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ATEC JOURNAL

ABOUT THE ATEC JOURNAL

The ATEC Journal (ISSN 1068-5901) is a peer-reviewed publication published twice a year by ATEC. The Journal provides an opportunity for educators, administrators, students and industry personnel to share teaching techniques and research. Authors are encouraged to submit their articles for publication consideration, whether scholarly, research, application, or opinion.

Submission deadlines are as follows:

- Spring Issue Closing Date: April 1
- Fall Issue Closing Date: October 1

ATEC JOURNAL PEER REVIEW POLICY

The ATEC Journal is a scholarly peer-reviewed/refereed publication targeted at the aviation maintenance industry. The Journal is focused on assessing developments in the areas of aviation maintenance education, curriculum, pedagogy, FAA certification and technological innovations affecting the maintenance industry. The Journal welcomes submissions reflecting the latest industry and academic thought in these areas. As a refereed publication, submissions will be subjected to a single-blind review by members of the editorial board and a limited number of professionals with expertise in the relevant field. The guidelines below describe the criteria for publication, explain the review process, and detail how to submit an article for review.

CRITERIA FOR PUBLICATION

To be published in the ATEC Journal the article must:

- Provide strong evidence for its conclusions,
- Be of interest to educators, researchers and/or those in the aviation maintenance industry,
- Assess unique or novel issues in a way that is likely to influence thinking in the field, and/or
- Introduce innovations in teaching or practical project application.

REVIEW PROCESS

The editorial board evaluates submissions to determine whether the general criteria for publication are satisfied and whether an article warrants formal review and publication. The process consists of a single-blind peer review by members of the editorial board and professionals possessing the requisite education and experience in the relevant field. Each article will be reviewed by at least two editorial board members. The author's identity will be known to the editor but will remain anonymous to other board member referees to ensure an impartial assessment. The referees will evaluate the strengths and weaknesses of a submission and provide those to the editor. On the basis of those comments, the editor will accept or reject a submission, or request that the author make revisions before publication. All papers that are reviewed and approved for presentation at the ATEC annual meeting will be published in the journal.

EDITORIAL BOARD

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Authors should upload their submission by utilizing the online submission form. Submissions shall include the following:

- Cover letter identifying the author(s), contact information, institutional affiliation and a brief description of the author(s) education and experience.
- Abstract of the article.
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Authors are responsible for anonymizing their article by removing all personally identifiable information from the abstract, article and supporting documents. To facilitate electronic review of the submission, all documents should be uploaded in a single combined PDF.

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ABOUT ATEC

The Aviation Technician Education Council (ATEC) was founded in 1961 to further the standing of FAA approved schools with education and industry, and to promote mutually beneficial relations with industry and government agencies. The council's mission is to act as the voice of aviation maintenance education.

CONTACT

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FROM THE EDITOR.

THOMAS W. Wild recently retired as the editor of the ATEC Journal. His tireless efforts enabled many of us - teachers, instructors, faculty members, educators, whatever we call ourselves - in the field of aviation maintenance education to publish and to share ideas and methods with others. The ATEC Journal was Tom's vision.

Tom started the ATEC Journal in 1986 as a simple newsletter for a few months, and then upgraded the effort to a published journal which was mailed to each member starting in 1987. The Journal was published bi-monthly for a period of time, then quarterly, and finally publication was reduced to the current twice per year schedule.

Tom worked diligently to maintain interest in the Journal, and encouraged others to submit useful articles and scholarly papers. Professor Wild – he was a full professor – taught at Purdue University for 37 years, primarily in the area of Powerplant technology. The turbine engine laboratory and the engine test cells in the School of Aviation and Transportation Technology at Purdue today are products of Tom's vision. Tom had that knack for developing a plan and then enlisting the support of others to achieve his intended goals; the outcome was always improved learning.

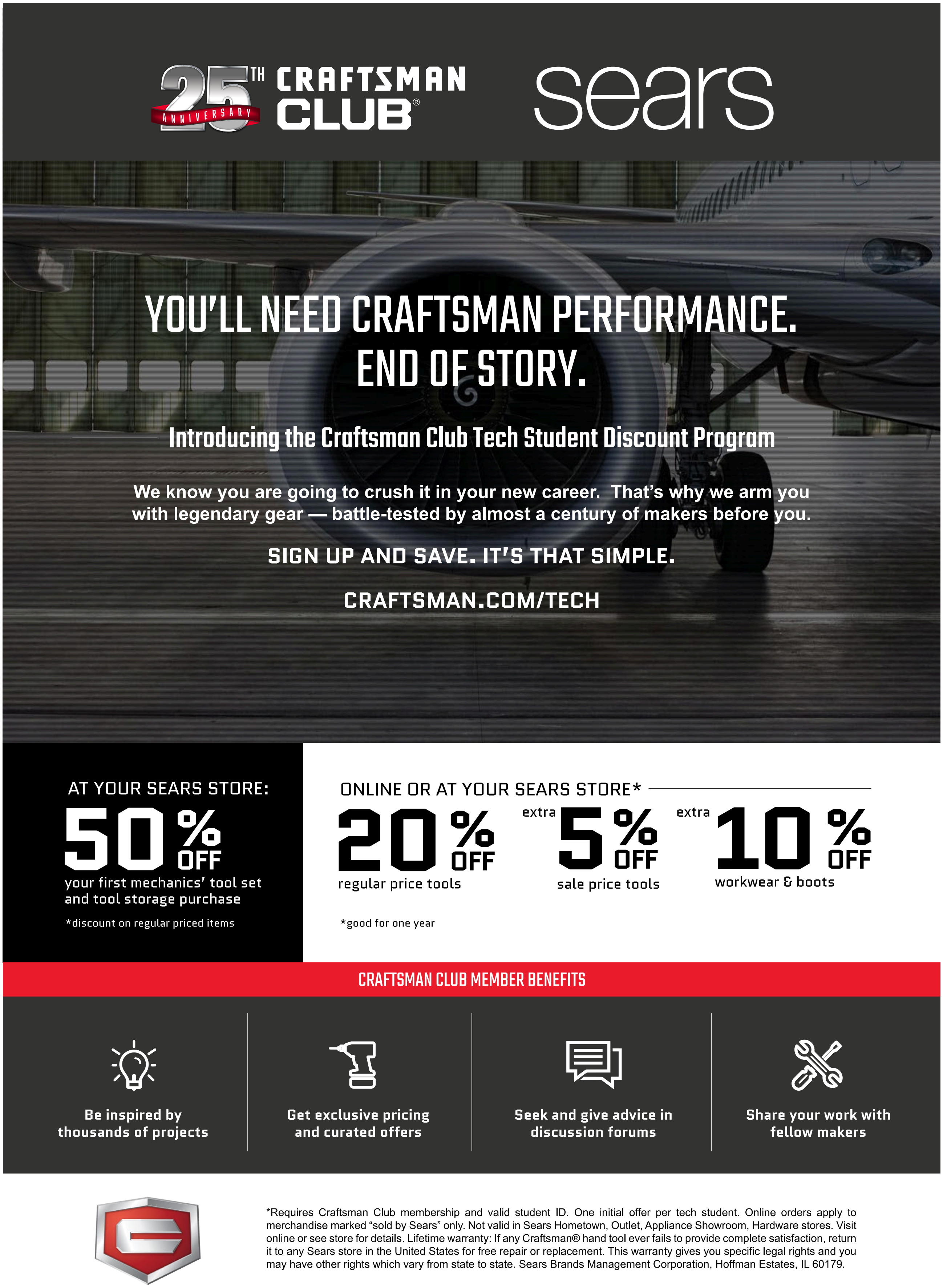
Tom occupies his time these days with aircraft projects, flying, a little golf, and family.

