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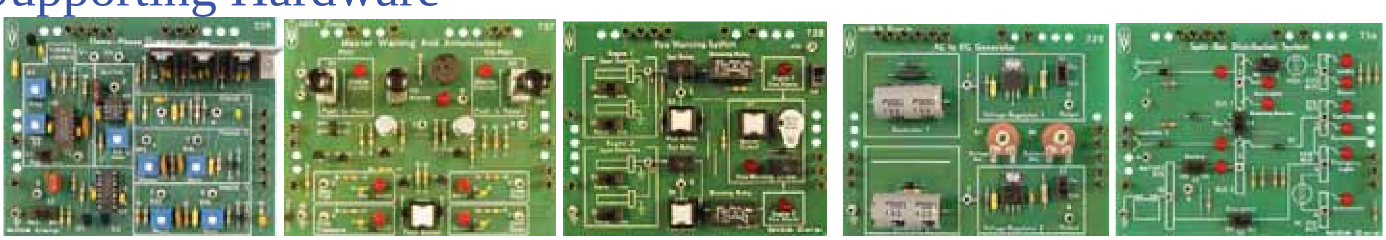

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A Preliminary Study into the Effects of Common Aircraft Chemicals and Solvents on Fiber Optic Cable Transmissivity

Dennis R. Hannon, Southern Illinois University
Aaron Ramsundar, Southern Illinois University

INTRODUCTION

Optical fiber is gradually replacing copper conductor technology in many applications (Corning, 2007). Cable with core material of either glass or plastic is available, each with its advantages and disadvantages as compared to copper conductors for transmission of data along an analog or digital data bus system. Instead of a flow of electrons as in conventional copper wire such as the twisted pair arrangement common in data transfer, fiber optics use light as the transmission medium. Optical fiber exhibits a high immunity to electrical noise and can accommodate greater signal bandwidth to support multiple signals; both important considerations in aircraft applications. A number of additional advantages include: less bulk and weight, lack of spark or short circuit potential, and a lower bit error rate (BER) (U.S. Navy, 1998). Some disadvantages of fiber optics usage include the need for interface connectors and conversion circuitry to permit data interchange between fiber optic and electrical conductors and devices, but these do not outweigh the benefits in aircraft digital data bussing installations.

A typical fiber optic data link arrangement consists of a transmitter which converts an electrical signal to an optical signal, the fiber optic cable itself for carrying the light and a receiver which converts the optical signal back to electrical impulses again (Sterling, 1999). In the transmitter, circuitry may consist of an analog to digital converter, a modulator utilizing a transistor semiconductor and an infra red, visible or laser light source which is often a light emitting (LED) or laser diode, and a connector to couple and maintain alignment of the fiber optic cable to the light source. The receiver contains a coupling connector, a detector which is a semiconductor device such as a photodiode or phototransistor, and an amplifier (U.S. Navy, 1998). The amplifier raises the power level of the signal and may process or enhance the signal as necessary depending on the particular application. The receiver may also incorporate a digital to analog converter to drive an actuator or transducer as appropriate.

Either analog or digital signals may be sent along fiber optic links, but the latter is the method most commonly employed. In civilian aviation, specific Aeronautical Radio Incorporated (ARINC) specifications such as those contained in the ARINC 600 and 800 series address the nature of the signals as well as the quality, installation and maintenance of cables utilized. The military standard is MIL-STD-1773. A typical airborne fiber optics installation may also contain devices such as signal multiplexers, couplers, splitters and other devices as needs dictate.

According to Cisco Systems' document entitled *Inspection and Cleaning Procedures for Fiber Optic Connections*, clean components are essential for quality connections between components and periodic cleaning of cable ends and connectors is an essential part of system maintenance. A failure at any juncture can lead to malfunction or at worst, catastrophic failure of the whole system. Because cable core diameters are microns in size, contaminants as small as dust particles and hair follicles as well as oils from human hands, solvents, or films present from vapors in the air can cause substantial reduction in cable throughput, complete blockage of the fiber core or a reflection of energy back toward the source degrading the signal (Cisco Systems, 2006).

While periodic cleaning of the end faces of fiber optic cable links in aircraft avionics systems is undertaken as part of routine maintenance or if problems develop, the effects of exposure of these cables and their interfaces to common aircraft chemicals and solvents as well as repeated cleaning regimens has not been well established (Zika, 2006). Aeronautical Radio Incorporated (ARINC) has established standards for the installation and cleaning of fiber optic cables (ARINC, 2005) and components and a number of isopropyl alcohol based fiber optic cleaning kits are available on the market. While these kits and techniques have proven successful for the most part in maintaining signal integrity, data as to the effects of chemical exposure and repetitive cleaning operations needs to be established. It has been the purpose of this research is to begin evaluation and documentation of the derogatory effects of common aircraft chemical and solvent exposure on cable transmissivity and make this data available to the industry. It is anticipated these preliminary results as well as future research will provide information useful to the overall determination of cable life cycles enhancing the safety and integrity of fiber optics usage in aircraft avionics systems.

RESEARCH PROTOCOL

The activities of this initial research have included evaluation of 10 meter lengths of plastic core fiber optic cable to represent lengths which may typically be used in aircraft installations. Representative cable specimens were cut to the specified lengths, categorized, polished, inspected, and tested to establish an initial baseline transmissivity level. Testing guidelines followed those outlined in Aeronautical Radio Incorporated Project Paper 805: Fiber Optic Test Procedures (ARINC, 2005). Each cable sample was then immersed in a different aircraft chemical or solvent for a period of time. Following a standardized cleaning regimen, multiple repeat transmissivity tests were conducted on each specimen including controls using a 650 ηM (near infrared LED) light source at specific intervals, the usual wavelength employed in 1 mm plastic fiber optic cable. Test result readings on each exposed test cable and control as identified by its exposure chemical were logged and documented in accordance with sound research practices and accepted scientific method.

MATERIALS AND METHODS

Durable Materials:

Fiber Optic Test Set; Manufacturer:
Industrial Fiber Optics #IF-FOM

Fiber Optic Microscope 100X; Manufacturer:
Fiber Optics Instruments Sales, Inc

Fiber Optic Hot Cutter; Manufacturer:
X-acto w/25 W Wall Mod L25 Iron

Crimping Tool

Fiber Optic Tool Kit; Manufacturer:
Industrial Fiber Optics #IF-TK4

Professional Fiber Cutter; Manufacturer:
Industrial Fiber Optics #IF-FC1

'ST' ferrule Polishing puck

Glass Polishing Plate

Fiber Optic/ Wire Stripper 766-A; Manufacturer:
Fiber Optic Instruments Sales, Inc

4-oz Water Dispenser

Consumables:

ST (Straight Tip) Connectors

PMMA 1 mm Fiber Optic Cable
(see specifications, Appendix E)

Isopropyl Alcohol

Bleached White Cotton Head Swabs

Distilled Water

Sanitary Cleaning Tissue

Fiber Optic Tool Kit Manufacturer:
Industrial Fiber Optics #IF-TK4

3 μM Polishing Film

2000-grit Polishing Paper

4 Extra KEEN Razor Blades

Solvents, Chemicals and Fuels:

Aeroshell® 80 SAE 40 Oil

AvGas 100 Low Lead

Philips 66 X/C Aviation 20-50 Oil

DOT 3 Brake Fluid

70% Isopropyl Alcohol

Jet A fuel

Lithium Grease

LPS 2 Lubricant

MEK (Methyl ethyl ketone)

Mil-5606 Hydraulic Fluid

Skydrol® Hydraulic Fluid

Spotcheck® SKC-S Cleaner

The fiber optic cable used in this study was obtained from Electronix Express, a Division of RSR Inc., of Avenel, NJ (Cat #2705FBS100M) in 100 meter spools. The cable was cut into 10 meter lengths and tagged with the name of the chemical solvent to which exposure was to be conducted. Each test specimen was paired with a control of the same length that was not subjected to exposure. Following the cutting operation, each cable end face was polished using materials in the fiber optic tool set consisting of a cutter block, razor knife, polishing puck, glass plate and abrasive paper. After polishing, the cable ends were inspected using a 100X fiber optic inspection microscope for abrasions, cracks, or scratches and re-polished if necessary.

Following initial preparation, each cable end was mounted in an industry standard "ST" type fiber optic connector for interface to the Industrial Fiber Optics Test Set. Each categorized test cable was identified by the solvent or chemical to which it was exposed and the results of each procedure and subsequent testing logged. The step by step procedure for cleaning, testing and inspection on the cables was well documented and a checklist used to assure consistency and repeatability and to minimize errors caused by inadvertent mechanical abrasion, end compression, accidental over-bending, etc.

Figure 1. Connector Assembly **Figure 2**. Cable End Polishing

Three successive transmissivity test readings were taken on each sample and averaged to help alleviate inherent test set measurement errors. Cable transmissivity was measured in microwatts and before and after exposure transmissivity ratios converted to decibels (dB) of signal loss (or gain) as compared to the baselines established at the beginning of each test cycle. A signal loss of about 0.4 dB or greater representing about a 9 – 10% signal loss was thought to be significant. In addition to fiber optic transmissivity, the outside diameter of each cable was measured with a micrometer both before and after chemical exposure to aid in determination of overall cable degradation from solvent exposure, which in some cases was severe.

