Meeting the Needs of the Aviation Industry through Aviation Maintenance Technician Schools

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Abstract

There is an acknowledged shortage of trained aviation technicians within the aviation industry, particularly in the United States. While a number of initiatives have been proposed to replace those retiring from the industry or leaving for other industries, a major concern is the ability to provide qualified entry-level technicians. This paper investigates the role and capabilities of the Federal Aviation Administration (FAA) approved Aviation Maintenance Technician Schools (AMTS) in supplying qualified technicians for an environment of increasingly complicated aircraft, dwindling maintenance budgets, and increased flight schedules. A preliminary study was conducted that included over 25% of the 176 AMTSs currently approved by the FAA. The study explored over 50 attributes of each school to examine current practices and capabilities, and recommend ways to meet industry needs in the coming years. Results showed trends in enrolments, expected graduates, and plans for expansion or change. Other data such as tuition, programme capabilities and student demographics are also discussed.

Keywords

Aviation maintenance education and training; Aviation Maintenance Technician Schools (AMTS); aviation technician.

INTRODUCTION

Today's aircraft maintenance technician is as crucial to the safe operation of modern aircraft as the pilot at the controls or the air traffic controller in the airport control tower. The field of aircraft maintenance within the United States, as well as the rest of the world, is presently experiencing a shortage of trained technicians that will continue into the foreseeable future (Phillips, 2000). The outlook for maintenance jobs decreased due to the events of September 11, 2001 and a weak economy. This, in part, caused airlines to reduce service as well as the size of their fleets. However, the demand for skilled technicians is still expected to increase through 2012 at a total rate of approximately 10% (Bureau of Labor Statistics, 2004a). While most job openings during that period will be due to replacement needs, the technology required to maintain newer aircraft will continue to advance, resulting in the need for increasingly complex skill sets on the part of the technician (Bureau of Labor Statistics, 2004b).

The best paying aircraft technician jobs within the U.S. are found with the major carriers. Median wages for technicians employed by major carriers in 2002 were approximately $45,000 (USD) with the highest 10% earning over $55,000 (USD). Additional benefits such as reduced-fair air travel, education allowances and attractive medical insurance all make working for major airlines the most competitive segment of the industry. Median wages for technicians in all segments of the industry are approximately $40,000 (USD) with the lowest 10% earning around

$16,000. About 40% of all U.S. aircraft technicians are represented by various unions that include the International Association of Aerospace Workers, the Transport Workers Union of America, and the International Brotherhood of Teamsters (Bureau of Labor Statistics, 2004b).

Any solution to the current and forecasted shortage of technicians, especially within the air-carrier segment of the industry, will require not only time, but an examination of how to attract qualified men and women into the field. Within the U.S., there appears to be a shortage of young people selecting technical career fields. The focus for most high schools is to prepare their graduates for four-year college programs rather than for two-year technical schools that include the majority of AMTSs. In addition, many young people aspiring to a technical career select emerging technologies in fields such as computers or health care where salaries are competitive and working conditions more favorable. The study discussed in this presentation will examine the current state of AMTSs and how they can best attract and train the technicians of tomorrow (Dubois, 2001).

CERTIFICATION OF U.S. AIRCRAFT TECHNICIANS

Within the United States, the Federal Aviation Administration (FAA) oversees the training and certification of aircraft technicians. Aircraft technicians, also called *mechanics* or *A&Ps*, are certificated by the FAA and earn what is called a *mechanic certificate*. Ratings of *Airframe* and *Powerplant* are added to the certificate and denote the parts of the aircraft the technician is qualified to maintain. The Airframe rating allows the technician to repair the aircraft structure and systems while the Powerplant rating permits maintenance of engines, propellers (limited) and their associated appliances. Once certified, aircraft technicians may, according to the FAA, perform or supervise the maintenance, preventive maintenance, repair, or inspection of an aircraft, aircraft engines, or propellers (FAA, 1995).

There are two distinct paths to becoming a certificated technician. The first is through experience and requires 18 months of documented work on either airframes or powerplants, or 30 months on both. This is known as the *Part 65* method since the procedures are found in FAA Regulation Part 65. Once the appropriate documentation is presented to the FAA, approval for testing is granted. The second method of certification is to attend an FAA approved Aircraft Maintenance Technician School (AMTS). This method is known as the *Part 147* process because AMTSs are approved under FAA Regulation Part 147 (FAA, 1992). The length of AMTS curricula can range from as little as 12 months to integration into 4-year degree programs. Typical program lengths are between 18 and 24 months as offered by community colleges and specialty schools. Once the experience or training requirements are met, the applicant is granted approval by the FAA to begin the testing process for certification. Tests are administered by FAA approved testing centers and examiners and involve a battery of examinations that include written, oral and practical formats (FAA, 1995).