The ATEC Journal was not a thankless effort for Tom, but it was certainly unpaid! We owe him a debt of thanks, for sure, and maybe the best way to repay that debt is to make the Journal everything it can be. The ATEC Journal is a great place to publish about new equipment and mock-ups, teaching methods, research efforts, and technical topics of interest for aviation maintenance, including aviation fuels, new technology engines, and new FAA regulations. The Journal is an important tool for aviation maintenance education; we need to support and utilize it as the resource it is. Find a topic – not necessarily one of these mentioned above – and explore it. If you need advice or some assistance, we will try to help.

David L. Stanley

ATEC Journal Editor

dlstanley@purdue.edu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DEMONSTRATING AERODYNAMIC CONTROLS IN A WIND TUNNEL

DON MORRIS, SOUTHERN ILLINOIS UNIVERSITY, CARBONDALE

ABSTRACT

Aerodynamic tabs come in a wide variety of types and functions. In many cases, the only difference between them are the way that they rigged or controlled. They have no operational effect on the aircraft unless the aircraft is traveling through the air. As such, it is difficult for many mechanic students to understand their how they work and the fine shades of difference between them.

Historically, these devices were developed to allow control of faster and more powerful aircraft. This paper traces their development and as aviation progressed. It then details the author's development, construction, and use of a multipurpose wind tunnel model that allows the behavior of these tabs to be observed in the lab environment. Flexible rigging allows the same model to simulate trim tabs, servo tabs, balance tabs, spring tabs, and antiservo tabs.

The author's experience operating this model is shared. In addition, it lays out plans for further development of the model to demonstrate aerodynamic flutter and the effect of control surface balancing.

• • •

About the Author: In addition to a lifetime of tinkering, Don Morris has an MS in Aviation Education from Embry Riddle Aeronautical University and a BS in Physics from Illinois State University. He is currently Assistant Professor in the Aviation Technologies Program at Southern Illinois University, Carbondale. He holds A&P certification with Inspection Authorization, and is a CFI. Before working for SIU, Don worked a wide variety of jobs – some of which include Avionics installer, Electronics Technician, and Middle School Shop teacher.

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FIGURE 1: MODEL IN USE IN WIND TUNNEL

INTRODUCTION

How is it that relatively small cars incorporate power steering, while WWII B-29 pilots were able to control their craft without power assisted controls? It is not reasonable that human muscles alone could control a 140,000-pound B-29 through the sky. Yet even the more modern 80,000-pound DC-9 can be controlled via pilot muscle input alone when the controls are manually reverted. The very idea seems ludicrous, yet it works. The aircraft uses a series of control tabs to harness the forward energy of the plane and multiply a relatively small pilot input force into a force sufficient to deflect large control surfaces at high speeds (Why we have Servo Rudders, 1993).

Aerodynamic control tabs are found on most aircraft, and must be rigged and maintained properly for safe aircraft operation. They come in a dizzying array of function and implementation. In the author's experience, making sense of these control tabs is much easier for future mechanics if they are able to observe them in operation. Since these control tabs do nothing unless they are aerodynamically coupled to the surfaces they control, this is very difficult without a wind tunnel. This paper details the design, construction, and learning laboratory use of such a wind tunnel model in our FAA Part 147 aircraft technician school.

BACKGROUND

The FAA's recently released 8083-31 Aviation Maintenance Technician Handbook (2012) discusses four types of trim controls: the trim tab, the servo tab, the balance tab, and the spring tab. Its chapter on aerodynamics does not discuss stabilators and their anti-servo tabs. However, the widespread use of these systems in small training aircraft and fast jet aircraft (Udris, 2014) convinced the author that these should also be included in any study of tab controls. (Please note that the 8083-31's diagram of a spring tab is in error. See figure 2 for a corrected control diagram.)

TRIM TABS

The trim tab is the simplest of all the tabs. It is directly movable by the pilot, usually through the operation of a trim wheel or crank. Precise positioning is possible. The trim tab is on the back of whatever control surface it is supposed to regulate, and its deflection causes the control surface to move in the opposite direction. Thus, when a trim tab that is positioned on an elevator is moved into a more downward position, the rear of the elevator is deflected into a more upwards position. This causes the tail

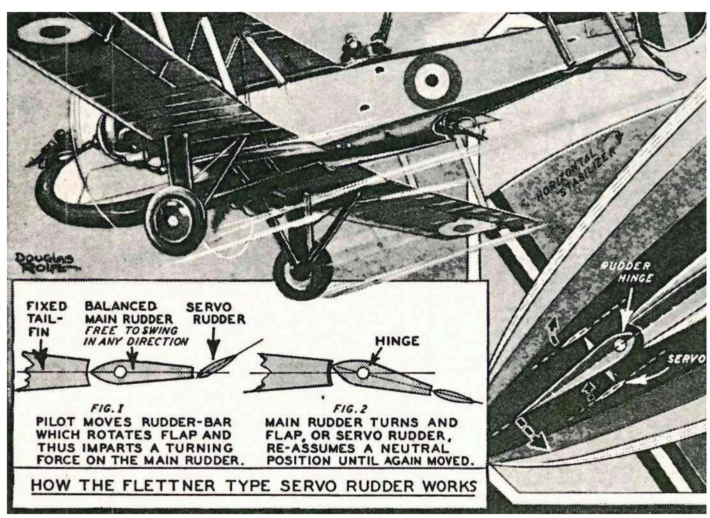

FIGURE 2: PART OF A 1933 ILLUSTRATION OF SERVO TABS.
IMAGE SOURCE: WHY WE HAVE SERVO RUDDERS, 1993.