Figure 3. *Transmissivity Test Set*

A control group consisting of each representative type and length of cable was established. Each uncontaminated control was subjected to identical inspection and testing as the test cable specimens. The initial baseline transmissivity and subsequent testing was conducted on each specimen, including appropriate controls, at 650 nM light wavelengths. Following initial transmissivity measurement, the cable tips were placed in the respective solvent/chemical fluids for a period of 1 week. The cables were then removed from the solvents, cleaned with isopropyl alcohol, examined, test readings taken and the data compared to each respective baseline sample measurement.

Raw data from each test measurement was recorded, interpreted and transferred to an Excel® spreadsheet and bar graph for documentation, study and comparison. The initial and mean after exposure measurement ratio was converted to decibels using the standard power ratio to decibel equation dB = 10 log P_{in}/P_{out} and displayed in as columns in Table 3. The values represent the decibel ratio difference in power transmissivity prior to and after chemical exposure.

RESULTS

Aviation Chemical	Test Cable	Initial Measurement (Control)	Test Measurement 1	Test Measurement 2	Test Measurement 3	Test Mean	dB Loss (or Gain)
Aeroshell 80 SAE 40 Oil	T1	299	288	289	261	279	0.300
AvGas 100 Low Lead	T2	308	285	273	228	262	0.702
Philips 66 X/C Aviation 20-50 Oil	T3	318	312	292	282	295	0.326
DOT 3 Brake Fluid	T4	281	262	248	249	253	0.455
70% Isopropil Alcohol	T5	307	305	295	299	300	0.100
Jet A fuel	T6	299	273	268	267	269	0.459
Lithium Grease	T7	314	305	320	320	315	-0.013
LPS 2 Lubricant	T8	300	292	306	300	299	0.015
MEK(Methyl ethyl ketone)	T9	275	0	0	0	0	NA
Mil-5606 Hydraulic Fluid	T10	326	305	314	299	306	0.275
Skydrol Hydraulic Fluid	T11	322	288	296	280	288	0.485
Spotcheck SKC-S Cleaner	T12	292	261	274	267	267	0.389
Control	T13	307	278	283	319	293	0.202

Table 1. Fiber Optic Cable Transmissivity Before and After Exposure to Aviation Solvents

Three test measurements were performed to determine repeatability of the testing procedure.

Initial and Post-Exposure Mean Measurements

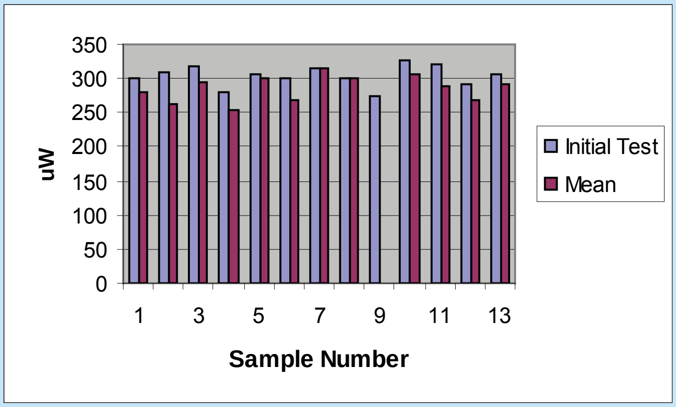

Table 2. Fiber Optic Transmissivity: Initial Reading v. Post-exposure Mean

Decibel Loss (or Gain) Data

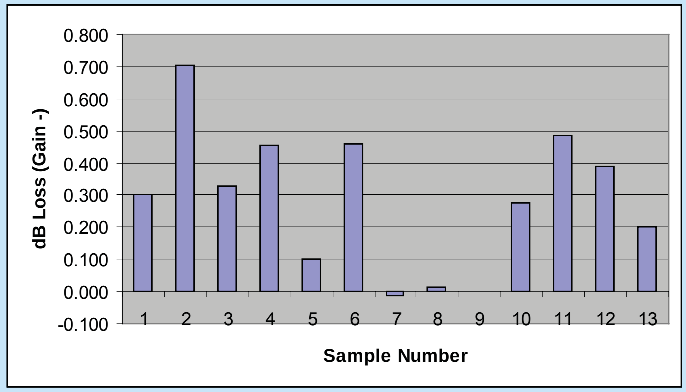

Table 3. Decibel loss (or Gain[1]) Before and After Exposure to Aviation Solvents

[1] Gain expressed as a negative value on the chart

Overall Cable Changes Before and After Chemical Exposure

Aviation Chemical	Test Cable	Initial Thickness (inch)	Thickness after exposure(inch)	dB Loss (or Gain)	Observation
Aeroshell 80 SAE 40 Oil	T1	0.0877	0.088	0.300	no visual difference
AvGas 100 Low Lead	T2	0.0907	0.094	0.702	Cable recessed 1/8 inch both ends (jacket swelling)
Philips 66 X/C Aviation 20-50 Oil	T3	0.0879	0.088	0.326	no visual difference
DOT 3 Brake Fluid	T4	0.0876	0.088	0.455	no visual difference
70% Isopropyl Alcohol	T5	0.0875	0.088	0.100	no visual difference
Jet A fuel	T6	0.0905	0.092	0.459	Cable recessed 1/8 inch both ends (jacket swelling)
Lithium Grease	T7	0.0879	0.088	-0.013	no visual difference
LPS 2 Lubricant	T8	0.0854	0.09	0.015	Cable recessed 1/8 inch one end (jacket swelling)
MEK(Methyl ethyl ketone)	T9	0.0869	0.09	NA	Cable protruded 1/8 inch both ends (jacket shrunk)
Mil-5606 Hydraulic Fluid	T10	0.0879	0.091	0.275	no visual difference
Skydrol Hydraulic Fluid	T11	0.0881	0.089	0.485	no visual difference
Spotcheck SKC-S Cleaner	T12	0.0899	0.09	0.389	no visual difference
Control	T13	0.0885	0.089	0.202	no visual difference

Table 4. Cable Appearance Before and After Exposure to Aviation Solvents

INTERPRETATION OF RESULTS

Following short term (1 week) exposure to common aircraft chemicals or solvents, the more volatile compounds appeared to have the greatest effect not only on cable performance but also produced noticeable physical degradation of the cable end face structure. Again, a signal loss at or near 0.4 dB (>9%) was felt to constitute a significant change in cable performance. A loss of 3 dB or more would signify a loss of 50% or more of the original signal power. Typically, plastic fiber optic cable signal loss is about 0.2 dB per foot in addition to a 0.25 dB connector insertion loss (see Appendix E). The amount of acceptable cable loss is driven by the nature of the signal including strength of the signal launched into the cable, bandwidth of the information transmitted and the system power budget; however, since both the test and control cables experienced these losses they were not of primary concern for the purposes of this preliminary research. Of the chemicals tested, 100 low lead aviation gasoline, DOT 3 brake fluid, Jet A aviation fuel, methyl ethyl ketone (MEK), Spotcheck® SKC-S cleaner, and Skydrol® hydraulic fluid caused the greatest losses. The effect of physical distortion or degradation on the cables probably contributed to this effect. In the case of, methyl ethyl ketone, a highly volatile plastic solvent, this effect degraded the cable to an extent making signal loss determination impossible.

As to the short term effects of a one week exposure and cleaning operation of cable samples to crankcase oil, generic lithium grease, and isopropyl alcohol, the signal degradation observed appeared minimal. It should be noted, that cutting back the deformed cable ends where observed by a centimeter or so, then repeating the cleaning and polishing process, restored the cables close to their original baseline values. It was felt the test equipment employed was not sensitive enough to evaluate the effects of slightly shortening the 10 meter cable test lengths.

RECOMMENDATIONS

Care should be taken to avoid exposure of fiber optic cable to most common aircraft chemicals and solvents. Especially noteworthy were the detrimental effects of aviation fuels and hydraulic fluid both of which often flow through tubing adjacent or in close proximity to electronic data bus runs. Acceptable practice has long prohibited the tying of data bus, coaxial or electrical cable to piping containing potentially corrosive fluids such as aviation fuels or hydraulic fluids (FAA, 1998). The effect of these on the plastic fiber optic cables tested reinforces this recommendation. Further, fiber optic cables should be kept clear of sumps while fluid residues of these types may accumulate. In the event of contamination of cable end faces, it may be advisable to cut the cables back slightly if possible prior to reassembling them in the connector body. Should portions along a cable length be exposed to the extent that visible distortion has occurred, the entire cable should be replaced. Splicing may be the only alternative in some instances but can be a difficult and tricky procedure (Sterling, 1999). Proper cable splicing requires particular acquired skills and experience which most airframe and powerplant or avionics technicians may lack and should be performed only by someone well trained in the art.

