in school longer, further reducing the pool of skilled labor from which to promote. This resulted in organizations having to educate to fill their needs as opposed to home growing them.

The other aspect of Technical Institutes as compared to colleges and universities, was their ability to "cater more effectively to people with work experience, to men with a career plan, passed out of book-mindedness and to people who want to do as opposed to study". The colleges were not effective in educating this group of people due to their different needs. Attempts to provide more intensive and practical forms of postsecondary education in auxiliary departments largely failed. These practical courses became "salvage courses for failures in the larger (sic engineering) courses. Their positive appeal to a distinct group of genuine promise had been low". The classes became stigmatized as courses for people who could not succeed in the standard engineering courses. A stigma was attached to the technical courses as being inferior to the engineering courses. The survey found there were "innumerable positions in industry for which men of engineering training are sought which do not utilize a wide range of scientific …knowledge.…The technical requirements of these (sic high responsibility) posts can be fairly met by intensive type of engineering training which avoids the most advanced science features". It was this lack of a science requirement that typified technology.

> *… Innumerable technical pursuits have each an underpinning of scientific knowledge and a content of rational practices from which results can be predicted with a considerable degree of accuracy. Each draws selectively on many sciences but one need not master each of these sciences a whole to gain proficiency in the art. …Since the bounds of needful knowledge can be more accurately predetermined and subject matters introduced selectively, in unit form, and without the elaborate concatenation which marks the engineering course, industrial technology can be taught in much more intensive form than engineering.*

This was different from engineering courses which "represented the minimum degree of specialization. Within certain broad, almost generic divisions – civil, mechanical, electrical, etc.– the aim was to teach, as fully as a fixed time would permit, the whole science of the field, with only incidental regard to any particular industry or function. Such specific practices as were taught were largely the tools of analysis and representation, and only incidental ends in themselves. Implicit in the whole process was the aim of preparing the student to choose, on scientific and economical grounds, among the whole range of resources which may be employed to solve a problem."

In 1931, no sharp boundaries could be drawn in the realm between vocational, industrial and professional education. "From the viewpoint of industry, a thoroughly trained technician or operating supervisor ought to be more acceptable than a half-baked or ill-adjusted engineer". The report concluded that technical education had a real and valuable role to play in the support of America's burgeoning manufacturing industries. The document reported a repeatedly observed ratio of 2.3:1 technically trained employees to classically trained engineer. From the report it was also noted that the Technical Institutes were more than vocational education schools. While the curricula were more directly technical than those of the four year schools, there was still a substantial treatment of the underlying and related sciences. The programs also included English communications and economics. Additionally, the Technical Institutes admitted students based on interest, unlike the engineering schools which usually admitted based on scholastics.

It was interesting to note that the predominance of individuals involved in production were Technical Institute graduates as opposed to engineers. Because the engineers were typically educated to perform extended analyses, data gathering and fact finding, they generally did not function well in the production area where there was not the luxury of time. Furthermore the engineering graduates generally did not want to go to production, though there was need for them. The hours were longer, the pay not as good, the working conditions less appealing, and there were fewer opportunities for advancement as compared to their more theoretical counterparts. Here was seen another source of the division between white collar workers and blue collar workers that would plague American industry for the next 60 years.

### THE HAMMOND REPORT

The Aims and Scope of the Engineering Curriculum (1939) and the Committee on Engineering Education after the War (1944) reports were authored by H.P. Hammond, was summarized in Higher Education for Science and Engineering as follows:

> *Aims and Scope of the Engineering Curriculum Recommended: diversification of curricula; parallel technical and humanities/social sciences "stems"' reconsideration of 4-year curriculum and move to 5- or even 6-year program. Committee on Engineering Education after the War: Reaffirmed 1939 report; promoted expanding technician programs to fill industrial needs then being met, non-optimally, by engineer; and teaching the "art" of engineering asdistinct from scientific method (1989).*

### THE GRINTER REPORT

The Grinter Report is one of the most influential and frequently referenced surveys in the area of engineering education. It is not unusual to find the leaders in engineering education to have the Gritner report readily available any time, and to have studied the report in depth.. Originally published in 1955 as the *Report on Evaluation of Engineering Education*, the Grinter report's purpose was to develop educational standards to aid in accreditation efforts. The goal was to provide differentiation in the engineering education curricula which lie between pure science and technology. The report presented nine recommendations. Four of the recommendations specifically referred to aims involving pure science and basic engineering science content. One of the nine was specifically concerned with the curricula supporting research activities. Of the remaining recommendations related to curricula, one was regarding appropriate humanities and social content and one considered oral and written communication. The last two recommendations dealt with graduate study concerns and the recruitment and retention of excellent faculty.

Like the Mann and Wickenden reports, Grinter had a clear aim presented for the engineering profession. Unlike Mann and Wickenden, the primary function of engineering was not the control of materials and energy in nature, but rather to serve society by making laborsaving devices and assuring society's welfare and safety. While the connection to society and supporting its welfare are both true and laudable, the report demonstrates a shift in engineering's role. Grinter specifically compared engineering to physicians; Mann and Wickenden suggested a desire to be seen as professionals like physicians.

Even more striking was the overt reference to technology as sub-professional. The document repeatedly placed emphasis on the learning of, and further development of, engineering science as a primary end to engineering education. Over one-third of the report was used in the description of humanities courses and the expansion of the literary awareness of the engineer. Noticeable emphasis was placed on the importance of a liberal education in preparing an engineer to serve society. Grinter's report emphasized a re-emergence of the science versus philosophy dichotomy which troubled engineering education during its formative years. It was concluded from the reports that engineering education was responding to societal pressures "to do no harm" and the role of education as a socialistic endeavor. It was also interesting to note that this emphasis on humanistic and societal involvement occurred at a period in history where engineers were gaining a reputation for being not being social. This observation was based on the perceptions of the researcher from the tone of the literature.

