Hearing Loss: There is a Threshold

Aviation technicians don't always realize there is a hearing injury threshold on the job. Whether in the hangar or on the line, one observes mechanics and technicians ignoring this hearing problem. They are exposing their unprotected ears to powerplant, machinery and various tool noise that exceeds that injury threshold. It is not only the high pitch of aircraft powerplants, but, also of grinding wheels, air power tools, some types of air pressure cleaning machines and seemingly harmless hand tools.

It is a fact that the human ear has noise-destruction limits. (Reference: National Academy of Sciences and the U.S. Public Health Service)

Since nobody deliberately desires to destroy their hearing mechanisms, common practice suggests that any noise environment that interferes with telephone conversation (approximately 90 decibels) is detrimental to the delicate sensory mechanisms in the human ear. This environment includes the cockpits of most general aviation aircraft. In the shop, activities such as hammering on sheet metals, riveting, wood sawing and metal grinding all produce noise levels in excess of injury thresholds. The impulse noise resulting from the use of blind rivets (as in firearms) is also injurious to hearing. Don't overlook the fact that duties at home also contribute to hearing loss. These duties include the use of a chain saw and lawn mower.

To sum it up:

A tool to add to your tool box, without delay, is a decent set of ear plugs or ear cups.

Liability Insurance: An American Crisis

Does an aircraft mechanic need liability insurance? Consider that the cost of having a baby might double in the next year, that Fourth of July parades and youth league sports may become things of the past, and that day-care centers across the country may be forced to close. What have these far-fetched examples to do with the aviation mechanic? Do you know that you, the aviation technician, may be sued for work performed? Do you know of the rising cost and declining availability of so-called "liability insurance?

"SUE-EM" is the word today. All too often, disputes over responsibility for alleged wrongdoing ("liability") end up in court. Juries seem to think that damage awards are paid by insurance companies with plenty of money and, consequently, enormous awards are becoming common.

In fact, that cost is simply passed along to insurance policy holders — compa-

nies, cities, towns, businessmen, physicians, civic groups, and everyday citizens. This means that consumers and taxpayers end up paying the bill.

Insurance premiums are going up fast. Many people and companies are having difficulty getting insurance at all. As a result, the cost of doing business and providing services is rising, and many professionals, including doctors are avoiding relatively high-risk types of work. That is why having a baby is going to be much more expensive and why many doctors are getting out of the obstetrical practice altogether.

The cost of DPT vaccine needed to protect infants from deadly diseases has tripled in the past year because of higher insurance premiums. The insurance expense for many day-care centers has increased by over 100% in two years and many centers are being forced to close. Even civil groups, such as Scout troops, parade committees, and community recreation associations, are finding themselves unable to afford insurance and are forced to cancel worthwhile activities.

These examples are offered to show that other industries and activities share the same concerns as the aviation industry. The rapid decline in general aviation manufacturers activities is a graphic illustration of the result of the liability crisis in our aviation industry.

No one is suggesting that a person injured by the negligence of another shouldn't have the right to sue and be fairly compensated. But the situation has clearly gotten out of hand. Ask any airplane manufacturer about this, and he can readily tell you the current story.

Each of these United States is involved in bringing about a responsible change to the tort (civil liability) laws. These initiatives would continue to protect people while limiting excessive awards and, with that, passed-on costs to consumers. That means all of us. Note the price of an aircraft or aircraft part today, and you will clearly realize just what liability has done to our industry. Take a close look at your function and responsibility within this industry. Do you need liability insurance?

NOTE: References to actual aviation maintenance liability cases are given in the book AVIATION MAINTENANCE LAW by Fred Biehler, published by the Aviation Maintenance Foundation. Also "Airworthiness-An Insurers View" by D. L. Dann, in a Newsletter from the International Federation of Airworthiness, Jan/Feb 1982, Vol. 8, No. 1.

Delaying Brake Changes is False Economy

A B-727 main landing gear brake unit received in a shop illustrated the penalty paid for permitting brake wear to

exceed the recommended limits.

The brake pads were worn down to the metal backing plates. The backing plates in turn, were worn down to the point where the fastener heads were ground away, thus allowing the backing plates to let go. The backing plates, having no retention, merely floated around, causing severe damage to the torque tube retaining bars and wheel heat shield.

The degree of wear on some brake units received in this shop for overhaul, showed a growing tendency to delay brake changes. In this particular instance, the wear indicator pin was showing well beyond the established limits. A fair average number of landings between brake changes is 600. This brake in question had completed 670 landings.