FIGURE 3 - ENTHUSIASTIC INQUIRY.
NOTE LAB PACKET BEING COMPLETED ON RIGHT.

to lower, and the nose to rise. Rudder and aileron trim function similarly. In use, trim tabs adjust an aircraft to maintain the desired flight attitude over a variety of speed and load conditions. To understand the trim tab, consider that a trim tab is used to adjust the natural streamlined position of the control that it is attached to - and thus the action that the aircraft will take when the pilot's hands are not touching the controls.Autopilots and Trim Controls

Another reason for trim tabs is for their use in autopilot systems. Autopilot control is almost universally implemented through machine controlled trim tabs. This is done for three reasons. First, it allows the use of low powered servos to control the aircraft. Second, it allows the pilot to override the autopilot should the autopilot malfunction and attempt to miss control the aircraft. Finally, it allows brief deviations from the control path without disengaging the autopilot. A good example of the latter might be to avoid a bird strike. The pilot manipulates the controls as needed. Upon releasing the controls, the autopilot returns the plane to its intended course.

SERVO TABS

From a historical perspective, the next type of tab to be encountered is the servo tab. Servo tabs have been around a long time (see figure 2). In modern aircraft, they are positioned as a trim tab is positioned. However, a servo tab is moved not with the intended consequence of controlling the resting position of the control, but with the goal of moving the control to whatever position is required. As such, servo tabs may be moved directly by the primary control, and not by a trim wheel. Servo tabs were initially used to control larger aircraft where the pilot's muscles alone were not capable of control.

In more modern times, servo controls have been used to provide manual backup capabilities to commercial jet aircraft in the event of hydraulic system failure. Another way to understand servo tabs is that they create aerodynamically powered movements of the control surface. Unfortunately, their effectiveness rapidly diminishes with reduced speed. Low speed control is imprecise.

BALANCE TABS

One of the problems with a servo tab is that its action relies on the forward movement of the aircraft. This means that it is only functional when the forward speed of the aircraft is high. This limitation resulted in the development of the balance tab. A balance tab is a control tab that is coupled so that it will move in the opposing direction as the control surface. Both the control surface and the tab are directly moved by the control. When properly designed, a balance tab functions to decrease aerodynamic control forces. This can be thought of as an aerodynamic power assist. These tabs were used to control aircraft whose speed or size required control forces that would have been unacceptably high without them. Examples of their use include the Boeing Superfortress, whose "trim tab" on the aileron is "geared to move when the ailerons move," (20th Air Force, 1945) making it a balance tab in today's terminology (see figure 4).

SPRING TAB

As aircraft reached higher and higher speeds, controls continued to evolve. The spring tab was developed to allow an aircraft to exhibit differing control characteristics at high and low speeds. The spring tab strongly resembles the balance and servo tab. Like the servo tab, it is directly moved by the control. However, the control surface is not left free as in a servo tab, nor is directly coupled to the control as in a balance tab, but it is spring loaded to the input control. This is the reason for the name of the tab. In low speed flight when control forces are low, the spring loaded surface deflects easily along with the motion of the control. This allows for large motions and control surface effectiveness at low speeds. However, as the speed increases, the control surface becomes more difficult to deflect.

Movement of the cockpit control fails to deflect the control surface, but the tab is deflected.

Aerodynamic forces then take over, and the tab deflects the control surface into position. This serves as a variable power boost, with the boost increasing as the speed and loads increase on the aircraft. A more uniform feel with crisp control across a wide range of speeds is thus possible. Spring tabs were used on some high speed aircraft of the 1950's, such as the T33.

ANTI-SERVO TAB

The last type of movable tab covered here is the anti-servo tab. While the previous tabs were moved in the opposite direction as the control surface and served to lighten or eliminate control forces, anti-servo tabs are used to provide control forces (Udris, 2014). These tabs are found on the back of stabilators, where the elevator and horizontal stabilizer are combined. An unfortunate consequence of this combination is that the control no longer has a tendency to streamline into a particular position. The anti-servo tab is placed at the rear of the stabilator, and is used to push the stabilator into the desired streamlined position. It moves in the same direction as control surface movement. As such, when the stabilator is deflected upwards, the anti-servo tab deflects farther upwards. When the stabilator is deflected downwards, the anti-servo tab deflects farther downwards. This provides a centering tendency. Increasing deflection increases the centering tendency, providing pilots with important tactile feedback. Without this tactile feedback, control of aircraft with stabilators would be extremely difficult.

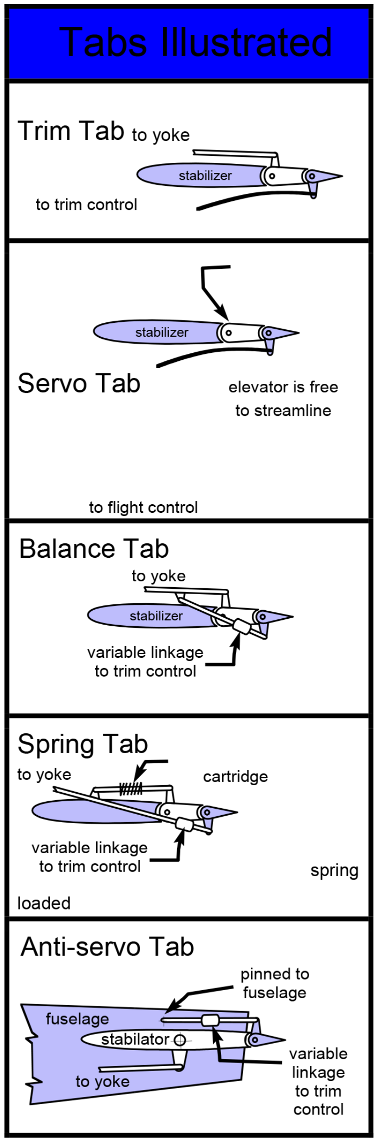

FIGURE 4: TAB CONNECTIVITY

COMBINATION SYSTEMS

While each of these tabs has been discussed as separate systems, many of these tabs (particularly anti-servo tabs and balance tabs) are hooked to their respective controls through a variable length adjustable linkage. The adjustable linkage is controlled by a pilot trim crank or wheel. This allows them to be used not only to add or relieve control forces, but also to be used as trim tabs. These tabs can do double duty, preventing the need of additional tabs when both balance and trim functions are required.