Because the responsibility of an engineer to society, according to Grinter, was in expanding theory, the recommended emphasis of education shifted from that presented in previous reports. This cultural pressure was further multiplied by industry's need for more and greater technological discoveries. As has been discussed in this document, the historical time frame was such that researchers and scientists were held in higher regard than the individuals applying the knowledge. This emphasis on research necessitated an emphasis on including the scientific method, analysis and synthesis as major components of the engineering curricula.

The report also considered the needs and requirements of the engineering faculty. It was suggested that notoriety and position in one's field would attract better students. This would seem to imply the students would be familiar with noted individuals in the various engineering disciplines and desire to learn form them. This may have been relevant for attracting graduate students, but it was not clear how this would attract undergraduates, who, in the researcher's experience, were less likely to be familiar with noted personages.

The support for the elimination of the technical application courses was much stronger than was observed in previous reports. It was directly suggested that application education was the role of industry while universities taught the science which underlie the practice. It is suggested that "practicing engineers achieve results by use of a kind of intuitive sense which, no matter how successful in practice, cannot be transformed into organized knowledge that can be taught to engineering students." Yet later in the same paper, Grinter suggests that the best use of laboratory time was in letting students explore ideas, generate data and perform analyses, all of them of the students' own designs. Given no other input, this suggested a requirement for intuitiveness on the student's part.

It was suggested that the pursuit of analysis and design could include projects, competition between groups, and open-ended problem solving. It was noted that Grinter suggested "synthesizing a new device rather than analyzing an old one." This demonstrated a further separation of the students from applications, presented by the researcher as an underlying cause for the loss of technical skills. Grinter suggested that courses of descriptive (hands-on) nature were essentially sub-professional because they lacked science theory content.

As already mentioned, Grinter expressed an opinion that the role of laboratory courses, if used, should be of a more open nature. The students should observe phenomenon and seek explanations, a definition of fundamental research. With regards to standard laboratory exercises, Grinter questioned their value. This raised the question of how the students were to obtain the basic knowledge of engineering if not by prepared exercises. This was similar to the philosophy that given abstract concepts, the students would be able to synthesize the disparate concepts into the final theory on their own without guidance.

Because of the pressures to include science theory classes, basic science courses and humanistic exposure, Grinter acknowledged that in most curricula, something must be removed. His recommendation was the elimination of courses emphasizing practical work, skills, or the art of engineering. Grinter suggested that practices changed too rapidly to be valid course content for engineering. As a historical review showed, this elimination of practical courses took place in the majority of accredited engineering programs. This was a further shift from the recommendation of Hammond that the art of engineering be taught separate from the scientific method.

While Grinter placed a value on graphical expression and spatial visualization for both communications and analysis activities, he suggested that "its value as a skill alone did not justify its inclusion in the curriculum." His suggestion was its inclusion should be as a natural part of the design analysis courses. Based on this research, it was likely that a student's exposure to learning and practicing the skill to a level that was useful as an analysis tool was eliminated by the removal of practical courses which contained a graphical content.

To his credit, Grinter asked industry representatives if they would "be pleased withgraduates of such programs or would they prefer men able to earn their salary immediately upon graduation without special job training?" At this point in time, most of the industries had sufficient applications knowledge but were lacking in science experts, so their responses indicated they would like the graduates to have more theory. It was likely the industry representatives assumed the students would continue to receive exposure to applications and that science theory would be an addition.

The remainder of the Grinter report went into great detail regarding graduate studies. The reference to a bifurcated engineering program as preparation for graduate work remained in this section of the document. The emphasis on the needs and requirements of a graduate program suggested a philosophical belief that engineering education should be performed primarily as support for further formal education.

There are several factors influencing the impact of embracing Grinter's recommendations regarding practical content and science theory. First, research indicates that industry needs are generally five to ten years out of synch with academia's response. The second impact is more long term; the state of the industries changed radically over the next thirty years while engineering education did not change radically. While the Grinter report is not the last survey of engineering education, it remains the most often used and most influential report during contemporary curriculum reviews and educational research.

## *SUMMARY OF ENGINEERING EDUCATION REPORTS FROM 1918 THROUGH 1956*

In comparing the results from the Mann report, the three Wickenden reports, and the Grinter report, the feeling of inferiority of engineering to other professional fields can be seen. In 1918 it was accepted that the role of engineering included both the science and the application activities. The engineer designed AND built the bridges, the mines, and the ships. But the labor role was at odds with the perception of professionalism as compared to physicians, lawyers and clergy. Engineering professionals began asking 'how do we get taken seriously?'.

By 1930 the labor role of the engineer had been down-graded to a more vocational perception, the role of a blue collar worker, while the role of science was considered the realm of the professional, the white collar worker. The gap between the blue collar worker and the science theorist was filled by the engineering technology professional who was more experienced in applications and who held supervisory and management roles. It is in the inability to reconcile the need of fulfilling an applications function with the desire to be seen as professional that the resultant loss of technical skills occurred. This evolution is demonstrated by tracing the aims and goals of engineers and the recommended educational content presented in the reports from the first in 1918 to the Grinter Report in 1956.

## *CONCLUSION*

It is from these reports that university expectations of technically based programs has evolved. The Gritner report alone has been the major framework of how technology disciplines were viewed over the last half of the 20th century. This viewpoint has historically kept technology programs and in particularly Aviation Technology programs from achieving the academic and professional recognition they deserve. Aviation Technologies fit all of the criteria of as a profession as was defined in these reports, yet probably because of engineering's own struggles with acceptance as a profession little room was left for the technologies of any kind.

Ironically however the same things that lead engineering to be recognized as a profession has at the end of the 20th century in the U.S. led to difficulties. By eliminating the applications laboratory training aspect of the education, by focusing on science and theory alone, and overemphasizing research over teaching, the profession of engineering found itself in a position where the graduates were of diminished value to industry.