Training provided by an AMTS is generic in nature and designed to concentrate on fundamentals rather than on specific equipment. When a technician graduates from an AMTS, aircraft operators, such as the commercial airlines, are then responsible for training on the specific models of aircraft/equipment on which the apprentice technicians will work (FAA, 1995). Up until the last few years, only major air carriers could afford the expensive training equipment necessary to give their technicians the required background and experience for maintaining sophisticated aircraft such as today's state-of-the-art commercial aircraft. Through

the use of simulators and computer-based training, many AMTSs are now able to provide a significant degree of sophistication to their training programs, however, the training of aircraft technicians in the newest technologies is a very acute problem facing AMTSs (Adams, 2000).

The U.S. uses Part 147 to approve and monitor their AMTSs, and Part 65 to certify technicians. These standards are based upon regulations enacted in the early 1960s. A recent attempt to update Part 65, designated Part 66, met with so much opposition that it was withdrawn. European programs, under the Joint Aviation Authorities (JAA), require compliance with JAR-66 and JAR-147. JAR-66 governs the certification of maintenance and JAR-147 the training and examining of technicians. There is a correlation between the numerical designations used by the FAA and JAA. While the Europeans are focusing on the latest electronics and structures, U.S. training programs are still requiring the inclusion of antiquated topics such as fabric covering and doped finishes in their training syllabi. Significant differences between Part 65 certification requirements and JAR-66 exist (FAA, 1995, FAA, 1998 & Kocks, 2001). They include:

- JAR-66 requires recurrent training while Part 65 does not.
- JAR-66 requires aircraft-specific training and certification. Part 65 awards one certificate for all U.S. certificated aircraft.
- Part 65 has two ratings, Airframe and Powerplant. JAR-66 has four ratings that generally break down into:
    - scheduled line maintenance,
    - overall aircraft maintenance,
    - avionics and electrical systems,
    - and an all-encompassing approval to perform maintenance on all aircraft systems.
- Each of the certification categories within JAR-66 has increased training time as well as more complex tasks.
- JAR-66 requires increased training on specific technologies such as digital techniques and electronic instrument systems
- Part 65 requires 1,150 hours for an Airframe or Powerplant rating and 1,900 training hours for both. JAR-66, depending on the certification category, requires between 800 and 3,000 hours.

AN OVERVIEW OF AMTS PROGRAMS TODAY

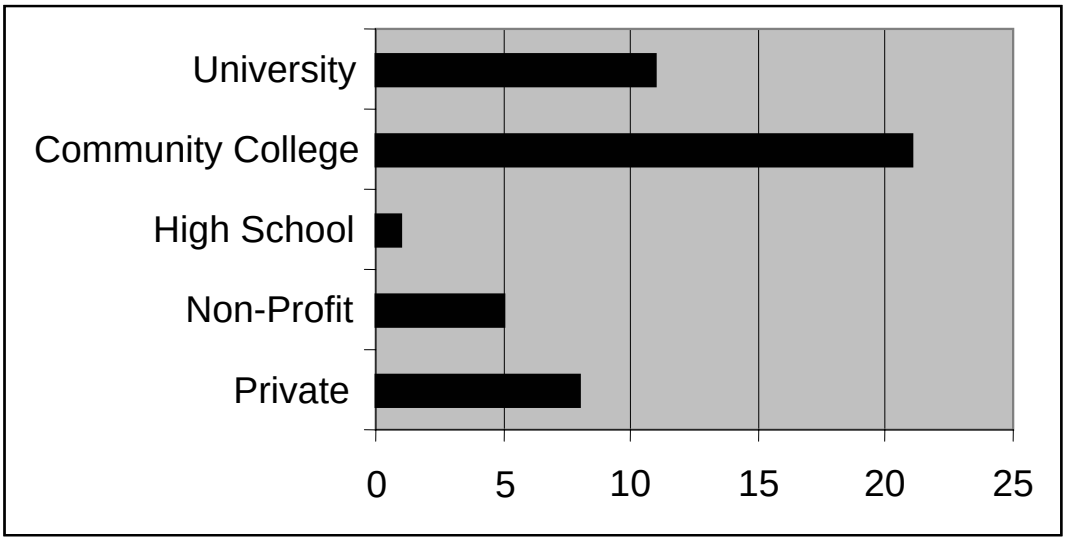
The Aviation Technician Education Council (ATEC) is an industry group whose members consist of over 90% of the certificated AMTSs as well as governmental and industry representatives. ATEC was founded in 1961 for the purpose of representing the schools to education, industry and governmental agencies and has been crucial in the advancement of curricula. In addition, ATEC conducts many studies into industry demand, curriculum issues, and represents its member institutions in regulatory and industry matters (Finnegan, 2000). Recently, ATEC has been concerned about dropping enrollments in AMTSs across the country and a member of their board provided the catalyst for the study discussed in this presentation (Kocks, 2001).

