EAA MILE HIGH CHAPTER

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VOLUME 9, ISSUE 7, JULY, 1986

THIS MONTH: This month's meeting will be held on Saturday, July 12, 1986 at the Rocky Mountain Energy Center at 7:30 P.M. The program will be a presentation on cloud formations by Lou Feierabend. He lives in the mountains above Boulder, and has been taking time-lapse photographs of clouds for a number of years. He has made them into a movie, which dramatically shows how clouds constantly change, and how much power they contain. Some of you have seen this presentation before, but it is quite good and is always worth seeing.

LAST MONTH: With 62 members and guests in attendance, the meeting of June 14, 1986 was called to order at 7:55 P.M. by President Kirby White at the Rocky Mountain Energy Center. The minutes of the May meeting were approved as published in the Newsletter.

Guests: There was one guest at the meeting -- Hal Gier of Boulder. He is the designer of the "Go-Four" airplane that has recently been advertised in some of the aviation publications. Hal talked about it briefly, and offered an information brochure to anyone interested. He has built a Fly Baby in the past.

Treasurer's Report: There was none given.

Old Business: Kirby mentioned that he had seen a number of Chapter 43 members at the Page Aircraft Salvage. A few of them spoke up and talked about the items that they had gotten.

New Business: Member Tony Bernicchi talked about a trip he took to Wichita, Kansas recently. He went there for the Cessna maintenance school primarily, but did some looking around during his time off. He and a friend came across Dave Blanton's Javelin Aircraft Company. Dave took them for a ride in the Ford V-6 powered Cessna 175. Tony said that the performance was quite good. He also happened to look out his motel window at just the right time one day and saw the Beech Starship take off. He was very surprised that, considering Wichita's deep history in aviation, there were no aviation museums in the city. Kirby said that he had heard Tri-County Airport was getting some major work done to it. Ron Denight and Brad Davenport reported that the runway and taxiways were in the process of being repaved. Roy Maneely brought in some copies of two different magazines for the members to take. One was "FlyPast," which is published in England. The other was "Aeronews," which is South Africa's equivalent to our "Sport Aviation" and was sent to Roy by member Darrell Miller. Bill Landers talked about a Fly-In that Chapter 800 on the western slope was scheduling for June 20-22, 1986 at the Crawford Airport. He had an information sheet for us to look at.

New Business cont: Guy Clark brought in a box of phenolic pieces that he wanted everyone to help themselves to. Bill Amos said that he was arranging to rent a motorhome and keep it in the Oshkosh camping area for about a week during the Fly-In. He invited anyone that was in need of a place to stay to talk to him about helping out with the rent. Bill said the rates were pretty reasonable. Bud Aumann recently was at the Boeing plant and described the apparatus that he saw that is used to test the wings for strength. It sounded very impressive. He also happened to meet Chuck Yeager there, and was able to talk to him for a little while. Bud asked him if he would consider test flying his RV-4 when it was completed. Bud didn't get a very positive response. Bill and Marilyn Schneider told us that Chapter 660 was planning a Fly-In Picnic at the Longmont Airport on Saturday, July 12, 1986 from 10:00 A.M. until 2:00 P.M. They said that it would be a pot luck, and Chapter 301's weight and balance scales would be there, also. Ken Williams reported on the Chapter 515 Breakfast that he had gone to on June 8, 1986 at the Loveland -- Fort Collins Airport. He had a good time and really enjoyed the Aeronca L-3 ride that Roy Maneely gave him.

Gene's Corner: Gene Horsman read a report on the court battle that is going on concerning the FAA's release of a report which analyzes in-flight airframe failures of V-tail Bonanzas. It has yet to be released to the public. Gene read an article that tried to explain why avgas prices have not come down to any great extent while the price of autogas at local filling stations has been plummeting. Many people have been wondering why aviation can't share in the benefits of lower crude oil prices. New general aviation aircraft shipments declined to make the first three months of 1986 the worst first quarter U.S. general aviation manufacturers have experienced since World War II. Large corporate aircraft appear to be the least in trouble.

Progress Reports: Roy Maneely excitedly told us that he had made a first flight in his 1959 Bellanca 260. He flew it on a ferry permit from Platte Valley to Jeffco, where he has a hangar. The take-off was an eventful one, as the left main gear was slightly out of alignment, and the airplane pulled to the left. Roy got it off safely, though, and has since corrected the problem. All of the Chapter 43 members gave Roy a well deserved round of applause for his accomplishment. Guy Sheeon reported that work was progressing on his 1947 Piper Super Cruiser. He and Cathy are finishing up a few things, and it should have its first flight very shortly. Earl Ellis keeps after the little things that need to be done, and will also have a first flight this summer in his Vari-Eze. Gaylon Overton is now working on the wings of his Mustang II.

A&P: The business portion of the meeting adjourned for coffee at 8:35 P.M. After the break, Ron Denight showed a couple of films. The first was of quite a number of WWII fighters and bombers in flight. The second was footage of his father's Midget Racer #97 both in flight and on the ground. The flying scenes included a few take-offs and landings. Ron also showed some slides of #97 and his own Denight Special. Then Bill Amos showed the videotape that Rotorway Helicopters has produced to advertise their Exec model. Many thanks to both Ron and Bill for the program.