So now at the beginning of the 21st century technology programs find themselves in a position disturbingly similar to that of the engineering profession in 1900. On the positive side, technology programs supply highly skilled professionals to industries which are more and more turning to the technologists to fill the applications functions once performed by engineers. There is currently great opportunity for Aviation Technology programs to seize the opportunities created by the new ABET 2000 guidelines and to become accredited as engineering technology programs. This comes at a time when the accreditation rules once again recognized the value of the technology education and at a time in which industries are turning to technology programs to capture the skills lost by traditional engineering education program. On the negative side technology programs at the large universities are under increased pressure to look more and more like the traditional engineering programs of the late 20th century. There is pressure to eliminate expensive laboratories, there is pressure to become involved in more research, and there is even some of the same self doubt among some educators that technology in it historical form is truly worthy of academic pursuit at a the university level. These pros and cons represent the opportunities and the challenges for Aviation Technology in the 21st century. The door has been opened for the move to become an engineering technology by the ABET 2000 guidelines, it is now up to the individual programs to pursue that opportunity without making the mistakes made by engineering in its quest for acceptance over the last century.

# Model Aviation in Academics

**By: Mike Leasure**

I called the class "Scaled Structures" to not raise too many objections to teaching aeronautic topics with "toy" airplanes. Allow me to start at the beginning and explain how it is that Purdue now offers a two hundred level class in aircraft model construction. The concept started out simply enough. A group of students, and I, wanted to form a university sanctioned club so that we could have access to sites for both indoor and outdoor model flying. The Appropriate paperwork was filed, the officers selected, and the club was born. We had a call-out and found that interest in model aviation spans many disciplines. Students from professional flight, engineering, and even agriculture wanted to participate.

A potential outdoor site near the airport was found and approved for low level, silent powered, flight. Our Armory was scheduled for indoor flying and a time slot assigned.

A storage area was established for model construction after removing some obsolete parts. Benches were constructed and basic tools purchased. At this time, interest was high; planes were being built and flown on a daily basis.

I began to realize the tremendous struggles and learning the students were accomplishing in their efforts to build, cover, troubleshoot, and fly their models. This began to look like an educational environment (class) that worked. A class where students voluntarily participated, applied tremendous dedication, and achieved their goals.

If it looks and acts like a class, it might just have potential to be a class. I began to inquire within the department as to the academic rigor a program of study must have in order to be considered eligible for granting credit. My first instincts had proven correct. The work the students were accomplishing was taking them most of the distance to this activity being a legitimate candidate for credit. A requirement for a written report at the end of class, as well as a few evaluation points in the semester, were all that were needed to satisfy the need for academic rigor.

This is the first semester for this class and so far, progress is excellent. We have more than 5 new models under construction. The tools and building area are often being utilized during the day and evenings. The indoor flying time period is well attended. We have even sponsored our first fun fly for students and local pilots to compete for prizes. When the weather improves, I look for a large increase in our outdoor activities as well.

So what mistakes have we made and what would we change? Our first challenge was organizing ourselves without an organization. The class grew out of a newly formed club. More simply put, we had to have a call-out just to see if there was sufficient student interest to continue. When the interest was established, an email list of members and potential members helped us communicate quickly and easily. Key members were contacted and asked if they would like to serve as officers this first year. We will hold elections in the future to provide input and continuity for the club and the class.

Active participation and follow up on my part has been essential. It is important that I monitor the building area carefully and remain in daily contact with the officers of the club. Weekly contact with the students building models for the class has been necessary.

The following schedule was handed out at the beginning of the class and has provided timely feedback for the participating students:

## Week 1 – 2

Evaluate your personal needs as well as your skill level and select a model that is appropriate. Order the kit, plans, or draft your original design. Have the model selection approved by your professor.

Instructor sign for covering and assembly________________________________

Notes: ________________________________________________________

## Week 3

Study the plans and kit contents and acquire the recommended glues, covering, work space, and tools. Begin to match the kit contents with the assembly booklet in preparation for assembly. Begin minor assembly.

## Week 4 - 10

Construct the airframe components (fuselage, wing, tail) and begin to fit them together to adjust as necessary. Study the accessories and hardware pack and begin to plan for installation of the motor and radio.

Instructor sign for covering and assembly________________________________

Notes: ________________________________________________________

## Week 11 – 13

Cover airframe components with selected covering and assemble airframe including hinging surfaces, landing gear and wheels, and wing mounting.

Instructor sign for covering and assembly________________________________

Notes: ________________________________________________________

## Week 14 – 15

Write a two page, typed paper describing your building experience. Please note what you learned and the things that were difficult or easy for you. What was surprising to you? Did your project turn out as you had planned?

Instructor sign for paper ___________________________________

Notes: ______________________________________________

*NOTE: Radio and engine purchase, or installation, are not required to complete the class.*

In conclusion, this has been a rewarding first year with the class, and the club. The engineering department has begun to take note of our ability to contribute to their objectives relating to " UAV's" and this is opening the door to working across traditional academic divisions. We are organized primarily for fun, education, and recreation and all of those elements have come together nicely. This has truly been a positive experience for all involved.

# Call For Papers

The Aviation Technician Education Council is seeking papers for presentation at ATEC 2007, Orlando, Florida, April 1-3, 2007. Papers for presentation on the following topics 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

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, 2006. All abstracts will be reviewed and authors of accepted abstracts will be invited to submit a full paper. Authors must supply their own laptop computer or make other arrangements with ATEC prior to the convention. Authors must register for and present their work at Orlando, Florida, April 2, 2007, at the Holiday Inn International Drive Resort.