An ATEC representative first approached the research team in late 2003 and the study was completed in mid-April of 2004. The actual study period was from February 1st 2004

through April 15th, 2004. There are 176 FAA certificated AMTSs in 42 states, the District of Columbia, and Puerto Rico (FAA 2003). The total number of AMTSs has decreases slightly since 1999 when there were 182 approved programs (FAA, 1999).

Study instruments were sent to 175 of the 176 schools listed in FAA Advisory Circular (AC) 147-2JJ dated September 9th, 2003. Each school listed in AC 147-2JJ was contacted via telephone prior to being mailed a form and only one school asked not to be included. A total of 44 schools responded, equaling a sample size of 25% of the total AMTS population. Reasons for an institution not participating varied and though some follow-up was performed, the majority simply failed to return the study with no explanation. Using data available from various publications, advertisements, and telephone conversations, there is a high degree of confidence that the study instruments returned for analysis in this study represent a typical cross-section of the AMTS population. They range from small privately owned schools to community colleges and four-year universities. Figure 1 shows the number of respondents in each category.

Figure 1 Aviation Maintenance Technician Schools by type (AMTS Study)



Each AMTS is approved and monitored through its local Flight Standards District Office (FSDO) in accordance with FAA Part 147. The Primary Maintenance Inspector (PMI) assigned to each school works with the school administrators to ensure curriculum compliance, instructor qualifications, and overall adherence to FAA regulations and policies. All curriculum changes are required to be approved through the PMI and most schools will establish a periodic communication process where updated instructor and graduate lists are submitted. AMTSs are certificated with the same ratings as the technicians. A school may possess “A” (Airframe), “P” (Powerplant), and/or A&P ratings (FAA, 1992). Of the 44 programs reporting, 45% (20) had an “A” rating, 48% had only a “P” rating, and 93% possessed only an “A&P” rating. In addition 8 schools, or 18% of the sample, offered an “Avionics” program that provides training on aircraft electronics. Exactly 50% or 22 of the responding schools offered an “A&P” only. This denotes that a student must complete the entire program and will be eligible for ratings rather than one or the other.

Age of the programs varied greatly between 1 and 75 years with the average being 37 years old and the median 35. The oldest program was established a mere 25 years after the Wright Brothers first flight. The demand for aircraft technicians was so great during World War II that the U.S. military depended on private contractors to provide the needed training (McCollister, 1996). Twenty percent of the schools responding were in existence prior to the end of WWII and another 20% have only been in operation since 1990.

AMTS PROGRAM CONTENT

As previously described, AMTSs offer Airframe, Powerplant, and in some cases Avionics programs to their students. While the FAA outlines specific topic areas to be presented, how they are presented and the exact amount of time spent on each subject will vary. The minimum number of *contact hours* required by Part 147, essentially the amount of time a student will spend in class, is 1,900 hours. While the FAA does not waiver in its rules and policies, there is a process for an *exemption.* An exemption is a deviation from published regulations and is on an individual program basis and requires justification, including an argument that public safety will not be comprised. Exemptions are submitted to the PMI for consideration (FAA, 1992). Only one responding school had received an exemption for contact hours with that program being 1892 hours in length. Reasons included the use of Computer-Based Training (CBT) and procedural simulators. Seven schools or 16% of the respondents listed their programs at 1,900 hours with the average being 2,016, a median of 1,964 hours and a standard deviation of 188 hours. The most contact hours reported was 2,800 for an A&P program that did not include any extra programs such as avionics.