DESIGN

A write-up such as the preceding can describe the different types of tabs to students. However, understanding such tabs is generally enhanced with hands-on experience. Since airspeed is required for any aerodynamic tabs to be effective, this project had to be accomplished in a wind tunnel. The Aviation Technologies Department at Southern Illinois, Carbondale is fortunate enough to have a 24-inch wind tunnel. Made by Aerolabs, it is capable of around 100 mph - plenty of speed for aerodynamic coupling.

Early in the project, the design goals were determined. The model needed to be simple and robust, and it had to include well-proportioned horizontal stabilizer, elevator, and trim tab. Separate control horns were needed to control the angles on all three of the surfaces, and near independent movement was needed. Locking capabilities for the surfaces were also required. Locking the stabilizer in place would allow the model to represent a conventional horizontal stabilizer and elevator. Locking the elevator to the stabilizer would allow the model to represent a stabilator.

The most difficult portion of the design was the bellcranks and pushrods. These had to include the capabilities of not only multiple point operation and flexible hookups, but they also had to support mixing of control inputs for the balance and anti-servo tabs. In the end, five separate control rod systems were required. These were color-coded for student use, and are shown in figure 6.

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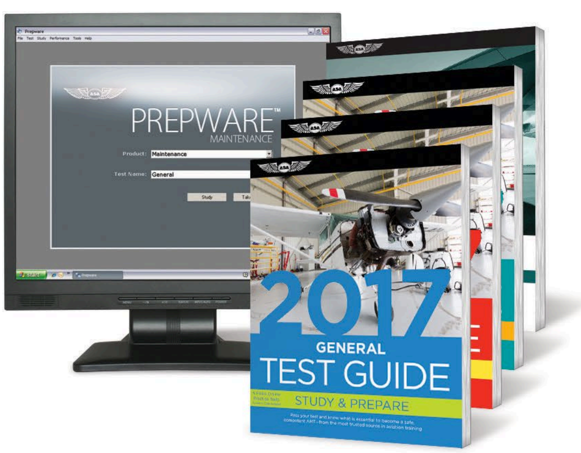

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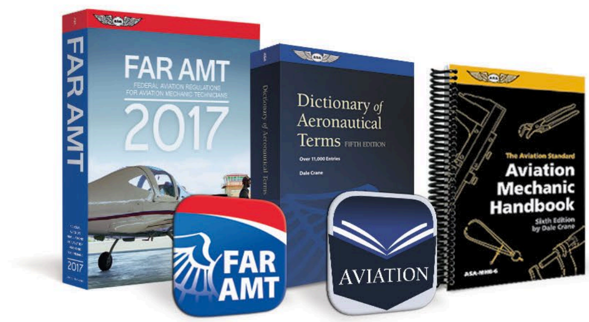

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FIGURE 5 - B-29 WING.
IMAGE SOURCE: 20TH AIR FORCE, 1945

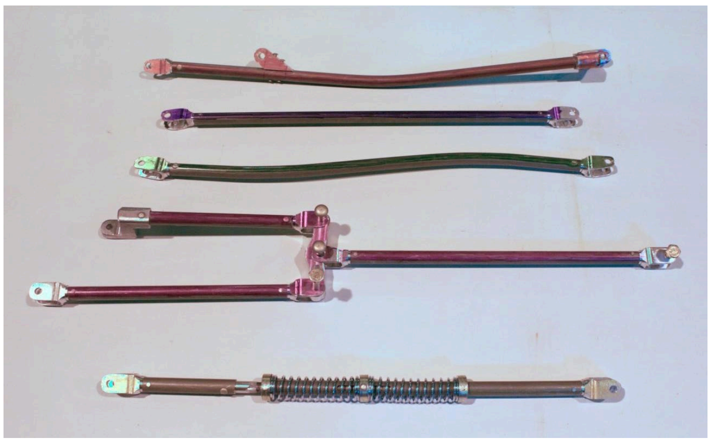

FIGURE 6 - PUSHRODS USED ON THE MODEL

Please note both the mixing rod with its variable mixing bellcrank and the spring loaded rod.

The entire model was designed and checked in Autodesk Inventor, 2014, using a free educational license (Autodesk, ND). The model was formed around three ribs. The inner and outer ribs (see figure 7) were mirror images of each other, but the central rib incorporated control points, pushrods, and bellcranks. It also included the main mount. A forked fitting extending downward from the mount allowed the model to be mounted to a wood stand in the wind tunnel.

Control for the model was provided by a single trim wheel and a single lever to represent the yoke. Since the ailerons were the only portion of the model allowed to move, only one axis of motion was required on the yoke. Multiple connecting points were attached to the yoke in order to obtain the multiple movements required by the various modes of operation. The trim wheel was simpler. A spiral cut in the side of the wheel allowed movement to be harvested from the side.

CONSTRUCTION

Since the models were drawn and verified in Autodesk Inventor, construction using CNC equipment was relatively straightforward. The models were converted into G-Code using an educational license of Inventor HSM (Autodesk, ND), and the G-Code was fed into a Tormach PCNC 1100 mill. Individual pieces were cut from · inch thick 6061 plate aluminum. This included all the parts shown in figure 1, two sets of the outer ribs shown in figure 2, as well as the control rod, yoke, and bellcranks for the control panel shown in later photos.