The criteria for assessing whether a brake unit should be changed or not, is not the number of landings (which is unknown to the line maintenance person) but the degree of wear as indicated by the indicator pin with brakes "ON" in accordance with the maintenance manual (B-727 MIM, Chapter 32 Landing Gear Instruction Main Landing Gear and Nose Landing Gear Brake Wear Limits). The instructions permit flexibility of operation and minimize delays by offering two wear indication standards. The first to be applied at in-transit checks, and the second for terminating flights or higher checks.

To make this system work it is essential that if brake wear as indicated by at least one indicator pin approaches or is near flush at in-transit checks, then the main base should be notified in order to call for a brake change. Adherence to this procedure would tend to solve the brake change delay problem. Additionally, the cost to repair or overhaul a delayed brake change is materially increased due to damaged components, so it pays to change the brakes on time.

Although the procedure above has worked well with other operators, it is recommended that the reader follow the instructions issued by his employer.

A-300 Cargo Door Actuator

An operator had an incident in which a C-1(A-300) cargo compartment door fell, causing damage to the actuator support fitting in the fuselage. The fall was caused by the operator neglecting to bleed the door actuator after fluid loss during maintenance on the hydraulic system.

In this case, a line in the nose wheel well had broken. The A-300 Maintenance Information Manual is very specific as it cautions to make certain that the cargo door actuators are filled with hydraulic fluid whenever cargo compartment doors are open and a line disconnection or component replacement occurs in that particular hydraulic sys-

tem (the yellow system, in this case). If the lines are not filled, bleed the actuator and pressure lines prior to closing the door. This applies to the rear cargo door system as well as to the cargo compartment door system.

DC-9 Stiff Thrust Reverser Controls

Recent cases of stiff DC-9 thrust reverser controls have been due to the push/pull controls having been greased. After a surprisingly short period, the grease hardens with the inevitable result. The DC-9 Manual is very specific regarding thrust reverser controls. They should be removed, washed in solvent and replaced on condition. That means no grease.

What is a Cockpit?

In a recent discussion of cockpit details between airline personnel and Boeing designers, a question was raised as to the origin of the word "cockpit". No one could come up with an immediate answer, but subsequent research produced the following:

The term originated in the ancient sport of cockfighting. In this, two fighting cocks are placed in a depression, or "cockpit", in the center of a small arena. The floor of the pit is usually below the floor level of the arena and a low fence surrounds the pit and projects a foot or so above the floor of the arena.

Because of a general physical similarity, the sporting term was applied to small boats in which the crew and passengers sit in a sunken area below deck level and are protected from water flowing on the deck by a low fence-like barrier, or coaming.

When airplanes came on the scene early in this century and evolved to the point of having what we now call fuselages, the well-established nautical term "cockpit" was applied to openings in the top of the fuselage where the pilot, passengers, or other crew members sat.

As the airplane evolved into the modern closed-cabin configuration, the aeronautical sense of the word "cockpit" took on a different meaning and is now used to identify the pilot's station regardless of form or location.

From *Boeing Airliner*

Tri-Wing Fasteners – An Evolution

And very unpopular with aviation maintenance personnel. Tri-Wing fasteners are used in a number of areas on the A-300 including engine cowls. Here is some background information on this piece of hardware.

This fastener was initially proposed by Boeing to end the airline's search for an improved design. This fastener was touted by all of the commercial aircraft manufacturers, and of course, its de-

signers. At the time, Boeing was deep into the production of its 707, 727, and 747 aircraft, and did not want to make a fastener changeover from Phillips to Tri-Wing. Lockheed and McDonnell Douglas, on the other hand, with their L-1011 and DC-10 aircraft waiting in the wings, were amenable to introducing whatever fastener the customer desired. Potential users, and this included all the major domestic air carriers, studied the industry pitch, tried Tri-Wings on limited evaluations, and leaned favorably toward acceptance. After all, their mechanics had been howling for years about the villainous Phillips (or any other flush-head designs that happened to be around), and were anxious to provide good fasteners acceptable to line, hangar and shop mechanics.

Before final acceptance, training and engineering people passed out Tri-Wings to mechanics for their critical evaluation. The response at that time was universally affirmative. So after considerable study, the Airline Fastener Committee approved use of Tri-Wings in aircraft ordered from Lockheed and McDonnell Douglas. Subsequently, Tri-Wings lwere written into the respective air carriers' specs.

Then came the realities of aircraft maintenance which have pretty well dictated just what you, the aircraft mechanic, think of that fastener.

While there never has been a flush-head design without fault, there may be some consolation in one change: 10-32 screws, the most commonly used, were too shallow. They are being superseded by one with more depth. This change was inspired by an extensive service evaluation by Delta Airline's maintenance personnel. (They seem happy with the change.)