Deadlines

December 1, 2006: Abstract Submission

January 13, 2007: Notification of Acceptance/ Rejection

February 24, 2007: Submission of Draft Full Paper/ Audio and Video requirements

March 17, 2007: Electronic Submission of Final Paper

Please direct any questions and or submissions to:

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Fax 317-381-6060

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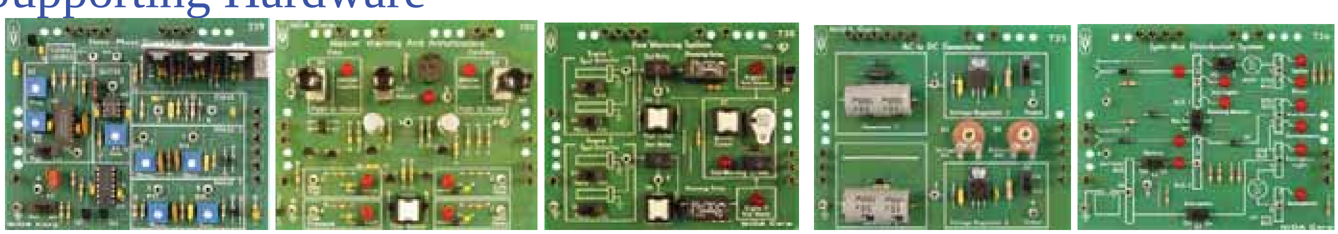

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# JAMES RARDON AVIATION MAINTENANCE TECHNICIAN STUDENT OF THE YEAR AWARDS

**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 1, 2006** 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 2007.

**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 2007 James Rardon AMT Student of the Year award winner will receive transportation costs (airfare, hotel, meals, etc.) to attend the ATEC Annual Conference in Orlando on April 1-3, 2007. 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.

# ATEC 2007
# Holiday Inn International Drive Resort
# Orlando, Florida, April 1-3, 2007

## Preliminary Agenda

**Presentations will include resources on how the information can be transferred to the classroom.**

**Sunday, April 1**

| | |
|---|---|
| 10:00-12:00 NOON | ATEC Board Meeting |
| 1:00-3:00 PM | **Workshop I: "Structural Materials Methodology"** |
| 3:00-5:00 PM | **Workshop II: "Recruitment Techniques for Diverse Student Populations"** |
| 5:30-7:00 PM | Icebreaker Reception – Exhibit Area |

**Monday, April 2**

| | |
|---|---|
| 7:30-8:30 AM | Continental Breakfast – Exhibit Area |
| 8:30-8:45 AM | Welcome-Laurie Johns (Board Floor Nominations) |
| 8:45-9:30 AM | **Keynote - Piper Aircraft: "New Technologies in General Aviation"** |
| 9:30-10:15 AM | **Cessna Centers for Excellence: "Ensuring Quality Work"** |
| 10:15-10:45 AM | Break in Exhibit Area |
| 10:45-11:30 AM | **Southwest Airlines: "Training the Trainer in Advanced Technologies"** |
| 11:30-12:15 PM | **Avionics: "Teaching to a Higher Level"** |
| 12:15-1:00 PM | Lunch |
| 1:00-1:20 PM | Board candidate speeches – 3 minutes each |
| 1:30 PM | Voting Begins (Registration Area) |
| 1:30-2:45 PM | **"Technical Paper Presentations"** |
| 2:45-3:15 PM | Break in Exhibit Area |
| 3:15-4:45 PM | **"Technical Papers Continued"** |

**Tuesday, April 3**

| | |
|---|---|
| 7:30-8:15 AM | Continental Breakfast – Exhibit Area |
| 8:15-8:45 AM | **Annual Business Meeting** |
| 8:45-9:45 AM | **"ATEC Issues and Challenges" – Open Forum** |
| 9:45-10:15 AM | **FAA – Ferrin Moore, Ed Hall** |
| 10:15-10:45 AM | Break in Exhibit Area (Door Prize Drawing) |
| 10:45-11:30 AM | **"Changes, Trends, Advancements and Best Practices** |
| 11:30-12:15 PM | **in Implementing PART 147" - Panel** |
| 12:15-1:45 PM | Lunch and Awards |
| 1:45 PM | **Presentation TBD** |

# STUDENT OF THE YEAR AWARD

September 2006

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 8th annual award of the James Rardon Aviation Maintenance Technician Student of the Year. You will find the criteria for eligibility and appropriate forms attached. I sincerely encourage each member institution to review carefully these forms and forward a nomination to the selection committee as specified in the attached 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 and free registration to the ATEC Conference for the winner. The eighth annual award will be presented on April 3, 2007 at our Orlando Conference. Forward your nomination by **December 1, 2006** 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 AWARD

## NOMINATION FORM

DATE: ____________

NOMINEE:_______________________________________________________________

LENGTH OF TIME AT THE SCHOOL: _____________________________________________

NOMINEE ADDRESS: _______________________________________________________

PHONE NO.: School_____________________________Home ____________________________________

INSTITUTION AND/OR COMPANY: ________________________________________________

INSTITUTION AND/OR COMPANY ADDRESS:_ _______________________________________

_______________________________________________ Phone No. ________________________________

NOMINATOR: _________________________________ Phone No. ________________________________

NOMINATOR POSITION/TITLE: _________________________________________________

NOMINATOR ADDRESS: ____________________________________________________

NOTE: Nomination statements must be limited to this form and not exceed these pages. Recommendations (separate attachments) are limited to three, no more than one page each. They must be signed and the organization name stated.

## NOMINATION STATEMENT

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

_______________________________________________________________________________

1. LEADERSHIP/MOTIVATION: ____________________

2. ACADEMICS ____________________

3. SCHOOL/COMMUNITY: ____________________

4. RECOMMENDATIONS/ADDITIONAL ACHIEVEMENTS

All information given on this application is correct. I hereby authorize release of all information contained on this application to any authorized awards committee member or board member.

Nominee Signature ______________________ Date__________

Nominator's Signature ______________________ Date__________

# FACULTY OF THE YEAR AWARD

September 2006

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 18th annual Ivan D. Livi Aviation Maintenance Educator of the Year Award. You will find the criteria for eligibility and appropriate forms attached. I sincerely encourage each member institution to carefully review these forms and forward a nomination to the selection committee as specified in the attached 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 to the ATEC Conference for the winner. The eighteenth annual award will be presented on April 3, 2007 at our Orlando Conference. Forward your nomination by December 1, 2006 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

**2007**

## 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 1-3, 2007 in Orlando.

The winner will be contacted in late February.