Once the CNC cut parts were made, the outer ribs were assembled using grade 5 bolts and nylock nuts. They were left loose enough to pivot easily. The inner control rib with its bellcranks and control rods were similarly assembled. The entire assembly was then skinned with 0.032 2024-T3 skin and AN470-3 rivets. The skin was the entire support

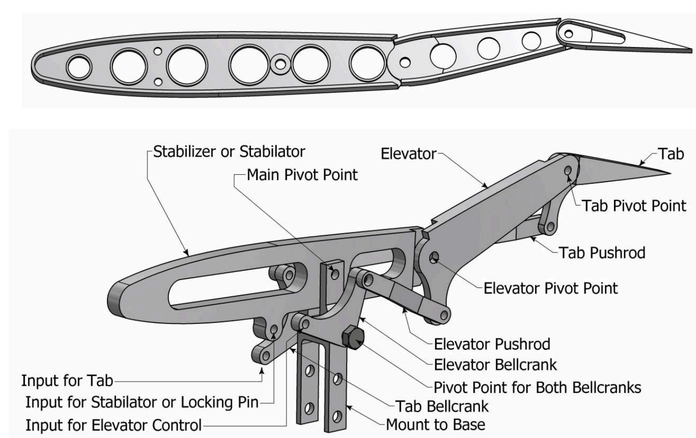

FIGURE 7 - INNER AND OUTER RIBS OF MODEL

for the outside ribs of the 18-inch-wide model.

A control panel was constructed to mount underneath the wind tunnel. This panel included the control yoke and the trim tab. Several attachment points were created to allow the controls to be rigged to the model in different ways. Pushrod end forks were fabricated from 6061 aluminum (see figure 9). Aluminum pushrods were fabricated from 2024-T3 aluminum tubing. The ends were riveted onto the pushrods. These were assembled into various color-coded configurations for the different modes of use (figure 6).

IMPLEMENTATION AND USE

Once all the parts of the model were constructed, the model was mounted in the wind tunnel and rigged (figure 10). A detailed lab manual was prepared, which included instructions for pinning the color coded pushrods and bell-cranks for each use. Since Southern Illinois Universities curriculum includes a class in aerodynamics and rigging, this was the class that was used to test the implementation of the model.

In use with lab groups, the author has found that the development of a historical story-telling narrative greatly increased student enthusiasm. Lab use of the wind tunnel model was done in conjunction with aforementioned narrative, an examination of each type of system on an actual aircraft, and the simulation of the system in the wind tunnel. The simulation results were gratifying. When the students were not handling the yoke, trim input effectiveness was visually verifiable. The resting position of the yoke varied by nearly the full range of travel. Students were easily able to feel the relief of control forces when the trim was properly applied. Similarly, the other types of control systems were effectively demonstrated.

EXTENSION FOR FUTURE WORK

Currently, the model described here has been in use for two years. Its use has been relatively enthusiastically greeted by the students. Unfortunately, as the model has worn in, its movements have become more free, and small amounts of play have developed. Since the controls are completely unbalanced, this has led to significant flutter when used hands off at moderate to high speeds. At first, this was seen as a negative. However, it is currently the author's intention to mount removable counterweights on the model so that the effect and importance of proper control system balance can be graphically demonstrated to the students. Hopefully, this will be the subject of a future report.