The new recess is listed as a 4J (Deep Four) and the No. 4 driver will work in either No. 4 or 4J recesses.

Unreported Minor Damage Can Cause Big Trouble

During a period, 29 ground accidents resulting in aircraft damage were reported by an air carrier. In two of these instances, local investigations failed to reveal how, when, or where the accident happened, because the damage was not reported to local supervisors for further reporting when it occurred. These unreported incidents can seriously affect the safety of the crews, passengers, and aircraft.

For example, a minor skin scrape during ground operations on the ramp presents no hazard and is easily repaired. But when the aircraft is pressurized at altitude, that weakened skin section can give way, producing an explosive decompression. Likewise, seemingly negligible damage to powerplants or tires assumes major importance under the stress of normal aircraft operations.

Because of this hidden danger associated with minor damage, maintenance personnel need to know that there is an absolute necessity for the immediate reporting of all damage to aircraft, no matter how slight it may appear.

This admonition should be directed to all personnel who have anything to do with aircraft, regardless of their responsibility or job.

A Soldering Iron Safe For Sensitive Components

When a new tool comes along that fills a gap, we let our readers know. In this case, a soldering iron has arrived on the scene that is safe for use on sensitive components.

The Amtex model XTC is a temperature controlled 50 watt soldering iron designed for use on heat and voltage sensitive components requiring precise soldering temperatures. In this age of electronics with heat-sensitive integral parts, this new tool can be of much value to the technician. It is not only for the electronics technician, but also for the aviation mechanic faced with the maintenance of non-electronic components and accessories that contain heat-sensitive parts.

The 50 Watt AMTEX XTC soldering iron features a thermocouple in the tip combined with a sliding potentiometer in the station for precise temperature control with positive feedback. This alone makes the unit totally responsive to temperature limits set by the manufacturer of the unit under repair. We are often faced with the caution; "if you don't have a soldering iron that can be limited to __ watts, don't attempt that repair." With this tool, we can break down that barrier and complete the job.

The iron's tip is positively grounded and zero crossing electronic switching in the station eliminates RF interference and magnetic fields. The unit provides temperature control from 140 degrees to 815 degrees with an accuracy of $\pm$ 2 percent. The unit heats up in 45 seconds and has quick recovery times because the heating element is directly under the tip.

Three sizes of slide-on iron plated tips are offered: 3/32, 1/8, and 3/16 inches. The iron has a 4 foot burn-resistant silicone cord with a convenient stand built-in.

Hands and Feet

Hands are wonderful things. Most of us have two. When issued, they usually come with five digits — four fingers and a thumb attached to the knuckles, to a palm and the back of each hand.

With fingers, we can display rings and wedding bands. We can point to things like aircraft, nice cars and beautiful sunsets. Hands keep our wrist

watches from falling off our arms.

Without hands and fingers we can't grasp, turn a wrench or screw driver, pick up potential Foreign Object Damage (FOD), or eat our soup without a straw. We can't pet a dog or cat, and we can't pinch a baby's cheek (the babies probably appreciate that).

The above was brought on by a recent happening in the hangar when the mechanic got his hand caught in a closing nose wheel door during a test. He suffered cuts, abrasions, and broken bones. It was the result of too many things going on at the same time or the tempo of operations. Too many people were doing things without everyone being aware of what the others were doing.

There is no resupply or a second issue on hands. They are a one-time acquisition meant to last a lifetime or the life of the product. Take good care of them. Remove the rings and watches before you work on machinery. Shut the engine down on the tug before you attempt to work on the radiator, and for your sake, make certain that the retracting door is not moving before you put your hands in that area.

And now for the feet. Do you like dancing? Square, ballroom, and rock & roll dancing all require using a pair of lower extremities called feet. Recently, we had heard of two separate incidents where ramp personnel experienced the pain of having an aircraft tire pass over these lower extremities. One person was where he was supposed to be but a bit too close, and the other was in the process of removing the wheel chocks.

The only requirement for you to become the next wallflower at the dance is just one moment's inattention.

Sloppy Maintenance Causes FOD

When you check or inspect an aircraft, do you worry about the possibility of Foreign Object Damage (FOD) when you notice something missing such as a cotter key, nut, washer, screw, safety wire, quick release fastener, clamp, or even a tire valve cap? You should. Missing items indicate a "missing" maintenance practice. Every piece of hardware on an aircraft was installed for a specific purpose. If an item is missing, it cannot perform the intended function.