### CRITERIA FOR ELIGIBILITY

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

1. Be employed by an institution and/or organization that is a member of the Aviation Technician Education Council.
2. Be an active instructor of Airframe and/or Powerplant Technicians. The applicant's workload must be of such a nature that they spend 80% of their workload time in contact with students teaching actual aviation maintenance technology classes.
3. Present a completed application with appropriate signatures by **December 1, 2006** 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 regularn 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%


INSTRUCTORS !!!
Prepare your students for real world Avionics/Electronics
with competency-based lab experiments.
These experiments have Flight Controls, Navigation
and Communication Instruction already built in
for possible future Part 147 requirements.
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Electricity-Electronics
Training System
Ed-Lab 702
Digital Systems
Trainer
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intermediate and
advanced electronics.
An easily managed, self contained
trainer. Parts do not get lost
and will not burn out.
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COMPUTERS & CONTROLS
COMMUNICATIONS
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or visit our website at www.cesindustries.com
ELECTRONICS
&
AVIONICS

# Real Life, Inc.

*By Sergey I. Dubikovsky, Ronald Sterkenburg*

***ABSTRACT***

One of the courses at the Aviation department at Purdue University is organized as a separate business venture to provide students with an opportunity to learn about the Aviation industry. This course does not replace theoretical knowledge, but enhances the student learning experience with practical experience. Students attend lectures, but a great amount of their time is spent manufacturing and assembling parts, and performing tests. The authors have experienced that the most effective learning process involves theoretical and practical learning experiences, which combine to produce the best results.

***"REAL LIFE" CLASS***

Life is the best teacher. Some might argue about this statement, but most people would agree. But what happens when you don't have a lot of previous experience? If you just graduated from college? What do you do to find a job? It might look like Catch-22: to get experience you have to start working, but to get a job you have to have some experience.

If you are dreaming about becoming an aviation maintenance professional, the Aviation Technology Department at Purdue University has an answer for you. It offers an Aircraft Manufacturing Processes course (AT 308), which is organized as an independent business venture and simulates a real world manufacturing experience for the students. During this course students are assigned tasks and job positions that they will encounter during their professional career. The students spent a considerable amount of time in the classroom learning theory about loads, strains, and structural joints. The theory is reinforced in the materials laboratory where they manufacture and test several hands-on projects using manual and CNC mills and lathes, and testing equipment.

AT308 is the third and final course in a series of aircraft structures courses, and students take AT308 during their junior year. During their freshmen year, students take AT108 and AT166, which are prerequisites for AT308, and students are taught sheetmetal fabrication and repair, corrosion, heat treatment, aerospace materials, welding and painting. The topics of AT108 and AT166 are geared towards the FAR Part 147 curriculum. Students enrolling in AT308 have developed basic aircraft materials skills, but all of them still have a lot to learn about structural joint design, the use of CNC equipment, and quality control systems like ISO 9000. American universities in general are adding more hands-on engineering projects to their curriculum to attract new students (Collicott, 1998). The need to encourage the study of engineering is becoming more important as globalization and information sharing helps other countries compete with the U.S and many traditional engineering activities are outsourced. Hands-on projects help keep students interested in technology to prevent them from switching to other majors (Costlow, 2005)

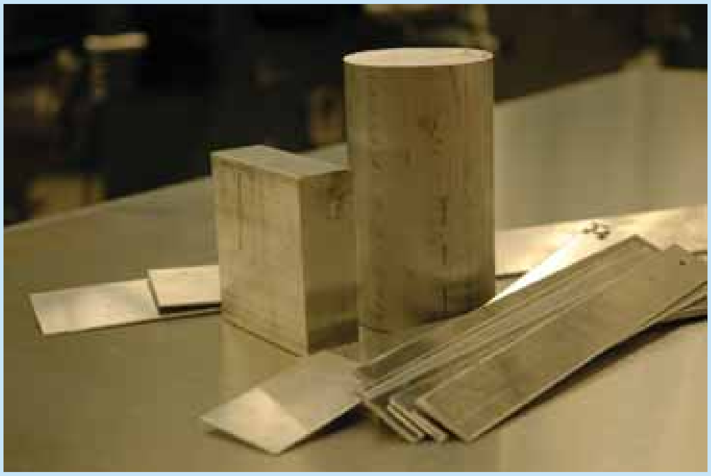
In the course of study students are given work orders, as if they were hired by a company. Their manufacturing facility, the laboratory, is equipped with various industrial tools such as lathes, milling machines, testers and so on. Students are working in teams, learning how to work together, but be responsible individually. They will be team leaders on some jobs, and quality control inspectors on others. By the time students have completed all assignments, they have been exposed to the whole idea of the manufacturing process. Modern industry is a complex mechanism, and students who have an understanding of how industry operates have a better chance to find their dream jobs.

People who work in management and engineering professions need to take responsibility for their actions, and be able to solve technical problems without constantly asking questions about every step. Knowledge and ability to educate oneself are required. However, they also need to realize the importance of following written and verbal instructions. Aviation maintenance is no place to make risky decisions, gamble with parts, procedures and processes. That is why AT308 emphasizes to follow the process exactly. However, drawings and processes can be changed if necessary. As we all know, mistakes happen. A good technician should be able to recognize a mistake when he or she sees one. Another important aspect of following instructions is safety; most procedures are designed with safety in mind.

There are many ways to correct a mistake, but all of them have one thing in common; if mistakes were made they need to be investigated and the results must be shared and documented so that the same mistake won't happen again. This is one of the concepts that students learn in AT308. A change request form must be completed, if a process or drawing is incorrect, and if a mistake is made, a request for deviation must be submitted. It is essential to realize that there are various tools available for each possible situation, and nothing is unchangeable. Students just need to understand how to deal with any problem. Communication with co-workers, managers or customers is very important in industry, and the best way to understand effective communication is to learn how to work in teams. Prospective employers increasingly demand a more comprehensive understanding of the engineering technology discipline and improved levels of communication skills from graduates (Shull, 2005).