CONCLUSION

The initial results obtained in this study were valuable in determining whether degradation of cable throughput from the effects of common aircraft chemicals and solvents was a viable area in which to perform additional, long term exposure research. It is apparent that short term effects of some compounds are negligible but the long term effects remain unknown. Other chemicals produced marked degradation over the shot term rendering additional study on them unnecessary at this point. We plan to continue this study into the 2007 – 2008 academic year including repetitive cleaning of uncontaminated cable end faces to determine if normal cleaning procedures produce significant cumulative cable degradation over time.

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APPENDIX A

Fiber Optic Cleaning Method 1

(Initial, less vigorous cleaning)

Apparatus Required

100% Pure Pharmaceutical grade bleached white cotton head swabs.
99% Isopropyl Alcohol.
100x Fiberscope

PRECAUTION

1. Prevent contamination from fingerprints, dust, condensation, and oils from skin by thoroughly washing hands or wear powderless latex gloves while cleaning.

2. Only the cotton head should make contact with the fiber optic surface. Do not allow the wood to touch the fiber surface.

3. Always wipe in one direction not back and forth.

4. Use of canned air can cause oily deposits on the ferrule end face.

5. Gently apply swab to prevent abrasions to fiber.

6. Ensure cable is grounded [1] to prevent static charges from building up and attracting air particles.

PROCEDURE

1. Clean the ferrule tip using the *Swab Procedure*.

SWAB PROCEDURE

2. Dip cotton swab into bottle of Alcohol.

3. Vigorously shake off excess Alcohol from the swab to prevent residue.

4. Ensuring cable is grounded[1], hold the fiber vertically so the fiber surface points to the ceiling, carefully place the base of the swab against the fiber optic surface.

5. Drag the swab across the fiber optic surface in a single stroke. Do not drag the swab back and forth.

6. Check fiber cable with fiberscope to ensure the fiber if free from solvent residue and cotton fibers.

[1]- Static Charge- NEMI has done some very interesting work related to static charge and cleaning techniques. Essentially, cleaning techniques that build a static charge on the end face make that end face more likely to attract dust down the line. This isn't particularly relevant for cleaning just prior to mating, but matters for cleaning prior to packaging, storage, or shipment. http://thor.inemi.org/webdownload/projects/opto/Cleaning_overview031004.pdf

[2]- Most information and procedures taken from Coherent website. http://www.cohr.com/Service/index.cfm?fuseaction=forms.page&pageID=45

APPENDIX B

Fiber Optic Cleaning Method 2[2]

(Thorough cleaning if necessary following *Method 1*)

Apparatus Required

Sanitary Cleaning tissue
100% Pure Pharmaceutical grade bleached white cotton head swabs.
99% Isopropyl Alcohol
100x Fiberscope

PRECAUTION

1. Prevent contamination from fingerprints, dust, condensation, and oils from hand by thoroughly wash hands or wear powderless latex gloves while cleaning.

2. Only the cotton head should make contact with the fiber optic surface. Do not allow the wood to touch the fiber surface.

3. Always wipe in one direction not back and forth.

4. Use of canned air can cause oily deposits on the ferrule end face.

5. Gently apply swab to prevent abrasions to fiber.

6. Ensure cable is grounded [1] to prevent static charges from building up and attracting air particles.

PROCEDURE

1. Clean the sides of the solvent exposed ferrules with Tissue paper, with care to not contact the tip (end face) of the ferrule.

2. Use visual inspection to determine when solvent residue is removed.

3. Perform *Swab Procedure* to clean tip (end face) of the ferrule.

SWAB PROCEDURE

4. Dip cotton swab into bottle of Alcohol.

5. Vigorously shake off excess Alcohol from the swab to prevent residue.

6. Ensuring cable is grounded[1], hold the fiber vertically so the fiber surface points to the ceiling, carefully place the base of the swab against the fiber optic surface.

7. Drag the swab across the fiber optic surface in a single stroke. Do not drag the swab back and forth.

8. Repeat from step 4, using the other side of the swab.

9. Check fiber cable with fiberscope to ensure the fiber if free from solvent residue and cotton fibers.

[1-] Static Charge- NEMI has done some very interesting work related to static charge and cleaning techniques. Essentially, cleaning techniques that build a static charge on the end face make that end face more likely to attract dust down the line. This is not particularly relevant for cleaning just prior to installing, but matters for cleaning prior to packaging, storage, or shipment. http://thor.inemi.org/webdownload/projects/opto/Cleaning_overview031004.pdf

[2-] Most information and procedures taken from Coherent website. http://www.cohr.com/Service/index.cfm?fuseaction=forms.page&pageID=45

APPENDIX C

Polishing Method[1]

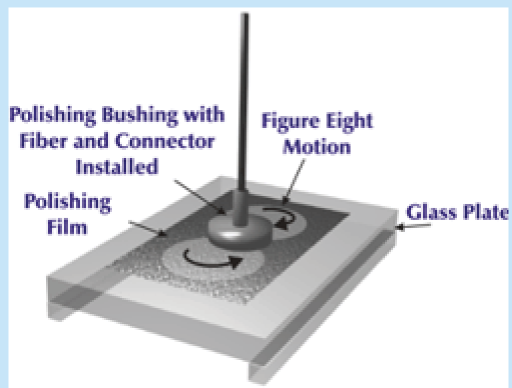
Apparatus Required

3 μM Polishing Film
2000-grit Polishing Paper
100x Fiberscope
'ST' ferrule Polishing puck
Glass Polishing Plate
4-oz Water Dispenser
Distilled water

PRECAUTION

1. Prevent contamination from fingerprints, dust, condensation, and oils from skin by thoroughly washing hands or wear powder-less latex gloves while polishing.

2. Ensure cable is grounded [1] to prevent static charges from building up and attracting air particles.



PROCEDURE

1. Start with the fiber installed in the ST connector and ready for polishing.

2. Fill the water dispenser with distilled water.

3. Using the water from the dispenser bottle, moisten the top of the glass polishing table. (This will keep the polishing paper from moving on top of the table.)

4. Wet the top of the 2000-grit paper with water from the dispenser.

5. Place the ST connector inside the polishing puck.

6. Polish the fiber in a gentle "figure 8" motion for 20 strokes.

7. After the 20 strokes, examine the end of the fiber using the fiberscope. If fiber has cloudy, not flat, or has scratches, repeat steps 4 through 6.

8. Place the 3 μM polishing film on the glass polishing table and wet the top of the film with water.

9. Polish the fiber in a gentle "figure 8" motion for 20 strokes.

10. After the 20 strokes, clean the end face using *Cleaning Method 1*,

11. Examine the end of the fiber using the fiberscope. The fiber should have a nice gloss.

[1] This Polishing Method was taken from the Fiber Optic Tool Kit P/N IF-TK4 manual. Picture taken from http://www.fiber-optics.info/articles/connector-care.htm

APPENDIX D

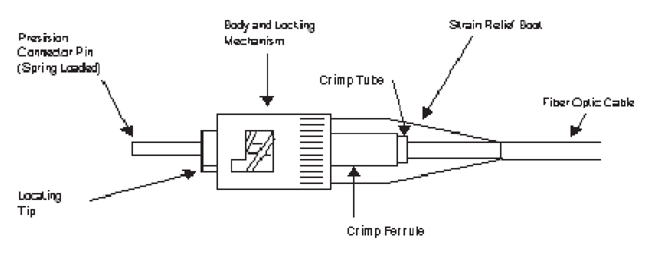
Methodology for ST Connector Installation[1]

Apparatus Required

ST Connectors
Fiber Optic Hot Cutter
Professional Fiber Cutter
Extra KEEN Razor Blade Cutting Block
Fiber Optic/ Wire Stripper 766-A
PMMA 1 mm Fiber Optic Cable (see specifications)

PRECAUTION

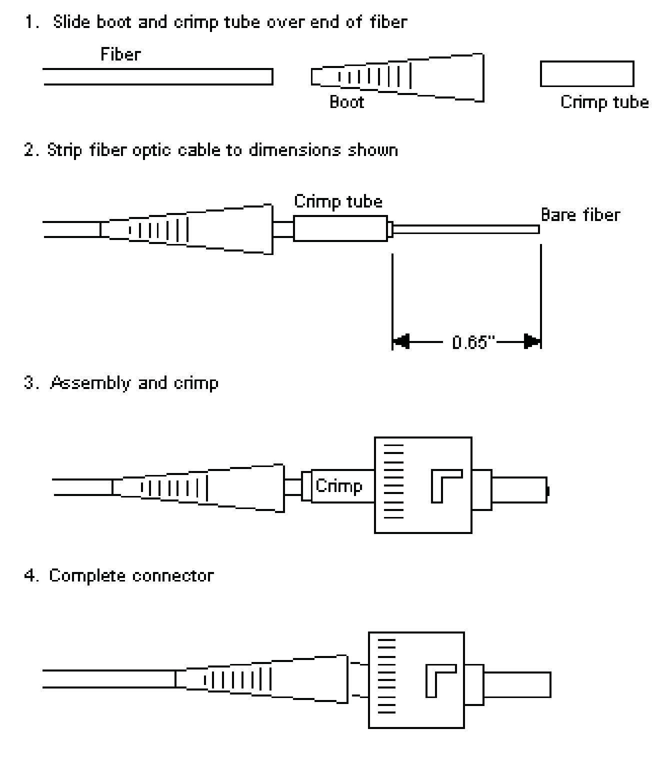
1. Make sure the cable is cut to desired length before installing ST connector.
2. Leave at least 1/8 inch extra fiber cable extending out of ferrule to be ground down flush and polished.
3. Be Careful to use the appropriate size hole when stripping cable to prevent scratching fiber from the wire stripper.