FIGURE 8 – NOTE CONTROL PANEL AND CONTROLS

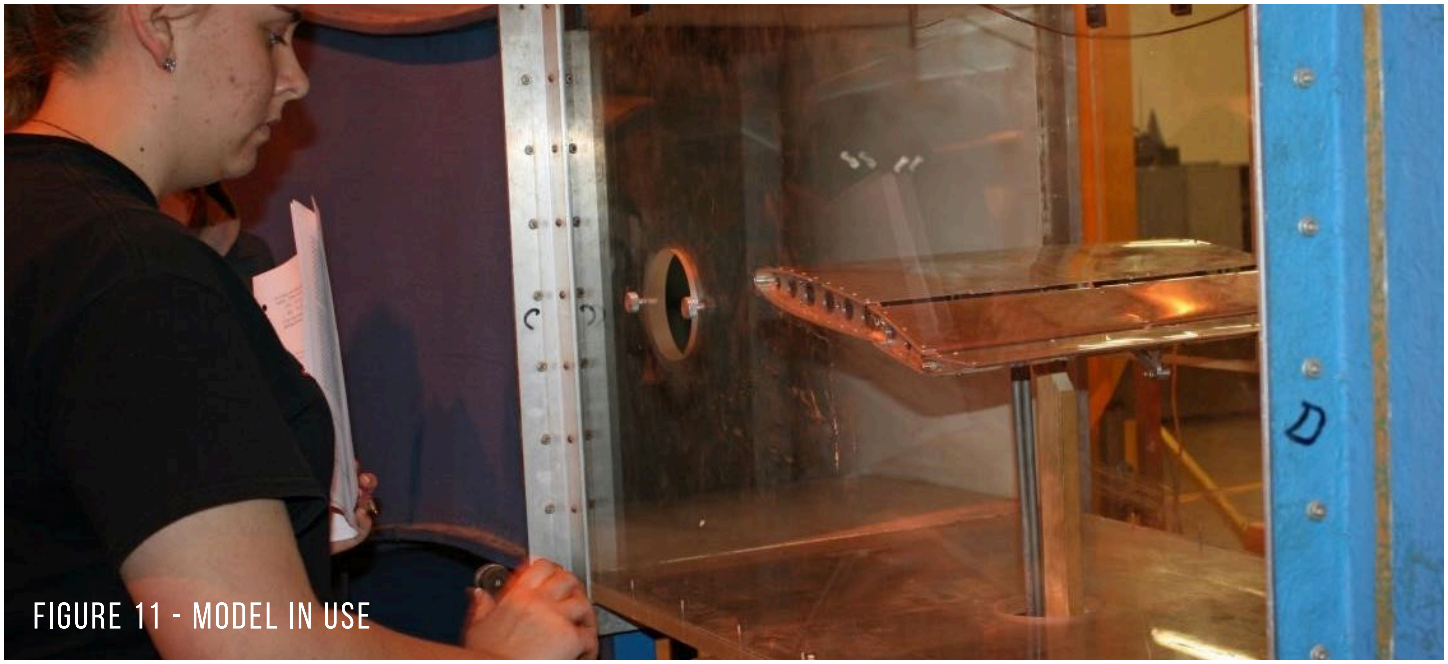

FIGURE 11 - MODEL IN USE

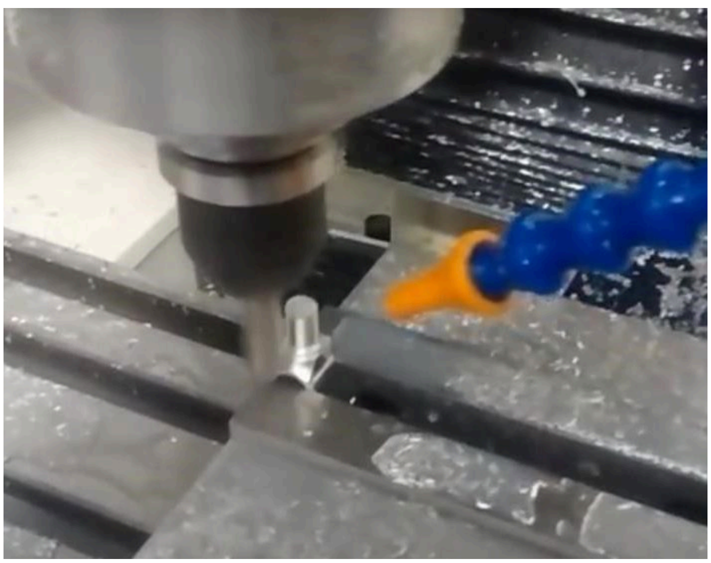

FIGURE 9 - CUTTING PARTS ON THE TORMACH.
WATCH THIS IN MOTION AT HTTPS://YOUTU.BE/Q7913BZFMNQ.

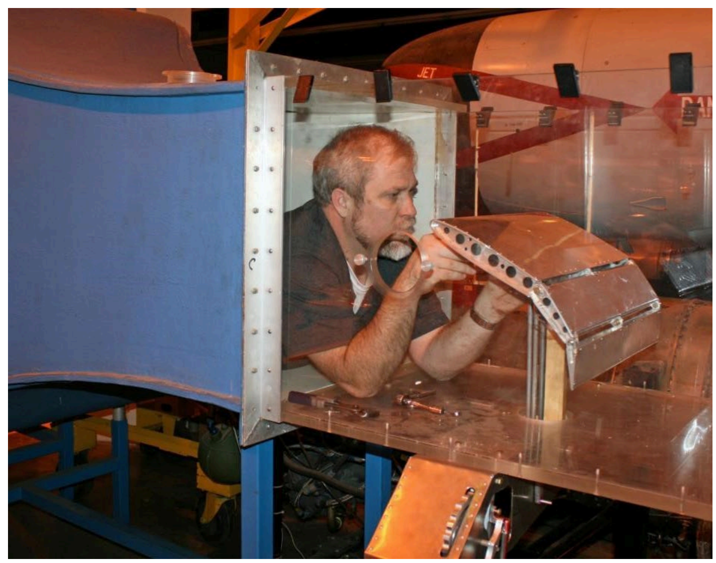

FIGURE 10 – PREPARING MODEL FOR USE IN THE 24 INCH AEROLABS WIND TUNNEL

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INCREASING THE ETHICAL EYE OF THE A&P STUDENT (CAN WE TEACH INTEGRITY?)

TERRY MICHMERHUIZEN

ABSTRACT

As a faculty member in a four-year bachelor degree program, I must comply with FAA requirements, university procedures, and college of aviation policy. In addition to those criteria, I feel strongly that faculty should do as much as possible to prepare them for employment after graduation. This will include emphasis on transportable skills such as troubleshooting, exposure to the effects of human factors during maintenance operations, ability to properly communicate, and an awareness of ethical decision making. Although all students in the College of Aviation are required to take an Aviation safety class which does have a section on Ethics, the students do not always embrace the ethics material that is presented. The textbook, Aviation Safety: A Balanced Industry Approach begins with a Chapter titled "Ethics and Aviation Safety" and discusses ethics at a macro-level approach. For example, some of the chapter subtitles are: Corporate Ethics Scandals, Organizational Culture and Ethical Climate, Ethics and the Safety Culture. I have found that the A&P students seldom see personal ethics as an integral part of their actual maintenance training. I believe that this is a serious matter that must be addressed. Somehow individual ethics must be made relevant to the students as they prepare for their careers.

The Webster dictionary defines "Ethics" as:

1. A discipline dealing with good or evil and with moral duty
2. Moral principles or practices

...and "Ethical" as:

1. Of or relating to ethics
2. Conforming to accepted and especially professional standards of conduct

It is the second part of the ethical definition that I have highlighted for emphasis here and I will address in this paper. The word "Ethics" or the term "Ethical Behavior" can take many different approaches in business:

- Proper use of company time
- Proper use of company materials
- Appropriate use of technical data
- Honesty in accounting and billing processes

While these are all valid issues to be considered in an overall approach to ethics in business, I believe that for the A&P technician, the ultimate ethical action is his/her maintenance record entry. Our industry is built on trust, both verbal dialogue and written documentation. When either of those is violated, we run the risk of introducing catastrophic failure to our profession, and the term "professional standards of conduct" becoming a phrase without meaning!

Although all students in the College of Aviation are required to take an Aviation safety class which does have a section on Ethics, the students do not always embrace the ethics material that is presented. The textbook, Aviation Safety: A Balanced Industry Approach begins with a Chapter titled "Ethics and Aviation Safety" and discusses ethics at a macro level approach. For example, some of the chapter subtitles are: Corporate Ethics Scandals, Organizational Culture and Ethical Climate, Ethics and the Safety Culture. I have found that the A&P students seldom see personal ethics as an integral part of their actual maintenance training. Somehow individual ethics must be made relevant to the students as they prepare for their careers.

My concern for raising this awareness of ethics in business occurred primarily during the Ethics course I took in pursuit of my Master's Degree in Management. That class stands out in my mind as I recall the instructor making the following comment during the first night of class. "You need to look at everything through your ethical eye, and if you do that, things will look differently!" The course had numerous case studies to help us develop and focus our "Ethical Eye." The one case study that was the most significant to me and my career was the Goodrich A7D Brake scandal of 1967. A summary of that study is:

- A young engineer was assigned to test a new brake system for the A7 aircraft.
- The brake was designed by a senior engineer who didn't take criticism well
- Testing of both prototype and final design were absolute failures
- Upper management had been telling the customer everything was fine
- Upon completion of the testing, a written report was required
- A totally false report indicating successful completion of testing was submitted without signatures
- Military pulled the contract from Goodrich after significant failures occurred during flight testing
- Corporate bureaucracy led to blame shifting and finger pointing

At that time, I was working for an aerospace manufacturer and could easily see how such an unbelievable situation could develop. Therefore, I determined to help students develop and then look through their own "ethical eye" and in doing so prepare them for possible ethical dilemmas that they could be faced with in their career.