One principle problem with AMTSs in comparison with traditional academic programs is the actual *contact hours*. A typical full-time degree-seeking student in an academic program will often attend classes between 12 and 15 hours per week. Most A&P students are in class 30 to 40 hours per week. This is not only fairly intense for the student, but also has increased costs for facilities and instructional staff. The FAA limits required class attendance to 8 hours per day or 6 days or not more than 40 hours in a 7-day period. Breaks are integrated throughout the daily schedule since a *contact hour* is actually 50 *clock minutes* (FAA, 1992). Programs responding to the study typically conducted class between 6 and 8 hours per day, 5 days a week.

Facilities were included in the study in an effort to examine the relationship between the curriculum and physical assets since increased implementation of high-technology is likely to require additional space. Average facility size is 30,658 square feet with the largest program measuring 120,000 square feet and the smallest 8,500 square feet. By program type, community colleges on average were the largest (31,105 square feet), followed by universities (25,597 square feet), and the single high school (16,000 square feet). One probable reason for community college facilities having a higher facility size average than universities is that many community colleges are essentially technical schools whose focus is technology-based training. A number of the universities in the study include the Part 147 program as a *feature* of degree programs with the overall mission being education. Program features compared to facility size will be explored later in this presentation. Forty percent of the responding programs are planning facility expansion.

Updating curricula and growing the program is a strategic and vital part of any AMTS. Forty three percent of the respondents defined plans for future growth of their program. Some

were directly related to the Part 147 program and others were merely an extension of their current aviation curriculum. Responses for future growth included the following:

- Avionics
- Flight dispatcher
- Evening classes
- Non-Destructive Testing (NDT)
- An associate degree
- Non-metallic structures (composites)
- Airport security
- Simulator repair

Today's aircraft are becoming increasingly dependant upon computer-based systems. The training of aircraft technicians with regard to computer technology skills is now a necessary part of the Part 147 curriculum and is acknowledged in the actual regulation (FAA, 1992). This is requiring that technicians possess reasonably developed computer technology skills (Burchell, 2000). One area that does not seem to have been at the forefront of this technology "revolution" is the training of aircraft maintenance technicians in computer-related systems. While 95% of schools responding report access to the Internet and World Wide Web, 1 in 4 programs do not provide any CBT directly related to the curriculum. Most schools engage in general aircraft instruction that entails basic knowledge of aircraft systems and structures (Smith, 1998). With technology playing such an increasing role in the storage and retrieval of aircraft maintenance data, information technology skills are becoming as important to the technician as the ability to use a wrench (Fiorino, 2000; Lombardo, 1999a).

The ability of AMTS training to be applied to an associate or bachelor degree is a major draw in the student recruiting process. There has often been a debate as to whether four-year universities better prepare A&P candidates for the testing process. The latest information continues to the support the opinion that there is no real difference in test results, although the benefit of additional education should not be disputed (Summey, 2004). Degree-granting institutions will award credit to either the actual courses or the A&P Certificate. The amount of credit awarded for the A&P Certificate varies greatly depending on the institution and the accrediting organizations. Seventy seven percent of study respondents either have credit granting articulation agreements or actually grant academic credit to either their own students and/or those wishing to transfer into their degree programs.

AMTS ENROLLMENT AND INSTRUCTIONAL STAFF

Student enrollment is the "lifeblood" of any academic program and that is certainly the case with most Part 147 programs. AMTSs responding to the study varied greatly in student enrollment. Table 1 shows enrollment and graduate numbers for 2003 and 2004 (estimated). Recruiting data was provided and shows an overall expectation of increasing enrollment counts. All respondents expect an increase in student enrollment of 18% in 2004 over the previous year.

Table 1 Aviation Maintenance Technician School Enrollments and Graduates (AMTS Study)

	Enrollment		Graduates	
	2003	**2004 (estimated)**	**2003**	**2004 (estimated)**
Average	68.3	79.3	35.3	37.7
Minimum	7	13	0	6
Maximum	384	450	179	142
Totals for all Respondents	2869	3412	1447	1544

Tuition data was difficult to analyze due to the different ways the programs were structured and how it was asked for on the study instrument. Rather than ask for a total cost, the study had entry for tuition by year, semester, quarter, credit hour, and contact hour. This deficiency will be adjusted in future versions of the study and will include requests for information on tuition, books and fees, room, and board. Tuition of respondents to the study ranged around $2,000 to over $26,000 for the complete program.