The ST-style Optical Connector

PROCEDURE

1. A fiber optic cable requires two ST connectors on each side.
2. Strip the jacket from the fiber cable with Fiber Optic/ Wire Stripper about ¾ inch, enough to let the fiber extend at least 1/8 inch from ferrule end face.
3. Insert Boot and Crimp Tube onto cable as shown in diagram below.
4. Slide connector body onto fiber and on top of Crimp Tube, until about 1/8 of fiber is exposed from end face (as in Step 3 of diagram).
5. Using Crimping Tool, Compress the Crimp Ferrule on the connector onto the Crimp Tube using the correct crimping dye (hexagonal dye).
6. After the connector is crimped onto fiber cable polish the ferrule end face using the *Polishing Method* (this is where the fiber and the ferrule end face becomes flush).
7. After polishing, use the *Cleaning Method 1*, to clean ferrule end face.
8. If 'ST' connector is not on other side of cable then repeat procedure to install.



Steps to Assemble a Connector on a fiber Optic Cable

[1]Pictures and Information taken from http://www.commspecial.com/connectorguide.htm#connectors

APPENDIX E

Fiber Optic Cable Specifications

Part Nos. 2705FBS1M, 2705FBS10M, 2705FBS100M and 2705FBS500M

Electronix Express
365 Blair Road
Avenel, NJ 07001, U.S.A.

Mechanical Properties of Plastic Optic Cable (Simplex)

Core Polymethyl Methacrylate (PMMA)
Material Cladding Fluorinated Polymer
Jacket FR-PVC, PE, FR-PE
Fiber Diameter, 1.0 mm
Cable Diameter 2.2 mm
Structure Step Index
Numerical Aperture (N.A.) 0.50
Acceptance Angle, 60°
Attenuation, dB/m @ 650nm Under 0.20
Allowable Bending Radius, Min. 25 mm
Available Temperature Range –40 ~ +70°C

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Propeller Blade Repair and Advisory

Circular 43.13-1B

Lowell W. Berentsen
Department of Aviation Technologies
Southern Illinois University Carbondale

ABSTRACT

The Federal Aviation Administration (FAA) is very clear about the necessity for the Aircraft Maintenance Technician (AMT) to perform aircraft maintenance in accordance with Title 14, Code of Federal Regulations (14 CFR), commonly known as the FAR (Federal Aviation Regulations). According to 14 CFR, §43.13a, "Each person performing maintenance, alteration, or preventive maintenance on an aircraft, engine, propeller, or appliance shall use the methods, techniques, and practices prescribed in the *current* manufacturer's maintenance manual or Instructions for Continued Airworthiness prepared by its manufacturer, *or other methods, techniques, and practices* acceptable to the Administrator" [italics added] (U.S. Department of Transportation [U.S. DOT], FAA, 2007). Occasionally, due to the passage of time and the revision of manuals of acceptable methods, old techniques are dropped from publications because of more current regulations and information, and new procedures in manufacturers' maintenance manuals. However, there have also been times when pertinent information has been dropped from a publication by mistake. In the case of having to use Advisory Circular (AC) 43.13-1B, which falls under the category of "*other methods, techniques, and practices*," as a resource for dressing out propeller blades that do not have current publication data, the information can be inadequate or, at the very least, confusing. The following work is an effort to clarify some points in Chapter Eight of AC 43.13-1B regarding the limitations in propeller blade repair.

FAA MAINTENANCE REQUIREMENTS

It has often been said the propeller is the most neglected critical component on an airplane. Continued Airworthiness Instructions set forth by the propeller manufacturers can be very broad and varied in detail. This article is not intended to duplicate approved methods for propeller repair or be a list of instructions about how to inspect or do minor repairs on propellers. Before making any repairs to a blade, according to AC 20-37E, *Aircraft Propeller Maintenance*, the technician should first "determine whether the propeller manufacturer has published damage limits that govern repair procedures applicable to that part" (U.S. DOT, FAA, 2005, page 23). AC 43.13-1B reiterates in Section 8-71, "Follow the propeller manufacturer's recommendations in all cases, and make repairs in accordance with latest techniques and best industry practices" (U.S. DOT, FAA, 1998, page 8-29). In a case where those publications are not sufficient, the A&P should consult the quality assurance or product support engineering department of that particular manufacturer or a reputable FAA-approved repair station rated for that component or appliance.

WEIGHT, PERFORMANCE AND STRENGTH

There are three important considerations when making any kind of repair on a propeller blade. AC 43.13-1B states in Section 8-73 that the damage is to be repaired "provided the removal or treatment does not materially affect the strength, weight, or performance of the blade" (U.S. DOT, FAA, 1998, page 8-29). The *weight* issue can be determined by a static balance check followed by a dynamic balance check, which will not be addressed here. Also, *performance* can be, and should be, verified by a qualified pilot. To determine whether or not the *strength* has been affected by a repair requires the ability of the technician to comprehend the information found in the manufacturer's latest technical data and, when appropriate, in AC 43.13-1B. However, when working with AC 43.13-1B, whether as mechanics or instructors, many have wrestled over some of the confusing instructions, particularly the "Examples," provided in Chapter Eight relating to the repair limits.

MAINTAINING BLADE INTEGRITY

A number of things can affect the strength of a blade. Obviously a crack will cause a blade to automatically be rejected. Having repairs in the face or the back side of the blade, which "form a continuous line across the blade section" chordwise, also is cause for rejection of a blade due to the strength being compromised (Hartzell, 2003, page 6-17). However, a consideration commonly overlooked is the inspection for minimum blade width or thickness at any given station of the blade following a repair. Maintenance personnel have failed to understand that the depth of repair in a blade is limited by the published or calculated minimum blade width or thickness tolerances of a repaired blade – not just the criteria for the depth of the impact on the blade. For example, "An individual edge repair should not exceed a depth of 3/16-inch," according to AC 20-37E, *Aircraft Propeller Maintenance* (DOT, FAA, 2005, page 23). But following that criterion alone is not sufficient.

Let's consider the example of repairing a nick in the leading edge of an aluminum propeller blade. For most modern propellers, the manufacturer provides explicit instructions about removing nicks, gouges, dents, and scratches. AC 20-37E, has followed the example of Hartzell, McCauley, and other propeller manufacturers by requiring that "the repair length should be 10 times longer than the depth of the repair," and not just settling for the 3/8-inch radius minimum previously published (DOT, FAA, 2005, page 23). The technician might dress out damage, following what he or she thinks are the *complete* manufacturer's instructions, and still end up with an unairworthy blade. Where some technicians fall short is when they fail to inspect the blade to be sure the *strength* has not been compromised; that is, that the width and/or thickness of the blade at the section of the repair are not less than the manufacturer's repair minimums.

Hartzell illustrates in each *Propeller Owner's Manual & Log Book* for their propeller models how to dress out damage but include, in bold upper-case letters, "CAUTION: BLADES THAT HAVE BEEN PREVIOUSLY REPAIRED OR OVERHAULED MAY HAVE BEEN DIMENSIONALLY REDUCED. BEFORE REPAIRING SIGNIFICANT DAMAGE OR MAKING REPAIRS ON BLADES THAT ARE APPROACHING SERVICEABLE LIMITS, CONTACT AN APPROPRIATELY LICENSED PROPELLER REPAIR FACILITY OR THE HARTZELL PRODUCT SUPPORT DEPARTMENT FOR BLADE DIMENSIONAL LIMITS" (Hartzell, 2003, page 6-15). Evidently the mere "NOTE" in small print in the earlier manuals was not getting the message across: "LOCAL WIDTH OR THICKNESS REPAIR DEPTH MAY NOT EXCEED THE MANUFACTURERS MINIMUM REPAIR TOLERANCE" (Hartzell, 1986, page 35).

Most modern propeller manufacturers provide the technician with very comprehendible tables, such as the ones in Figures 1 and 2. The tables for each propeller and blade model indicate what the repaired minimum blade width and thickness is at each blade station section. The technician can clearly see what the minimum dimensions must be following a repair, helping him or her to know how much material can be removed while still retaining the *strength* necessary for an airworthy propeller. To find the "minimum repair tolerance" information the technician needs to look in the manufacturer's service manual or overhaul/repair instructions of the specific propeller and blade being repaired. As an example, if the technician has dressed out a nick on the leading edge at station 24 (which is 24 inches from the center of the hub) of a Hartzell HC-A2XF-2 propeller with model 7636D blades (Figure 1), the width of the blade at station 24 cannot be less than 5.312 inches after the repair. Anything less than 5.312 inches at that blade segment renders that blade "not airworthy" for that particular installation.