During a previous time of teaching (1991 to 1995), I had conducted a two-part ethics evaluation, and am inserting part of my abstract about that analysis from the 1995 ASEE proceedings here for reference (1).

As an instructor in an aviation maintenance training program, I am worried that many students do not really understand ethics or ethical decision making. This concern is based upon their answers to a questionnaire that I developed for student information and distribute on the first day of class each semester. The ethics section asks the following questions:

1. Do you have a code of ethics that you personally adhere to?
2. If so, what is the basis for your personal code of ethics?
3. If not, what rationale do you use for making decisions?
4. If you don't know, when do you expect to develop or formulate one?

I presented their responses to those questions in that paper, and believed my concerns were justified. While contemplating the results, I determined to further pursue their level of ethical thinking. Therefore, I used an `ethical dilemma' situation (not an actual case study) to expose them to potential real-world decision-making situations.

Recently I revised the ethical dilemma scenario (See attachment) and provided it to 16 students in the senior class, as an assignment in their Aircraft Inspection and Airworthiness Certification course. They had to suggest three possible options. A general listing of their responses and a comparison to the responses from the 22 students in 1995 that were required to suggest two options is shown below. NOTE: One student provided only one scenario; therefore, the total in the 1995 column is 43, not 44.

Although the number of students surveyed is not sufficient enough to be statistically relevant, and the variation in student numbers and number of options makes comparison of the data rather challenging, I believe we can make the following two observations:

1. Students today seem to be more interested in actually doing the right thing and did not shy away from the possible confrontation that was likely to accompany such an action.
   - Six suggested a proper inspection be conducted, one would actually conduct it (44%) vs 3 (13%) in 1995
2. Students 21 years ago seemed more likely to leave the organization.
   - Three resignations (19%) in 2016 compared to 14 responses (32%) in 1995

Admittedly the ethical dilemma scenario I provided to them was somewhat artificial in that nobody had to face the actual consequences for their actions. But most students did give three realistic options, and I believe an increase in their ethical awareness did occur. Some of their options were things I had not thought of or seen in the previous survey done in 1995. The one that intrigued me this year the most was "Perhaps it's a test, the boss wants to see what I will do!" That comment reminded me of the "Obedience to Authority" experiment conducted by social psychologist Stanley Milgram. In that experiment (conducted in 1961-1962) test subjects believed they were administering electrical shocks to a person in another room if that person improperly answered a memory question. Although no shocks were actually received by the "Student learner" the person reading the word pairs (who was really the test subject) was often uncomfortable with the painful sounds coming from the adjacent room. If the "teacher/reader" sought direction from the "authority figure" (i.e. person in the white coat) and requested to stop the procedure, he/she was told "The experiment requires that you continue." This is not too far removed from saying "The aircraft must be signed off for a flight!" When I discussed the scenario with the students, and quizzed them about the fundamental issue, most replied "safety." That is of course a logical answer to almost any aviation maintenance related activity. But I don't believe that that is the central issue. Rather, it is integrity, personal integrity. If you made an entry in accordance with 14CFR Part 43.11(a)(4), did you really DO the inspection? Once a technician begins "fudging" on his/her maintenance record entries, and is neither accurate nor honest with reflecting what was done to the aircraft, integrity is lost both to the individual and the aviation community. (The reason that safety is not the issue is that an identical plane with identical flight time would NOT have to be inspected at 100 hours, if it was ***not used for flight instruction or hire***, reference 14CFR Part 91.409 b)

CONCLUSION

The FAA has defined the term "Airworthy" as meaning "the aircraft conforms to its type design and is in condition for safe operation" [14CFR Part 3, para 3.5(a)]. Furthermore, the regulations are very clear about the operational con-

RESPONSES	FREQUENCY 2016	1995
Suggest that a proper inspection be conducted	6	0
Consult lead IA	6	4
Sign it	5	10
Don't sign it	5	2
Talk to boss	5	4
Report to FAA	4	4
Use 10-hour time extension*	4	0
Start looking for a new job	3	0
Resign	3	14
Retain a lawyer	3	0
Talk to pilot	1	0
Conduct the inspection	1	3
Assume this is a test and tell him "I won't sign off"	1	0
Attempt a secret recording of conversation with the boss	1	1
Start leaking information about the integrity of this place	0	1
TOTAL RESPONSES	**48**	**43**

**This solution is based upon the erroneous thinking that the 10-hour allowance to overfly the allocated 100-hour interval is available for this kind of situation. In reality the allowance is only applicable if the aircraft must be flown somewhere to conduct required maintenance. 14CFR 91.409(b) the 100-hour limitation may be exceeded by not more than 10 hours while enroute to reach a place where the inspection can be done. The excess time used to reach a place where the inspection can be done must be included in computing the next 100 hours of time in service.*

dition of an aircraft "No person may operate a civil aircraft unless it is in airworthy condition" [14 CFR Part 91, subpart 91.7(a)]. How does a pilot then make their determination for airworthy? Must he/she verify the engine model number to the proper entry on the aircraft type certificate data sheet? Obviously the answer is no, they have neither the time, nor the ability (in most cases anyway) to conduct the level of inspection required for an annual or 100-inspection. The preflight that is conducted should verify that the aircraft is in condition for safe operation, the second part of the definition. The first part can be verified by the pilot by reviewing the maintenance records (log books) for the aircraft. At this point, the pilot must have faith in the maintenance entries and signatures previously recorded by the technician, and believe that they are proof positive that at the time of that entry, the aircraft was conforming to type design and in condition for safe operation. As 14CFR Part 43.11(a)(4) states, "Except for progressive inspections, if the aircraft is found to be in airworthy condition and approved for return to service, the following or a similarly worded statement 'I certify that this aircraft has been inspected in accordance with (insert type) inspection and was determined to be in airworthy condition'" shall be entered in the maintenance record for the aircraft.