Class make-up was also queried and showed that women made up an average of 7% of total enrollments. Minorities were 20% and foreign students another 6%. On the instructional side, the average number of maintenance instructors was 5 full-time and 3 part-time. The largest program had 16 full-time instructors. Another program had 15 full-time and 15 part-time teachers. The smallest school had a single instructor who taught 15 students.

Job placement numbers are also on the rise. In 2002, 77% of all A&P graduates from the responding institutions were hired within the aviation industry; another 13% were placed outside of aviation in such areas as automotive maintenance and manufacturing. Placement numbers between 2003 and 2004 are expected to rise another 5% that is indicative of current demand within the industry (Bureau of Labor Statistics, 2004a).

CONCLUSION AND RECOMMENDATION

Overall, the state of A&P training in the United States appears stable with great potential for growth. A number of factors will play upon the future of the AMTSs, most significantly the demand for air travel and related aircraft technologies. The FAA is in the process of reintroducing Part 66 as well as considering alignment with JAA requirements. Reaction to Part 66's first attempt was met with a fairly strong and united voice, indicating that major changes will be needed on the part of one or both sides of the debate for it to be successfully implemented (Kocks, 2001). Regulatory assistance will be necessary to bring Part 147 programs onto an even par with both the current technology as well as JAR-147.

Despite the relatively small sample size, the AMTS study, based upon current readings and contacts within the aviation industry, gives an up-to-date and relatively accurate assessment of the aircraft maintenance technician training system employed within the United States. Conclusions to be drawn from this study include:

- AMTS enrollments are expected to show a modest increase over the next year (18.9%)
- AMTS graduates are expected to increase over the next year (6%). Enrollments are typically higher than graduation rates due to both attrition and progression into a degree program.

- The typical AMTS exceeds minimum FAA requirements in student contact hours by an average of 116 hours.
- Community colleges had the highest average enrollment (60.1 students) with Universities at 52.4. The community colleges also on average had larger facilities and more ambitious plans for growth and expansion.

Many schools are focusing their marketing efforts on minorities, women, and foreign students. It will be interesting to see in follow-up studies what effects, if any, these efforts have. While many AMTS institutions offer college degrees, the implementation of new technologies are forcing the school, and, therefore, their students, to embrace new technologies such as computers, electronics, advanced materials, etc.

There are a number of possible recommendations resulting from this study. While the available data only represented 25% of the sample size, indications are that this initial study is indicative of the majority of the Part 147 training system. The following recommendations are simplistic in nature and additional consideration will be needed in the areas of fiscal needs, regulatory requirements, industry needs, and aviation safety. Suggested ways to improve the current AMTS system based upon the study discussed in this presentation include:

- Efforts should be taken to reduce obsolete material and embrace the latest technologies. Composites, avionics, computers, advanced engines, non-destructive inspection, are among potential curriculum additions. Most schools exceeded FAA minimum contact time by over 100 hours that is time that could possibly be utilized for the newer topics.
- With advanced technology comes the need for advanced training. Improving learning skills will permit easier learning and increasing soft skills such as reading comprehension will prove invaluable. A college degree provides greater employment opportunities; additional steps should be taken to encourage students to advance their education.
- Twenty five percent of the responding schools did not have a CBT program. The use of computers in the classroom not only has the ability to enhance the learning environment of the student, but also provides the student with improved computer literacy. It also makes more effective use of the instructor's time. Implementation of computerized training systems is not long the major investment it once was and should be strongly considered by all Part 147 institutions.
- Increase efforts to recruit minorities, women and foreign students. These are untapped work forces with tremendous potential. Opportunities abound and pay is becoming more attractive.
- Align the Part 147 system with JAR-147. This will take extensive cooperation on the parts of the trainers, employers and regulators.

Several immediate efforts are planned for follow-up to the study presented here. First will be a concentrated effort to gather data from a larger percentage of the AMTS population. Additional information will be requested that focuses on tuition rates, financial aid, and program costs. Next will be a second study to measure trends and hopefully forecast demand. While energy expended in this study was focused upon AMTSs within the United States, plans are being formulated to investigate aircraft technician training in Canada, Europe, and Asia. Canada and Europe (JAA) are similar to the FAA in many ways and that project is slated to begin in early 2005. ATEC will again offer needed assistance and support. Efforts will be made to increase the accuracy of the AMTS study and expand to other parts of the world.

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