TABLE III. — BLADE REPAIR TOLERANCES

Rad.	Angle Min.	Angle Max.	Face Alignment Min.	Face Alignment Max.	Width (Min.)	Thickness (Min.)
7636D Blade						
9					4.700	1.980
12					5.572	1.095
18	41°	42°	.138	.202	5.702	.666
24	37°	37.6°	−.072	.008	5.312	.449
30	33.2°	Setup	−.192	−.128	4.450	.319
36	29.8°	30.2°	−.242	−.178	No Limit	No Limit

Figure 1: *Hartzell Chart for Minimum Width and Thickness Following Blade Repair (Hartzell, 1971, page 6)*

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In a McCauley service manual for fixed pitch propellers, the instructions read similarly to the Hartzell instructions: "Reject blades that will require removal of more material than the minimum permissible widths and thickness in applicable table of Section IV" (McCauley, 1973, page 2-8). In some McCauley overhaul manuals the directive is printed as a *warning* to emphasize the importance of the information. This required inspection is often overlooked by line mechanics or technicians, who routinely dress out propeller blades, because they fail to take into consideration blade wear, and previous filing and dressing of the blade, which adds to the total amount of material being removed from the blade width or thickness.

730720

Overhaul

Table 4-32. MINIMUM PERMISSIBLE BLADE WIDTH & THICKNESS, 1C172(EXCEPT MTM & TM) (FOR REPAIR)

Station (Fig. 4-22)	Width (Inches) at Propeller Diameter 72	74	76	Thickness (Inches) at Propeller Diameter 72	74	76
4.5	5.230	5.230	5.232	2.545	2.545	2.545
9	5.275	5.275	5.275	1.100	1.100	1.100
12	5.293	5.295	5.295	0.835	0.835	0.835
15	5.315	5.315	5.315	0.678	0.678	0.678
18	5.250	5.255	5.255	0.570	0.570	0.570
24	4.760	4.775	4.775	0.400	0.400	0.400
30	3.830	3.875	3.910	0.270	0.275	0.275
33	3.115	3.165	3.210	0.210	0.212	0.215
36	---	---	2.500	---	---	0.160

Figure 2: McCauley Chart for Minimum Width and Thickness Following Blade Repair (McCauley, 1973, page 4-37)

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NEW BLADE DRAWINGS AND MANUFACTURING TOLERANCES

There may be times when the technician has to perform minor repairs on very old propellers of which the maintenance manuals may not be so clear; or worse, the propeller manufacturer may not have even produced a repair or overhaul manual. For propellers and blades that do not have published tables listing the repaired blade minimum dimensions, the technician needs to locate the manufacturer's new-blade dimension specifications or blade drawings, which contain the dimensions and blade angles. After the technician has found the manufacturer's specifications, the dimensions in the drawing may not be the *minimum* manufacturing limits. The Beechcraft 215 Propeller blade drawing (Figure 3) serves as a good example. There is a plus-and-minus limit in the "Manufacturing tolerance" table (Figure 4) for manufacturing this blade. Once the technician knows what the specifications and tolerances are, the graphs in Figures 8-27 (Figure 5) and 8-28 of AC 43.13-1B are used in the calculation of what percentage of material can be removed beyond the *minimum manufacturing tolerances*. In the Beechcraft 215 Propeller blade drawing (Figure 3) the blade stations are provided in the top view, the manufacturer's specifications for the blade width are provided in the center view, and the manufacturer's specifications for blade thickness are provided at the bottom of the figure.

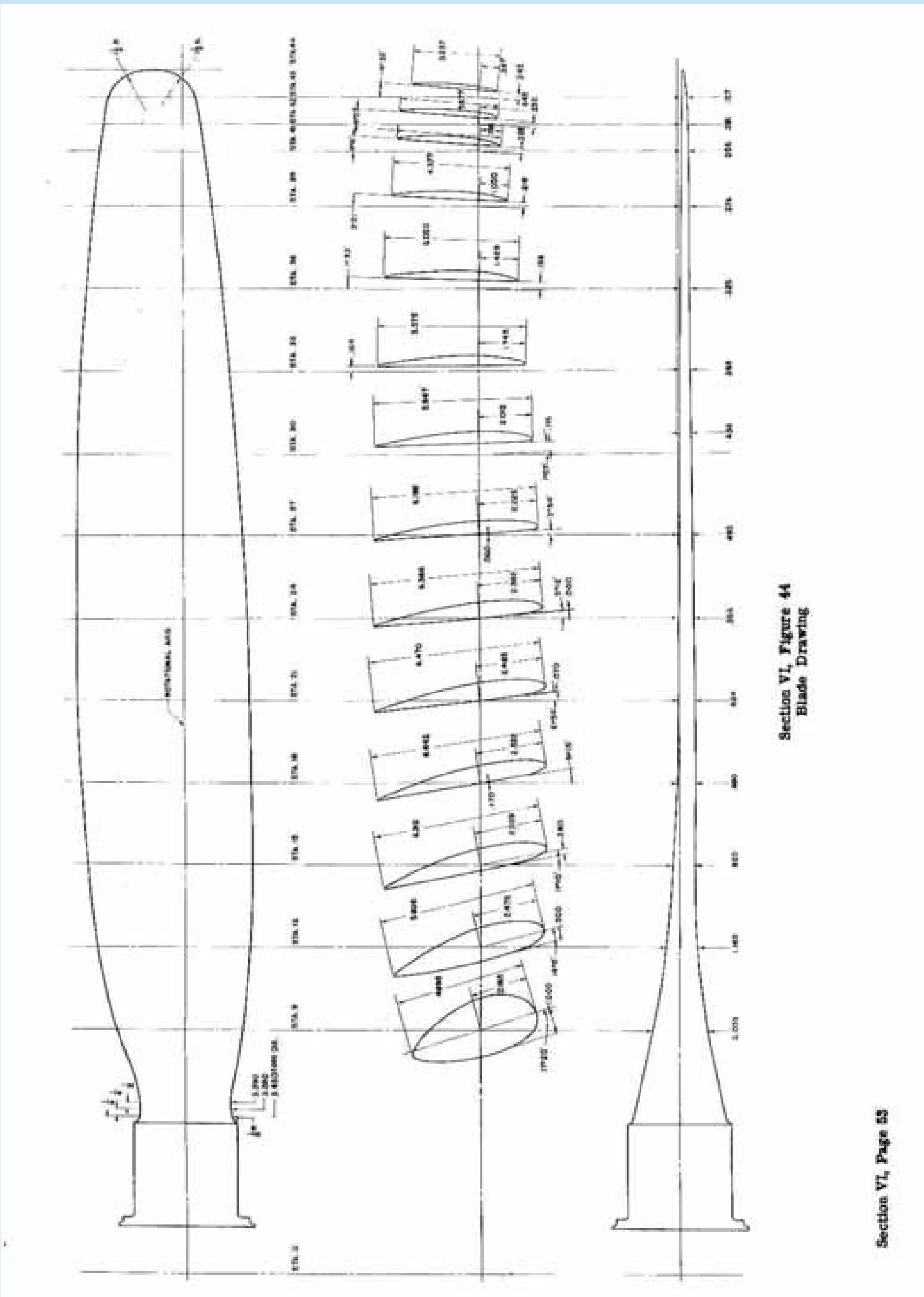

Figure 3: *Beechcraft Blade Drawing and Specifications (Beechcraft, 1952, page 53)*

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The “Manufacturing tolerance” table (Figure 4) was published in the older issues of AC 43.13-1, back to and including the first issue in 1965. Prior to that, the table was published in 1959 by the Federal Aviation Agency in the *Civil Aeronautics Manual 18 (CAM 18): Maintenance, Repair, and Alteration, Of Airframes, Powerplants, Propellers, and Appliances* (Federal Aviation Agency, 1959 [*CAM 18* is now being copied and sold by Essco Aircraft, Barberton, Ohio]).

		Manufacturing tolerance (inch)
Basic diameter less than 10 feet 6 inches:		
Blade width	from shank to: 24-inch station	±3/64
	to tip	±1/32
Blade thickness		±0.025
Basic diameter 10 feet 6 inches to less than 14 feet 0 inches:		
Blade width	from shank to 24-inch station	±1/16
	from 30-inch station to tip	±1/32
Blade thickness	from shank to 24-inch station	±0.030
	from 30-inch station to tip	±0.025
Basic diameter 14 feet 0 inches and over:		
Blade width	from shank to 30-inch station	±3/32
	from 36-inch station to tip	±1/16
Blade thickness	from shank to 30-inch station	±0.040
	from 36-inch station to tip	±0.035

Figure 4: *Blade Manufacturing Tolerance Chart (Federal Aviation Agency, 1959, page 90)*

However, the table in Figure 4 was not included in the new AC 43.13-1B. Here is where some of the confusion begins with the new advisory circular. Although that table of manufacturing tolerances has been omitted from the advisory circular, the text directing the technician to use those limits in the table is still there, in the beginning of Section 8-74, which can be very confusing to the reader. The text under “REPAIR LIMITS” states, “The *following limits* are those listed in the blade manufacturing specification for aluminum-alloy blades and govern the width and thickness of new blades. *These limits* are to be used with the pertinent blade drawing to determine the minimum original blade dimensions to which the reduction of Figure 8-27 and Figure 8-28 may be applied” [italics added] (U.S. DOT, FAA, 1998, page 8-31). This statement means nothing without the table in Figure 4.