The more training they have for their "Ethical eye" to consider, the greater their level of sensitivity for being "Ethical" and therefore "Conforming to accepted and especially professional standards of conduct." Aircraft maintenance records will then accurately reflect work accomplished on the aircraft, pilots will be able to trust what they read, and ultimately the flying public will be provided safer air transport. The following statements are included because they tend to confirm the ethical concerns that exist within our maintenance community.

"Neither cost nor delivery are part of the determination of an airworthy aircraft."
—Comment at an IA recurrency seminar.

"Companies come and go, but your signature lasts FOREVER!"
—Comment at an FAA DAR recurrency seminar

I believe that communicating ethics to the A&P student is an ongoing task that should be accomplished in numerous classes, in various forms by different instructors. I share a personal story with them of an incident in my business career where I was "strongly encouraged" to sign paperwork authorizing the shipment of products which I had not had time to fully review. Then I refer to a PAMA seminar comment I attended years ago where Greg Feith and John Goglia conducted an accident investigation course. The takeaway comment from that session was "Anytime someone tries to force you to sign off something you are not comfortable certifying as Airworthy, FAST FORWARD yourself to a court of law!! The maintenance record entry you made under pressure one day, has now been scrutinized by subject matter experts from the FAA, the NTSB, various OEM's, and the insurance company! As you enter the courtroom witness chair to testify, and you are sworn in to 'tell the truth, the whole truth, and nothing but the truth, so help you God'". You want to be able to do that, and answer affirmatively with your head held high, and not ashamedly negative, with your head slumped down.

This leads to "The Aircraft Mechanic's Creed "which should be displayed proudly in every aviation maintenance facility.

THE AIRCRAFT MECHANIC'S CREED

UPON MY HONOR I swear that I shall hold in sacred trust the rights and privileges conferred upon me as a certified mechanic. Knowing full well that the safety and lives of others are dependent upon my skill and judgment, I shall never knowingly subject others to risks which I would not be willing to assume for myself, or for those dear to me.

IN DISCHARGING this trust, I pledge myself never to undertake work or approve work which I feel to be beyond the limits of my knowledge nor shall I allow any non-certified superior to

persuade me to approve aircraft or equipment as airworthy against my better judgment, nor shall

I permit my judgment to be influenced by money or other personal gain, nor shall I pass as airworthy aircraft or equipment about which I am in doubt either as a result of direct inspection or uncertainty regarding the ability of others who have worked on it to accomplish their work satisfactorily.

I REALIZE the grave responsibility which is mine as a certified airman, to exercise my judgment on the airworthiness of aircraft and equipment. I, therefore, pledge unyielding adherence to these precepts for the advancement of aviation and for the dignity vocation.

Jerry Lederer

Founder, Flight Safety Foundation

(Attachment)

ETHICAL DILEMMA SCENARIO

Background: You recently graduated from college with a degree and your FAA certificate. You are working your first job at a small FBO, where you are employed as an A&P. There are four other A&P technicians, and one lead mechanic who also has her IA certification. You are married, and are expecting your first child in about three months. You recently bought a house and are hoping to upgrade your car soon. (You still owe about a year on the auto loan)

Situation: Your boss, the owner of the FBO (not the lead mechanic) approaches you just before lunch on Friday. He states that there has just come up a request to rent one of the FBO's aircraft (Piper Seminole), but the problem is that is has a 100-hour inspection due now. When you mention that to the boss, he reminds you (nicely! that although that is true, and that he wasn't asking you to do anything wrong, illegal, or unethical, he was just wanting to remind you that it is a revenue producing flight, as it will be gone on a long cross-country flight, and you know the plane better than anyone else in the shop, as you have been maintaining for the last year. He just thinks that a "full inspection" might be more than the plane needs right now. He also mentions that it has been a rather "lean month" for the FBO, and he might have trouble making a full payroll next week without this flight!! Finally, he tells you about a former employee he had to let go because he wasn't a "team player". Seems that a similar situation had come up once before and the jerk wouldn't sign it off. Not only did he get fired, but apparently has not been able to get an-

other job in the area, because, as the boss tells you, "Every time I get a call about Billy Bob, I tell the potential employer that he just 'Couldn't seem to understand who was in authority, couldn't follow orders, and basically, wasn't a team player!'"

Reaction/Response: You are to provide three different response options, and develop one of them completely. Be realistic in your answer, as we all know what should (or shouldn't be done!!) but sometimes the lines get blurred in the real world. This assignment is due back Wednesday noon.

REFERENCES

(1) The lead story was true and was included in a paper titled "A Survey of What a Course in Ethics Might Entail" submitted to ASEE in 1993 by Paul Leiffer, R. William Graff, and Wayne Helmer. It is used here with their permission.

(2) Michmerhuizen, T. (1995). Ethics and aviation maintenance. In ASEE Annual Conference Proceedings. (Vol. 2, pp. 2688-2693). ASEE - American Society for Engineering Education.

CALL FOR PAPERS

Each year, ATEC's annual meeting provides an opportunity for the AMTS community to engage on topics important to the future of aviation maintenance education. By submitting and presenting papers, education professionals can share success, workshop ideas and otherwise expand the academic horizons of their peers. Papers for presentation may be submitted for consideration at any time, but must meet deadlines (below) for inclusion in the next conference.

THEME: "SUCCESS IN THE CLASSROOM"

Example topics

- Capstone Experiences
- Increasing Student Engagement
- Industry Partnerships/Advisory Boards
- Development (fund raising/resource acquisition)
- Distance Education/Computer Based Education/Use of Multimedia
- Innovative Laboratory Projects
- Teaching New Technologies
- Using Outcome Based & Program Assessment
- Professional Development to Enhance Classroom Instruction

Recruitment & Retention Techniques

- Curriculum Development & Planning

Note: All reasonable submissions related to the theme will be considered

SUBMISSIONS

- Abstracts must be electronically submitted in Microsoft Word to atec@atec-amt.org
- Abstracts will be considered via blind review and authors of accepted abstracts will be invited to submit a full paper
- Authors must register for the conference and present their work at the annual conference

TIMELINE

- January 1: Abstract submission deadline (400 word maximum)
- January 15: Notification of acceptance
- February 15: Submission of draft paper and presentation
- March 15: Submission of final paper and presentation