### *REAL PROJECTS, REAL RESULTS*

During the semester 13 different work orders must be completed, which cover different aspects of the industrial environment. The manufacture of parts and assemblies is the first step in the process. The most complicated part to manufacture is a vacuum port that is used in a composite laboratory for a vacuum bag project, it takes time, effort, and skill to make them, and saws, lathes and milling machines are used in the manufacturing process. All manufactured parts are inspected by the students, and because of the team work concept, they will inspect each others work to experience the importance of quality assurance.



Secondly, students will assemble sheet metal parts together using rivets. Riveted structural joints are widely used in the aviation industry, and future aircraft maintenance technicians have to know how to repair a failed joint. However, it is more important to know why a joint fails. Students will first calculate the strength of riveted joint test pieces, then make the structural joint test pieces and finally test the test pieces using a tensile tester. Students will find out if their predictions were correct or not. This experience gives students direct feedback about how different loads and different material thicknesses affect a structural joint, and it reinforces the class room theory. Students experience the difference between failures of a material itself versus shear failure of the rivets.

The third component of the course is testing. As was mentioned before, students test several structural riveted joints on tension, and hardness testing of several samples of aluminum strips is performed to learn about the effects of heat treatment. "Dog bones" are relatively simple to make, but the effects of the property changes of aluminum alloy after heat treatment is not so easy to explain. Students learn about different types of heat treatment, but most importantly, they will realize what would happen if different processes were used.

Practical use of knowledge is the most crucial part of learning. Theoretical calculations will sink deeper into the minds when people see the end result. AT308, Inc. delivers exactly what is needed: learning by validation of the theoretical side of the course. There is another way to learn. The Franklin W. Olin College of Engineering in Needham, Massachusetts, offers a different approach to engineering education. Guizzo (2006) reverses the theory first, practice later model and gets students involved in hand-on engineering projects from the very start. The course topics in AT308 are supported by practical hands-on projects that demand time and effort to complete. Students are forced to be organized, and they get exposed to many sides of the industrial environment. During the course they learn to follow process sheets and learn about manufacturing processes, industrial equipment, and working in teams.

Many human resource management textbooks discuss the topic of effective communication in the workplace, and it sounds almost ridiculous to even mention it as a problem in our highly technological society. Almost everyone has a phone, email, instant messaging, or other form of communication at his or her fingertips. However, lack of communication causes most of the problems in the industrial environment. The price of these problems could be devastating in the aviation industry. Students will also learn how to address conflicts in a professional manner, if any problems would occur. Good communication is the key to professional success (Samual, 2005).

Another challenging area of the aviation industry is traceability of every part and every repair ever made. Students have to follow every step of a process sheet. At the same time they are documenting it as they go. It needs to become part of the habit to record your actions, which in the end could save your careers in the future.

### *CONCLUSIONS*

### *REFERENCES*

Collicott, S. H., (1998). Increasing freshmen experience in, and awareness of, aerospace engineering at Purdue University. AIAA 36th aerospace meeting and exhibition.

Costlow, T. (2005, December 5). Projects Pose Grand Challenge. **Design News**, 60 no. 18.

Guizzo, E. (2006, May). The OLIN Experiment. **IEEE Spectrum**, 43 no. 5.

Samuel, L. (2005, February). Communication Skills Are Keu (i.e. Key) to Career Success. **Water Environment & Technology**, 17 no. 2.

Shull, P. J., (2005). Collaborative Learning and Peer Assessment to Enhance Student Performance. **Journal of Engineering Technology**, 22 no. 1.

**SERGEY DUBIKOVSKY** is an Assistant Professor at Purdue University in the Aviation Technology department. He started to teach Aircraft Manufacturing Processes at Purdue in fall 2006. His undergraduate and graduate degree in Mechanical Engineering is form South Ural State University (formerly Chelyabinsk Polytechnic Institute). Contact: sdubikov@purdue.edu

Ronald Sterkenburg is an Associate Professor of Aviation Technology at Purdue University.

# ATEC Update

## ATEC BOARD SETS GOALS

At their September 9-10, 2006 Board meeting, the ATEC Board set the following goals for 2006-2007.

- Working with the FAA and industry, change the way that schools and curriculum are reviewed and approved by the FAA.
- Standardize the approval process for the 147 curriculum.
- Develop a closer match between industry needs and the 147 curriculum that bridges the gap.
- Improve the marketing of the AMT career field.

Board committees are in the process of developing strategic and tactical plans to address these goals.

## FAA FUTURE OF AMT

The last FAA Symposium was hosted by Embry Riddle in Daytona Beach, FL on May 24-26, 2006. Continued work was completed as a result of the meeting and was presented by James Mader and LaVern Phillips. We need to review this work and prepare to present it to the Industry Relations Group and finally the FAA prior to the November conference.

Several of our Board members are participating in these conferences on the Education and the Industry Relations Groups.

The next FAA Future of AMT Symposium is scheduled for November 29-December 1, 2006 to be hosted by Aviation Institute of Maintenance in Virginia Beach, VA.

Information can be found at www.aviationmaintenance.edu/faa.

The recommendations of the Education Group of the FAA Future of AMT Symposium are as follows:

1. Language be used in PART 147 to create a living document that can be readily modified to keep abreast of upgrades in technology and changing requirements in the workplace;
2. Required subject matter be reduced to an abbreviated list of core competencies, so that specialty technical areas and academic themes can be added by the respective schools to best serve their clientele (both students and industry);
3. Hourly training requirements be removed from the regulation so that AMT learning programs can become outcome based (also known as competency based), affording students the opportunity to learn at a pace that best meets their individual needs;
4. A committee, consisting of representatives from AMT schools, aerospace industry employers, aviation professional organizations, and the FAA, be formed to develop the new regulation in a concise manner.

It was agreed by the ATEC Board that the FAA should continue to provide the criteria and certification oversite but the schools should decide the competencies and training for the needs of students and industry using an outside third party group to provide approvals and guidance for curriculum development and to direct learning methodologies and related practices.