According to the “*Manufacturing tolerance*” table (Figure 4), a propeller that has a “diameter less than 10 feet and 6 inches” has a manufacturing tolerance of plus or minus 3/64 inch, from the shank to the 24-inch station, than what the manufacturer’s drawing specifies (FAA, 1959, page 90). Subtracting 3/64 inch from the new-blade width specification provides the *manufacturing minimum* for a new blade. The *manufacturing minimum* is the technician’s starting point for determining how much material can be removed from the blade, as is noted on the face of the graph in Figure 5: “REDUCTIONS SHOWN ARE THE MAXIMUM ALLOWABLE BELOW THE MINIMUM DIMENSIONS REQUIRED BY THE BLADE DRAWING AND BLADE MANUFACTURING SPECIFICATION” (U.S. DOT, FAA, 1998, page 8-32 and 8-34). The technician is made aware that the graphs and information in AC 43.13-1B do not stand alone. However, AC 43.13-1B along with the new-blade manufacturing specifications and the new-blade manufacturing tolerances, gives the technician the necessary information to determine the repaired blade *minimum dimensions* when using the graphs in Figure 8-27 and Figure 8-28 of AC 43.13-1B (U.S. DOT, FAA, 1998). Considering all the available information, a propeller that was manufactured to the “widest” and/or “thickest” tolerances will have just a little more leeway for removing material from the blade without reaching the minimum “after-repair” dimensions.

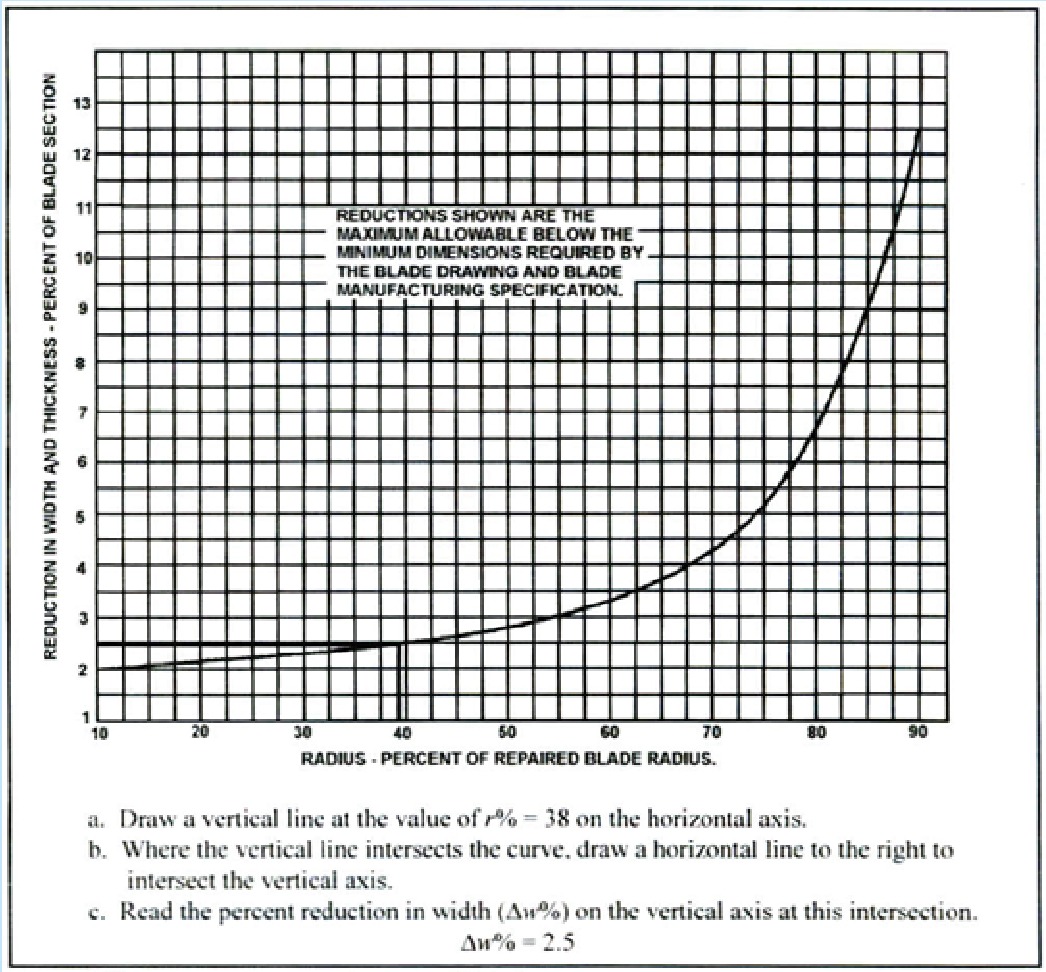

FIGURE 8-27. Example 1. Determine the repair width limits.

Figure 5: *AC 43.13-1B Graph for Repair Width Limits* **(U.S. DOT, FAA, 1998, page 8-32)**

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EXAMPLES IN AC 43.13-1B

Besides leaving out the table described above, the new AC 43.13-1B tries to simplify the process of finding the repair minimums by using examples of how to determine the repair limits. The instructions in the old AC 43.13-1 are very minimal and presume the technician knows how to use the basic graph in Figure 5, or has someone to teach the technician the procedure. The "Examples" in the -1B edition use the information from the older editions, but contain errors. When the technician or the student tries to follow the examples, it often leads to confusion and frustration.

In "Example 1," the technician is instructed to identify the location (the blade station) of the damage: "The repair location (r_1) is 24 in. *from the shank* and the original, as manufactured, blade width (*w*) at the repair location is *1.88 in*." [italics added] (U.S. DOT, FAA, 1998, page 8-32). Two points should be noted: First, describing the damage location as being 24 inches *from the shank* is an ambiguous statement. The blade station is *never* located by measuring *from* the *shank*, but is always measured from the center of the hub. This is probably a misinterpretation of the "*Manufacturing tolerance*" table (Figure 4), which has nothing to do with *locating* blade damage. The table is identifying an area for the manufacturing tolerance of blade width and thickness with the wording, "from shank *to* 24-inch station." The instructions are only acknowledging that the tolerances do not include the shank area. The error is repeated again in "Example 2" where the minimum blade thickness calculations are made. Secondly, the example of a blade width of "1.88 in." at station 24 (presumably), on a 126-inch-diameter propeller, is unrealistic and therefore adds to the confusion in understanding the instructions (U.S. DOT, FAA, 1998, page 8-32).

NEW EXAMPLE

Given the problems with the examples cited above, a new example is provided here using the Beechcraft 215 blade drawing specifications. In reality, a technician who is working on the Beechcraft 215 propeller blade (Figure 3), would not use the instructions in AC 43.13-1B because the Beechcraft propeller manual includes its own instructions, special chart, and graph for determining minimum blade width and thickness. In fact, the instructions and graph in the Beechcraft 215 propeller manual are so similar to the instructions and graphs in AC 43.13-1B that the results of using either source will be the same.

In this example, the hypothetical damage on a Beechcraft 215 blade is located on the leading edge at station 24 (r_1). The width (w) to which the blade is supposed to be manufactured at station 24 is 6.386 inches (Figure 3). The manufacturing tolerance is plus or minus 3/64 inch or 0.046875 inch (Figure 4), which is not a whole lot but could make the difference between an airworthy or unairworthy blade. So the *minimum* manufacturer's width is 6.386 inches minus 0.046875 inches, or 6.339 inches. This blade width of 6.339 inches is the calculated *manufacturer's* minimum blade width that will be used later for determining how much material can be removed from the damaged leading edge at station 24 of this Beechcraft blade.

REPAIR LIMITS GRAPH

Using "Example 1" in AC 43.13-1B, Step 1 says to calculate the blade radius. The example is simply showing the reader how to find the radius (r) of the propeller by dividing the diameter by two. The Beechcraft blade tip (Figure 3) lies at the 44-inch station, which means the propeller has a 44-inch radius (r).

In Step 2 the technician must determine the "RADIUS – PERCENT OF REPAIRED BLADE RADIUS," for use in the graph (Figure 5), which is a matter of calculating at what percent of the blade radius (r) the repair (r_1) is being made (U.S. DOT, FAA, 1998, page 8-32). For the Beechcraft blade (Figure 3), the technician then must determine at what percentage of the blade radius (r), which is 44 inches, the hypothetical damage at station 24 (r_1) lies. Dividing r_1 (24 inches) by r (44 inches) will give the percent of the radius at which the repair will be located. In this case, the result is 0.55, or 55% of the radius ($r\%$).