Most maintenance personnel do get concerned if they notice a cotter key, nut or piece of safety wire missing, but on several observations, there has been little concern about the tire valve caps being missing. These small caps are installed on aircraft tires and fill valves as a safety device, serving two distinct functions. One function is to keep out moisture, oil and dirt that can contaminate systems or damage valve cores. The other function is to act as a secondary seal, retaining internal pressure if the valve should fail, a good way to

prevent landing on a flat tire.

It was mentioned that these caps have been removed to prevent FOD potential. It should be noted that preventing FOD is of course, essential in any way possible but the cap is also essential for its intended purposes. Following the reasoning not to replace the cap as it is possible FOD could be adapted to not replacing other essential hardware for similar reasoning.

The tire valve cap or any other missing part should be replaced if missing regardless of your fervent efforts to prevent FOD, but if it is missing, take a careful look around the area for that missing part, or any other part or object that could become FOD.

Wrap-Up That Hydraulic Leak

That elusive and messy hydraulic leak has got to be somewhere. We have all seen that situation where it only leaks when the aircraft is flying. That tells us that the leak is in a line that is under pressure in flight, and therefore doesn't leak on the ground. Rather than having to inspect all of that hidden tubing in so many places on the aircraft, and with the leak running along the line and then finally dripping on a low spot and generally not the leak area, there is an easier method of leak detection, and it does not mean tightening every hydraulic fitting and connection in the system. It has been called the Ragleak Detection System or RDS, for short.

The procedure is to obtain sufficient clean, lint-free shop rags to securely wrap and tie each hydraulic fitting in the general area of the leak. Then ensure that the wraps (or ties) will not interfere with any moving part. In places such as wheel wells and speed brakes, you must have a clear picture of the position of all the components when they are retracted.

Now, with the use of a hydraulic "jenny" to cycle the system, there should be only one wrap wet with hydraulic fluid.

Congratulations — you have found the leak!

Battery Safety

Recent incidents involving batteries shows that a review of battery safety is in order.

Battery safety must be second nature to all aircraft and support equipment operators, and specifically to maintenance personnel who handle batteries as a matter of course.

The major battery hazards to be aware of are weight, caustic electrolyte, explosive gases and electrical shock. Most batteries are very heavy relative to their small volume. Be aware of proper lifting and handling techniques since personal injury or damage to the battery can result due to improper han-

dling. The electrolyte used in lead-acid type batteries is sulfuric acid, which can furiously burn the clothing and delve into the skin. The electrolyte used in Nickel Cadmium (NI-CAD) batteries is potassium hydroxide, which is only slightly less dangerous than sulfuric acid. If electrolyte is splashed on the skin, immediate flushing with large quantities of water and an appropriate neutralizing solution is the proper first aid measure. If electrolyte is splashed on the eyes, or on your eyeglasses or that vicinity, flushing with large quantities of water is the first aid measure. A clean fresh water hose without nozzle may be used, also. A good water bath is advised.

As part of its normal operation, a battery produces highly flammable hydrogen and oxygen gases. These gases are produced more rapidly when a battery is in a state of overcharge or thermal runaway. Batteries must never be exposed to fire or flame and must be well ventilated. It is not wise to use a CO_2 fire extinguisher on a hot battery unless flames are present since static electricity generated by the discharge of the extinguisher could explode the hydrogen and oxygen gases. To prevent short circuits and sparks from exploding the gases, any tools must be used with extreme caution.

When a battery is to be removed from an aircraft or a piece of support equipment, the contacts or terminals should be covered by insulation material (insulating plugs if available). Even if the contacts (terminals) are covered, the battery should not be carried with the contacts next to the body. Batteries can short across your belt buckle, or as in one recent case, across a belt to a pocket key retainer chain.

Sealed lead-acid batteries are designed to be maintenance-free. Keep in mind that although these are sealed units, they are still lead-acid type batteries and that all safety precautions applicable to lead-acid batteries prevail.

Seeing Is Believing

Although the title of this article is tempting, it was purposely placed to lure you to read on. To be specific, there are too many times where the aviation mechanic works in an area inside the aircraft that is insufficiently illuminated to do a good job and be a safe working area at the same time. Even if you are working inside the hangar, and have an electrical line cord available, the usual portable work light offers more glare than usefulness. Then too, there is the ever present flashlight with its run-down batteries or with prolonged use, a weaker light value as the work proceeds. I have seen large portable flood-type lights that could accommodate a complete room but only offers that ever-present glare. Offsetting that light to eliminate the glare generally eliminates adequate work light. We are especially vulnerable to working in restricted areas in the aircraft and at the same time, working on small units. Then

too, if you are equipped with eyeglasses, that presents another barrier to full and unrestricted sight since an eyeglass wearer has to adjust his viewing angle to eliminate glass-glare or to move his head to focus in the case of bifocals.