## ATEC FINANCES

ATEC currently has cash reserves in the amount of $20,618.65 in three CD's earning between 2.5% and 3%, and we have $55,000.00 classified as "reserved" sitting in our checking account earning nothing. This gives us a total reserve of $75,618.65. As a result, the Finance Committee recommends:

1. Add to each of our three current CD's an amount required to bring them each to $10,000.00 which is the minimum amount required to get us to the next level of earning. The amount required to accomplish this is $9,381.35 and would be moved from the $55,000 reserve currently in the checking account.
2. Create a 4th CD in the amount of $10,000 and then set all four up to mature at 3 month intervals.
3. Invest at one of the four or five highest yielding financial institutions with a return ranging from 5.6 to5.68%. All of the institutional options are rated at 4 stars on the 5 star system. Our current institution, Wachovia would only pay us 3.5% on the $10,000 level CD.
4. A member-nonmember rate should be instituted at the conference.

The net result would be a liquid reserve in the checking account of $35,618.65 along with the unreserved operating balance of approximately $10-$15,000 at any time. The maturity structure would also allow us to have unpenalized access to an additional $10,000 if needed at every 3 month interval.

## MEMBERSHIP DUES

At their September 9 meeting in Washington DC, the ATEC Board made two changes in the dues structure in order to simplify the dues process:

1. In 2007, ATEC dues will change to a flat dues rate of $210 per year for all institutions regardless of size.
2. The dues period was changed from the May 1-April 30 fiscal year billing cycle to a January 1-December 31 calendar year cycle.

As a result of these changes, during the 2007-08 billing period, and for that billing period only, ATEC will send out its dues invoice in May 2007 for a year and a half period in order to transition to the calendar year billing cycle. This will mean that in May 2007, your institution will receive an ATEC dues invoice for $315. But it will cover your membership in ATEC until January 2009, a year and a half. Then, just prior to January 2009 you will receive a $210 invoice to pay for the new 2009-2010 dues.

Please contact us if you have any questions. This will be a discussion item at the April 1-3 ATEC Conference.

## AWARDS, DIRECTORY AND CALL FOR PRESENTATIONS

The Ivan D. Livi Outstanding AMT Educator Award and Jim Rardon Student of the Year Award applications are enclosed in this Update, placed on the Web and included in the on-line ATEC Journal.

Award application returns will be sent to Awards Committee after the **December 1 deadline**.

The 2007 ATEC Directory material is enclosed in this Update. **The closing date is December 1**.

The Call for Presentations is also included in this mailing and will be placed in the ATEC on-line Journal and on the Web.

## 147 AC

Revisions to the PMI handbook to reflect the new 147 Advisory Circular are being worked on by the FAA.

The FAA has asked for ATEC's input to the inspector training handbook by mid-October.

Suggestions from schools regarding changed should be sent to Dr. Ray Thompson at ret@purdue.edu by **October 6**.

## PROPOSAL ON DISTANCE EDUCATION

Purdue University is completing a proposal for the FAA to review. However due to the interest by several schools and a willingness to consider new methods by the FAA, ATEC will work with several schools willing to test an online 147 course.

## FAA MEETING

On September 8, ATEC Board members Ray Thompson, Laurie Johns, LaVern Phillips and Jim Mader met with FAA officials, Ferrin Moore and Ed Hall. In addition to several issues previously mentioned (distance education and the FAA Symposium, they also discussed alternative approval mechanisms for PART 147 schools. These include moving to outcomes based accreditation, credit hours not classroom hours, using outside approval bodies such as NCATT for future approvals.

## MEMBER SERVICES

Input received from the membership after the Annual Conference indicated members wanted ATEC to:

1. Provide a list of training facilities and manufacturers sites available to ATEC members.
2. Provide a current data base for vendor and training information.
3. A listing where AMT schools can list equipment they want to dispose of, trade or sell.

In regards to Item 1 and 2, the Committee is attempting to provide the requested listings. Source Books have been required that list Manufacturers, Operators, and companies that provide training on various types of equipment. The majority of the information is in regards to simulator training for flight and maintenance crews, but, the MSC will investigate what opportunities there are for ATEC PART 147 school personnel. Also, the NBAA has been contacted in regards to a listing of training facilities. Although the NBAA does not have a list specifically for this purpose, the NBAA has numerous scholarships and training opportunities for AMT instructor listed on their website which is http:web.nbaa.org/public/education/.

Item 3 in regards to a listing of equipment for trade or sell was an item of discussion at a recent meeting of the Northrop Rice Foundation Board. NFP is willing to implement and manage a website for this purpose. This is being explored further.

## WING AERO AVIATION BOOK SCHOLARSHIPS FOR ATEC STUDENTS

The Wing Aero Products Company is sponsoring Aviation Book Scholarships for ATEC member school students. Wing Aero will donate ten (10) sets of PART 147 Aviation books to students selected in the same manner as those for the S&K Tool Awards. The Northrop Rice Foundation will administer the scholarships and present a list of winners at the ATEC Annual Conference. Information in regards to these scholarships will be sent to the schools in the near future.

## ATEC WEBSITE

The ATEC website continues to be up and running. There were some minor events that caused the site to be inaccessible for very limited times this past summer.

The ATEC Communications Committee is considering the following upgrades to the website:

- making the school profile link interactive
- a speakers bureau listing
- an A&P job advertisement page for faculty and AMTs

## ELECTRONIC ATEC JOURNAL

If you or your faculty have not signed up to receive the on-line ATEC Journal, send an e-mail to: domenic.proscia@vaughn.edu and ask to be put on the list. Over 600 people now receive the ATEC Journal on-line.

## CONFERENCE – APRIL 1-3, 2007, ORLANDO

The Preliminary Agenda for the Orlando 2007 ATEC Conference is enclosed. Complete information and a final Agenda will be mailed before Thanksgiving.

So mark your calendar now for April 1-3, 2007 at the Orlando Holiday Inn Resort on International Drive.