In Step 3 the technician must determine from the graph (Figure 5) the "REDUCTION IN WIDTH AND THICKNESS – PERCENT OF BLADE SECTION" (U.S. DOT, FAA, 1998, page 8-32). This is the percent of reduction in blade width or thickness ($\Delta w\%$) that is allowed. This is calculated by first finding the 55% repair radius ($r\%$) on the horizontal axis of the graph in Figure 8-27 of AC 43.13-1B. From the 55% mark, draw a line vertically to where it intersects the curve, then at that intersection draw a line horizontally to the left (not to the right as the instructions on the graph in AC 43.13-1B states) until the horizontal line intersects with the vertical axis on the left side of the graph. The allowable percentage of reduction in width ($\Delta w\%$) is 3%.

In Step 4 the technician must calculate the blade width repair allowable (Δw), in inches, to be removed. First, convert the 3% ($\Delta w\%$) to a number that can be used mathematically by dividing 100% into 3%, which equals 0.03. To calculate the removal of 3% ($\Delta w\%$) of the material, multiply 0.03 by the manufacturing minimum width (w), which was previously determined to be 6.339 inches. The result, which is 0.19 inch, is the amount of material that is allowed to be removed (Δw) from the original manufacturing minimum width.

In Step 5 the technician must determine the "after-repair" minimum blade width at the repair location. The amount of material allowed to be removed (Δw), which is 0.19 inch, is now subtracted from the manufacturing minimum of 6.339 inches (w). The *actual* blade width may be greater but 6.339 is the number used for calculating the *minimum* blade width at station 24. By calculating the math (6.339 – 0.19 = 6.149), the technician is able to determine that the blade width at station 24 must be a minimum of 6.149 inches, after the repair is completed, to remain airworthy.

The procedure for finding the minimum blade thickness is nearly identical. The only difference is that the technician needs to find the minimum manufacturing specifications for the thickness of the blade that correlates with the blade station of the repair to be done. AC 43.13-1B offers another graph, Figure 8-28, for determining the repair thickness limits; however the graph is identical to the graph in Figure 8-27 except for the lines for the new example that are drawn on the graph. In fact, CAM 18 and AC 43.13-1A provide only one graph to work with, Figure 15-4 and Figure 12-4 respectively, without the examples drawn on the graph.

CONCLUSION

Instructors need to be sure that future Aircraft Maintenance Technicians understand that it is not enough to be able to dress out blade damage so that all the damage is removed, and the repair has a proper radius and contour. The technician needs to be sure the strength has not been compromised by removing too much material, and to always refer to the blade manufacturers' most recent criteria, including information in the overhaul manuals, for complete repair data. If the manufacturers' data is not available, the technician needs to understand the intent of the most current AC 43.13-1.

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TO: ALL ATEC MEMBERS

On September 17, the first meeting of the 147 ARAC was held in Washington, DC. The ARAC working group's charge is to evaluate and make recommendations to improve specific sections of Part 147.

Specifically:

"The working group is tasked to recommend revisions to 14 CFR Part 147 to contain some basic, consistent requirements. The objective is to provide an easier means to keep current training curricula, training criteria, and hours of training, while remaining within the minimum requirements.

The working group will review available information about general curriculum requirements and specific operating rules for attendance and enrollment, tests, and credit for prior instruction or experience that could be applicable to meeting the requirements of Sections 147.21 and 147.31 and appendices A through D of 14 CFR Part 147.

In addition, the working group is tasked to evaluate and incorporate, as appropriate, revisions granted by exemption to Sections 65.75(a) and 65.77 of 14 CFR Part 65. The working group should consider the appropriateness of modifying Sec. 65.75(a) to allow students enrolled in Part 147 Aviation Maintenance Technician Schools to take the Aviation Mechanic written tests after completing the corresponding portion of the curriculum, but before meeting the experience requirements of Sec. 65.77.

Required completion is no later than 9 months after the first working group meeting or June 30, 2008, whichever occurs first."

ATEC has been developing a position paper and the Board of Directors is requesting your input so the ATEC position clearly reflects the consensus of the entire membership. Three ATEC Board members serve on the 147 ARAC.

Focusing on the ARAC's charge, please provide your comments to ATEC at ccdq@aol.com **by October 15** so ATEC can provide our member schools' position to the ARAC.

Thank you

ATEC 2008
Riviera Hotel & Casino
Las Vegas, Nevada
April 6-8, 2008

PRELIMINARY AGENDA

Sunday, April 6

10:00-12:00 NOON	ATEC Board Meeting
1:00-3:00 PM	**Workshop I: "Classroom Techniques for Teaching Composite Repair"**
3:00-5:00 PM	**Workshop II: "Teaching LSA Type Powerplants"**
5:30-7:00 PM	Icebreaker Reception – Exhibit Area

Monday, April 7

7:30-8:30 AM	Continental Breakfast – Exhibit Area
8:30-8:45 AM	Welcome-Laurie Johns, President, ATEC (Board Floor Nominations)
8:45-9:30 AM	**Keynote – "Boeing 787"**
9:30-10:15 AM	**To Be Determined**
10:15-10:45 AM	Break in Exhibit Area
10:45-11:30 AM	**"Is Your Grad Ready To Go To Work?"**
11:30-12:15 PM	**"State of the AMT Career and Its Effect on Student Choice"**
12:15-1:00 PM	Lunch
1:00-1:30 PM	Board candidate speeches – 3 minutes each
1:30 PM	Voting Begins (Registration Area)
1:45-3:00 PM	**Technical Paper Presentations**
3:00-3:30 PM	Break in Exhibit Area
3:30-4:15 PM	**"Cessna Skycatcher: Wave of the Future"**
4:15-5:00 PM	**"NCATT LSA Curriculum"**
6:00 PM	Awards Dinner

Tuesday, April 8

7:30-8:15 AM	Continental Breakfast – Exhibit Area
8:15-8:45 AM	**Annual Business Meeting**
8:45-9:45 AM	**FAA Update**
9:45-10:15 AM	**Open Forum – Issues and Challenges – 147 ARAC**
10:15-10:45 AM	Break in Exhibit Area (Door Prize Drawing)
10:45-11:45 AM	**"Stevenson Wydler Act: Equipment and Maintenance Resource" – Dan Tobin**
11:45 AM	**Adjourn (box lunches to go)**

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FAR-AMT, Aviation Mechanic Handbook, Dictionary of Aeronautical Terms

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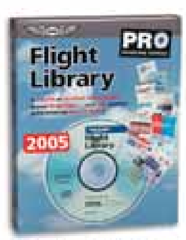

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EDUCATOR OF THE YEAR AWARD

September 2007

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 19th 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 nineteenth annual award will be presented on April 7, 2008 at our Las Vegas Conference. Forward your nomination by **December 3, 2007** 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

2008

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 6-8, 2008 in Las Vegas.

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 3, 2007** to ATEC, Awards Committee, 2090 Wexford Court, Harrisburg, PA 17112.
4. Nominations may be made for one particular outstanding achievement by a person. They may also be made for a person who has consistently contributed above average performance.
5. Nominees are not eligible if they are a current member of the Executive Board or, as regular members, they are serving on the Public Relations Committee.

CRITERIA USED FOR EVALUATION

1. Initiative/creativity: What did this person do, what new ideas or applications were used and what was the outcome?
   Total value in per cent...45%
2. Attitude/performance: What was the direct impact to the student(s)? How was the attitude and/or performance of the student effected by the event, ideas, or performance?
   Total value in per cent...25%
3. Education/training: What education and training does the nominee possess? How did this influence the event, idea, or performance?
   Total value in per cent...15%
4. Recommendation(s) and/or nomination statements from the benefit and effect of the event, idea or performance.
   Total value in per cent...15%

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STUDENT OF THE YEAR AWARD

September 2007

Dear Member:

The ATEC awards committee is pleased to solicit nominations for the 9th 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 ninth annual award will be presented on April 7, 2008 at our Las Vegas Conference. Forward your nomination by **December 3, 2007** to the ATEC Business Office, 2090 Wexford Court, Harrisburg, PA 17112.

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

Sincerely,

Laurie Johns

ATEC President

JAMES RARDON AVIATION MAINTENANCE TECHNICIAN STUDENT OF THE YEAR AWARDS

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

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

Nomination Process: Nominators must complete a Nomination Form with appropriate signatures by **December 3, 2007** 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 2008.

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 2008 James Rardon AMT Student of the Year award winner will receive transportation costs (airfare, hotel, meals, etc.) to attend the ATEC Annual Conference in Las Vegas on April 6-8, 2008. 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.

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

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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__________

Call For Papers

The Aviation Technician Education Council is seeking papers for presentation at ATEC 2008, Las Vegas, Nevada, April 6-8, 2008. 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, 2007. 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 Las Vegas, Nevada, April 7, 2008, at the Riviera Hotel & Casino.