Recently, a mechanic stated that he had the problem solved since he had purchased a five-cell, aircraft aluminum cased flashlight, that really illuminated the work area. Observing his actual use of that unit, I noted that due to the size of the flashlight, he could only utilize it in the largest of work areas (of which there were few) and then its focus and beam spread possibilities were limited. Another showed me his rechargeable NICAD pocket flashlight that resulted in pocket size illumination. It was not even useful for behind the instrument panel work. Another mechanic showed me his solution. It was a 6V battery-powered lantern type that had a beam spread wide enough to illuminate large work areas, but it failed to adequately illuminate the actual spot in question and he reverted to a portable common garage work light hooked onto an available overhead electrical bundle that constantly moved away from his actual work operation in a swinging motion as he worked.

I was still seeking the solution to the problem when, all of a sudden, here it (apparently) was, in the hangar ready for use by the maintenance personnel. It was a home made reflector about 18" long and wide enough to accommodate three in-line fluorescent tubes. That meant bright white light, cool light and constant light that would spread evenly over the entire work area. It was proudly placed in the belly work area for this particular job, and the switch turned on. It did indeed, illuminate that entire area but when the mechanic crawled inside with his tool tray, he found that the light did not penetrate the small inner area that he needed to do the job and replace that fitting. He promptly turned on his pocket flashlight for added internal illumination, only to find that the big light tended to wash-out his small flashlight, and seemed to diminish its powerful beam. He promptly turned off the big light and accomplished the job as we generally do, with insufficient light. That could mean that the total job had questionable results.

Still seeking an answer, I had the opportunity to finally observe a solution. It was a high-intensity work light that featured twin tube design. This appeared to be a new, portable fluorescent light that was designed to take advantage of the latest compact “twin tube” high intensity lamps that were a recent development on the lighting market. DAY-RAY Products of Pasadena, Calif. has made a solid attempt to solve this dark area work problem and could result in a better job done in restricted areas. Small in size, compact, with a hanger on top or hand held, it produces an even strong

white but cool light. Encased in a rugged, vapor- and moisture-resistant, molded fixture with a built-in handle, this new light features a shorter configuration for a greater concentration of light. It has a starter integral to the base with a fully encapsulated ballast to avoid a flash when started. This assures that the start will not fire in a gaseous area. The unit has as standard equipment, a sufficiently long (25ft.) power cord. During operation the DAY-RAY light proved to be glare-free, and sustained cool operation over an extended period of time. During an inspection operation, it illuminated all required areas, including deep crevices and recesses both inside and outside the aircraft. Behind the instrument panel, it proved its versatility by lighting the entire area, spreading its light around the back sides of the wire bundles, onto the bundle clips, and well into the instrument connections. I noted that fluorescent type light with high intensity as this is, tends to bend its light by projection which common incandescent light does not do. In the wheel well proper, there appeared to be no areas that were blacked out. A final try was made inside the tail cone of a general aviation light aircraft in which this light clearly illuminated all areas that required inspection. With the light's hands on or hang versatility, I can think of very few areas on any size aircraft that will not be adequately illuminated by this light, which by all appearances, was designed with the mechanic in mind. Later on, I noticed it hanging from the open hood of an aircraft tug undergoing a carburetor repair. Although it was hanging far overhead, it clearly illuminated that carburetor mount enabling the mechanic to bolt on the, replacement unit with little effort and no squint.

The only flaw noticed was that there weren't enough lamps to go around. With only one such light in the tool room, and mechanics had to wait their turn for its use. At least a half dozen should have been in stock to "keep the wheels turning" and the cash register filling.

Continental Engine Model IO-520-D: Counterweights.

There were persistent problems with alternator belt breakage. The belt life varied from a few minutes to a maximum of 60 hours. The crankshaft counterweights were removed and extreme wear was found on the fourth and fifth order counterweights. All counterweight bushings and the sixth order pins were replaced.

The submitter advised that engine operation appears much smoother and the belt breakage problem was eliminated. Engine time 540 hours.

Note: This article was published in Alerts No. 77 dated December 1984. The following was recently received.

The Cessna 182N aircraft had a history of displaced alternator drive belts. It

occurred three times in 1.5 hours. The submitter said that the engine would set up a frequency vibration in the alternator drive belt causing it to come off the drive. The problem was found to be counterweight pins and bushings, on the crankshaft. After replacing the pins and bushings, the engine ran smooth and the belt problem stopped. The engine had 743 hours total time.♦