# Industry News

## 2007 FAR/AIM Series Now Available!

*Newcastle, WA* - For more than 20 years, ASA's Federal Aviation Regulations and Aeronautical Information Manual (FAR/AIM) books have been the standard regulatory reference of the industry. ASA has built a reputation for providing the aviation community with the most accurate and reliable FAR/AIM products available. Fro 2007 we continue this tradition by including the most current regulations and AIM, including the new Transportation Security Administration rules affecting the aviation industry.


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

In addition to the Updates available as free downloads from the ASA website, a free email Update subscription service is offered for automatic notification when a rule has changed. By simply sending a plain text email to listserv@list.asa2fly.com with "subscribe" as the subject and "Subscribe FAR/AIM (your name)" in the text section, you will receive regulatory email updates as soon as they are available.

| Title | Product Number | Suggested List Price |
|---|---|---|
| 2007 FAR/AIM Book | ASA-07-FR-AM-BK | $16.95 |
| 2007 FAR for Flight Crew | ASA-07-FAR-FC | $16.95 |
| 2007 FAR for Aviation Maintenance Technicians | ASA-07-FAR-AMT | $19.95 |
| 2007 Pro Flight Library CD-ROM | ASA-CD-FL-PRO-07 | $79.95 |

**FAR/AIM** *The Aeronautical Information Manual* and 14 CFR Parts 1, 43, 61, 67, 71, 73, 91, 97, 103, 105, 110, 119, 135, 136, 137, 141, 142, NTSB Part 830, and TSA Part 1552, Pilot/Controller Glossary, NASA Aviation Safety Reporting Form, convenient handbook-sized 6˝ x 9˝ format.

**FAR for Flight Crew** For Airline Transport Pilots (ATPs), air carriers, dispatchers, flight engineers, and all Part 121 operators, 6˝ x 9˝ format, includes Pars 1, 63, 65, 91 Subpart K, 119 (New!), 121, 135 (New!), and 175 Hasmat (New!). Part 25 may be downloaded from **www.asa2fly.com/farupdate.html**

**FAR for Aviation Maintenance Technicians** For aviation technicians and repair centers, 8-1/4˝ x 10-3/4˝ format, includes Parts 1, 3 (New!), 13, 21, 27, 33, 34, 35, 39, 43, 45, 47, 65, 91, 119, 121J&L, 125, 135, 145, 147, and 183, and Advisory Circulars 20-62D, 20-109A, 21-12B, 39-7C, 43-9C, 43.0-1E, 65-30A, and FAA-G-8082-11A.

**Pro Flight Library CD-ROM** This electronic aviation library includes over 850 publications and 6,000 graphics on one CD-ROM. Search, read, copy, or print all of the FAA publications, regulations, and documents. System requirements: Windows NT, 2000, or XP.

# AMTS Airframe: Structures Textbook Now in Full Color

*Newcastle, WA - Aviation Maintenance Technician Airframe: Structures* is Volume 1 of the Airframe section in ASA's AMT Series by Dale Crane. These textbooks were created to set the pace for maintenance technician training and attain a level of quality that surpasses all other maintenance textbooks on the market. Now in its third edition, *Airframe: Structures* has been updated to today's practices and procedures — and features **full-color illustrations** throughout.

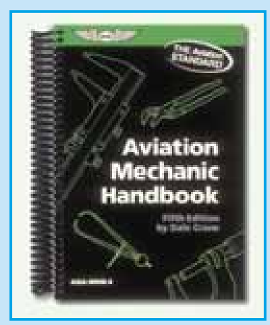

*AMTS Airframe: Structures* covers the second section of the FA's required curriculum, incorporating an introduction to basic aerodynamics along with chapters on metallic and nonmetallic aircraft structures, assembly and rigging, hydraulic and pneumatic poser systems, and aircraft landing gear systems. The AMTS curriculum meets 14 CFR Part 147 requirements and Subject Matter Knowledge Codes from the FAA mechanics knowledge tests. This versatile format is designed for at-home, classroom, or university-level training, and includes colored charts, tables and illustrations throughout, in addition to an extensive glossary and index.

Also included is a study guide in the form of Study Question sections (with Answer keys at the end of each chapter), which is perfect for evaluation by an instructor, or for self-testing. Crane's mechanic textbooks are all-inclusive — no separate, inconvenient workbook is needed by the student or instructor. Soft cover, 536 pages, illustrated, indexed.

| Title | Product Number | Suggested List Price |
|---|---|---|
| Aviation Maintenance Technician — Airframe: Structures | ASA-AMT-STRUC-3 | $49.95 |
| *Other books in the Aviation Maintenance Technician Series:* | | |
| General | ASA-AMT-G3 | $59.95 |
| Airframe: Systems | ASA-AMT-SYS | $29.95 |
| Powerplant | ASA-AMT-P2 | $59.95 |
| Instructor's Guide for AMT Series | ASA-AMT-CG | $149.95 |

# Aviation Mechanic Handbook

## New Fifth Edition Available




*Newcastle, WA* - A core reference manual for mechanics, aircraft owners, and pilots, Dale Crane's handbook for mechanics has been considered "The Aviation Standard" for many years. This book compiles specs from Stacks of reference books an government publications into a handy, toolbox-size guide. Includes all the information critical to maintaining an aircraft. Your single source for applicable mathematics, conversions, formulas, aircraft nomenclature, controls, and system specs, material/tool identifications, hardware sizes/equivalents, metal fabrication and fabric covering techniques, composite materials, aircraft batteries, inspections, corrosion detection/control, aircraft tire and spark plug information, frequently used measurements, scales, charts, diagrams . . . and much more.

The new Fifth Edition features additional information on aircraft batteries. Includes index, color illustration' pages are tabbed to facilitate quick lookups. Stay-flat flexible spiral binding is easy on all surfaces. 376 pages, 5˝ x 7˝ spiral-bound format.

| Title | Product Number | Suggested List Price |
|---|---|---|
| Aviation Mechanic's Handbook | ASA-MHB-5 | $16.95 |