Deadlines

December 1, 2007: Abstract Submission

January 21, 2008: Notification of Acceptance/ Rejection

February 23, 2008: Submission of Draft Full Paper/ Audio and Video requirements

March 14, 2008: Electronic Submission of Final Paper

Please direct any questions and or submissions to:

Michael D. Gehrich

Aviation Technology Center

Vincennes University

2175 Hoffman Road

Indianapolis, IN 46241

Office 317-381-6016

Fax 317-381-6060

mgehrich@vinu.edu

ATEC Update

NCATT UPDATE

After two and a half years, of their 3-year NSF grant, NCATT can proudly boast of a number of accomplishments. They submitted and received notice of funding for an NSF Continuation Grant with an increase in their funding. Their work to date has included establishing standards, curriculum, and the necessary examinations and certifications for entry level Aircraft Electronics Technician areas. As of June, NCATT had certified almost 200 AET's. They were working on finalizing the AET accreditation of 2 schools with several others in the review stages.

Their website www.ncatt.org provides current information and the means for individuals to embark on their certification process.

147 ARAC

On September 17, the FAA held the first meeting in what will be a series of meetings for the ARAC Committee to discuss FAR PART 147. Several of our Board members are on the committee and several of our Institutional Member schools have representation on the committee as well. ATEC Vice President, Ray Thompson, will serve as chairman of the 147 ARAC.

ATEC needs your input so we can present a clear position to the ARAC.

"The working group is tasked to recommend revisions to 14 CFR Part 147 to contain some basic, consistent requirements. The objective is to provide an easier means to keep current training curricula, training criteria, and hours of training, while remaining within the minimum requirements.

The working group will review available information about general curriculum requirements and specific operating rules for attendance and enrollment, tests, and credit for prior instruction or experience that could be applicable to meeting the requirements of Sec. Sec. 147.21 and 147.31 and appendices A through D of 14 CFR Part 147.

In addition, the working group is tasked to evaluate and incorporate, as appropriate, revisions granted by exemption to Sec. Sec. 65.75(a) and 65.77 of 14 CFR Part 65. The working group should consider the appropriateness of modifying Sec. 65.75(a) to allow students enrolled in Part 147 Aviation Maintenance Technician Schools to take the Aviation Mechanic written tests after completing the corresponding portion of the curriculum, but before meeting the experience requirements of Sec. 65.77.

Required completion is no later than 9 months after the first working group meeting or June 30, 2008, whichever occurs first."

ATEC has been developing a position paper and the Board of Directors is requesting your input so the ATEC position clearly reflects the consensus of the entire membership. Three ATEC Board members serve on the 147 ARAC.

Focusing on the ARAC's charge, please provide your comments to ATEC at ccdq@aol.com **by October 15** so ATEC can provide our member schools' position to the ARAC.

AWARDS

The Ivan D. Livi Outstanding AMT Educator Award and Jim Rardon Student of the Year Award applications are included in this mailing. They will also be placed on the Website and included in the on-line ATEC Journal.

The two awards will be presented to the winners at the Riviera Hotel in Las Vegas on April 7 during a special awards dinner.

Award application returns must be received by the December 3 deadline.

CALL FOR PRESENTATIONS

The request for technical AMT presentations to be presented at the ATEC conference on April 7 in Las Vegas is included in this mailing. It has also been placed on the ATEC Website www.atec-amt.org.

ATEC MEMBERSHIP

September 2006		September 2007	
Institutional	90	Institutional	90
Individual	0	Individual	8
Industry	11	Industry	10
Life	12	Life	10
TOTAL	113	TOTAL	118

ATEC DIRECTORY

Please check your enclosed directory listing and return it to the ATEC Office with any changes by **December 3**.

ATEC CONFERENCE – MARK YOUR CALENDAR

DATES: April 6-8, 2008
PLACE: Riviera Hotel, Las Vegas
PRELIMINARY AGENDA: Enclosed

Please note two format changes:

- On Monday, April 7, ATEC will provide an Awards Dinner for the first time in many years.
- Then on Tuesday, April 8, at 11:45 AM we will offer box lunches to go for those people who need to catch flights back to the East Coast.

FAA MEETS WITH ATEC

Ferrin Moore of the FAA met with the ATEC Board on September 15 in Washington, DC. He made the following comments:

- Regarding light sport aircraft, are any schools developing or offering courses on LSAs? The FAA is getting inquiries and the FAA wants to support new curriculum. Contact Ferrin at ferrinmoore@faa.gov.
- A large UAV division is being created. Unmanned cargo plan certifications are being developed. The FAA might have to develop a new certificate so A&Ps can work on these new pilotless aircraft.
- In the new 147 ARAC, the FAA wants to revamp the A&P curriculum as the main purpose of the ARAC. They will be looking at Sections B, C and D.
- Schools having problems with standardization of PMI Interpretations should utilize the Customer Service Initiative (CSI) on the FAA website to address inconsistencies.

NEW INSTRUCTOR TRAINING PROGRAMS

Two new instructor training scholarships have been added to the growing list of benefits available to ATEC member school instructors. Go to the front page of www.atec-amt.org.

FlightSafety International (FSI) is donating, as a scholarship, a seat once per year for an instructor to attend one of the FSI's King Air Maintenance Courses. The course is of a two-week duration and is conducted at the FSI facilities in Wichita, KS. The course is valued at $7200.00 and will be administered as a scholarship by the Northrop Rice Foundation.

Southwest Airlines is donating, as a scholarship, a seat once per year for an instructor of an ATEC member school to attend a two-week Boeing 300/500 or 700 Systems course, or a one-week Boeing Avionics course.

ATEC WEBSITE

Although the website was down for 16 days in late August-early September because of server problems, the site is up again and fully functional.

Check out the site for:

- Conference Information
- ARAC Updates
- How to Reach Board Members
- AMT Promotional Video "Nowhere to Go But Up"
- Scholarships
- Awards and Call for Presentation/Papers
- The latest Updates and the ATEC Journal

Industry News

New Powered Parachute FAA Handbook Available from ASA

Newcastle, WA— ASA expands its library of FAA titles with the new Powered Parachute Flying Handbook.

A powered parachute (PPC) is a category of aircraft that requires the pilot to inflate the wing (parachute) and then control the aircraft with a "pendulum configuration" of the cart hanging below it. This unique and fun aircraft is an evolution of a number of ultralight aircraft, including the parachute, paraglider, and powered paraglider. The FAA's Powered Parachute Flying Handbook (FAA-H-8083-29) introduces the basic pilot skills and knowledge essential for piloting powered parachutes. It benefits student pilots just beginning their PPC endeavors, as well as those pilots wishing to improve their flying proficiency and aeronautical knowledge, and flight instructors engaged in the instruction of both students and licensed pilots by providing information and guidance in the performance of procedures and maneuvers required for pilot certification.

The handbook begins with an introduction to powered parachutes, including a history of this unique aircraft. Chapters cover the aerodynamics of powered parachutes, components and systems, the powerplants (engines) used on these aircraft, preflight and ground operations, basic flight maneuvers, takeoffs and departure climbs, airspace, ground reference maneuvers, airport operations, approaches and landings, and night, abnormal, and emergency procedures. This book is the official FAA source for learning to fly powered parachutes and many test questions for the FAA Knowledge Exams for pilots come from this reference. Illustrated throughout with full-color graphics and photography, and includes an index. Soft cover, 160 pages.

Title	Product Number	Suggested List Price
Powered Parachute Flying Handbook..........................	ASA-8083-29	$29.95
ISBN 978-1-56027-671-5		

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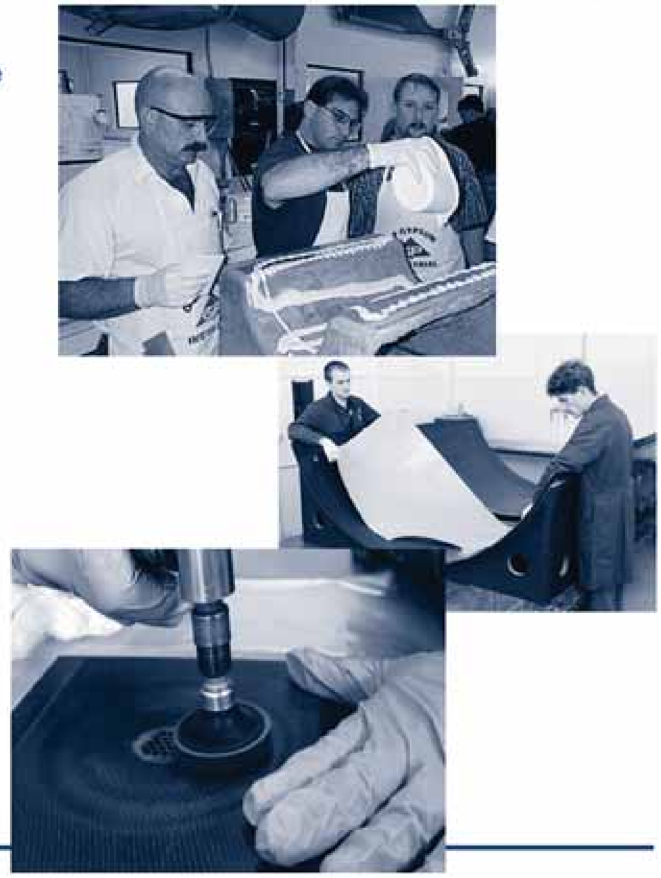

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