ROSTER UPDATE: Please add the following new members to your Roster:
Tom Gregory, 9032 Dudley St., Westminster, CO 80020, H. 425-0939 W. 425-0877
Garry Kubat, 1004 Adams Ave., Louisville, CO 80027, H. 666-9515 W. 620-2280, 1946 Piper J-3 Cub
Mike Ladigo, 2750 W. 86th Ave. #168, Westminster, CO 80030, H. 428-3433 W. 426-5637

GLOSSARY: From "I'd Rather Be Flying" by Donna Vasco
S-Turns: a maneuver designed to maintain the legal 6 foot distance from clouds.
Say Again: a term used by deaf pilots when conversing with spastic controllers.
Separation: that condition achieved when two or more aircraft fail to collide.
Short Field Landing: any landing that terminates short of the last taxiway.
Slip: small piece of paper stating amount and price of fuel purchased.
Soft Field Landing: any landing that does not drive the wheels up through the wings.
Solo: what pilot sings when flying alone.
Stability: mental condition, rare among pilots.
Staggerwing: bi-wing competitor to the Pied Piper.
Stall: explaining to the finance company why you cannot make your airplane payment on time.
Supercharger: pilot with eight credit cards.

OPEN HOUSE: Colorado Aero Tech is planning to have their annual Open House on Sunday, August 3, 1986. They would like to have a few airplanes on display, and contacted me about it. If any of you would be interested in showing your planes, please get in touch with me. Either antiques or classics or homebuilts are needed. The actual time of the Open House is 1:00 P.M. to 4:00 P.M., but they would like to have the display airplanes in place by about 11:00 A.M. They will pay $50.00 for every plane that comes in, even if is based at Jeffco. Also, the Cheyenne extension is going to have their Open House on August 24, 1986, which is also a Sunday. They need display airplanes too, and are offering the same $50.00 expense offsetting figure.

FROM THE PRESIDENT: I have been fortunate (?) enough to have had some time off work recently, and took advantage of it to get around to see a few of the Chapter members and their projects. For the most part, Vice President Fred Seal came along; in fact he was instrumental in finding several of the places, especially at Van Aire. In alphabetical order (more or less), we saw the multitude of projects that Troy Anderson is working on, both aviation related and otherwise. Ron Benell is fitting doors to his new hangar at Van Aire, with the help of Jim Douglass. The hangar is big and beautiful. Bob Green is working on his Super Cuby, and has quite an interest in RC airplanes, which I didn't know before. Roy Maneely was at his hangar at Jeffco doing some finishing work on his 1959 Bellanca 260, which is looking really good. Then Dean Smith rode up and a little later we all went over to see Ron Denight's Special that he is doing some major modifications to. It is progressing nicely. Dean Cochran was at the airport the next time Fred and I went to see Roy, and let us look over his Thorp T-18 and the Piper Pacer that hangars with him. Guy and Cathy Sheeon were working on their 1947 Piper Super Cruiser at

FROM THE PRESIDENT cont: the Longmont Airport when we showed up. It should be flying soon, and I was fortunate enough to get a little taxi time in it. Jim Thompson and I went for a short ride in the Aurora Airport area in his 1950 Cessna 170-A, which was very enjoyable. I hope I haven't left anyone out, and I very much appreciate the hospitality afforded to myself and Fred, even though we pretty much just dropped by without any warning.

I also took in a movie that was recommended: "Top Gun." It was entertaining and enjoyable, yet retaining a sense of realism that is missing in so many aviation films. I would recommend it to any of the Chapter members looking for something to go see, and kids can be taken without too much worry, too.

FROM THE EDITOR: What a coincidence! I, too, have recently seen "Top Gun." I suggest that you take it in again, though, because there are a couple of things that seem to have been overlooked by you the first time you saw it. In the first place, the Soviet fighter is not a MiG-28, but a U.S. F-5. To my knowledge, and I could be wrong, there is no such thing as a MiG-28. Also, the close encounters during the dogfights were a little too close, although it made for spectacular effects on the screen. Realistically, I think they would fire heat seeking missiles as they have a range of about two miles. But all in all, I agree that it was quite good, and well worth the money and time.

AVIATION HAPPENINGS: July 12, 1986 EAA Chapter 660 Picnic Fly-In. See poster on the back cover of this Newsletter.
July 13, 1986 EAA Chapter 720 Fly-In Breakfast at Weld County Airport. Pancakes and sausage served from 7:30 A.M. to 11:30 A.M. Price is $3.00 per person.
August 1-8, 1986 Oshkosh.
August 9-10, 1986 Poker Run and Safety Seminar by Pikes Peak 99's. Starts at Meadowlake Airport and at Buena Vista. Contact Marty Benham at 471-7965 in Colorado Springs.
August 16-17, 1986 Steamboat Springs Fly-In and Airshow.
September 5-7, 1986 Greeley Fly-In and Airshow.

LOCAL BRIEFS

Applications being accepted for Denver-Santa Fe air race

Entries are being accepted for the 1986 Mile High Air Derby Sept. 12-14 from Denver to Santa Fe.

The event is open to licensed male and female pilots flying stock model non-turbo aircraft from 145 to 570 total horsepower. Registration deadline is Aug. 1.

The 411-mile event is a speed, time and distance competition, requiring careful attention to navigation choices. Winners will be determined by a best-speed-over-handicap formula. Prize money will be presented to the top three finishers, with product prizes going to others.

The race will begin at the Front Range Airport east of Denver, with a fly-by at Flagler Airport, a stop at Raton, N.M., a fly-by of the airport at Las Vegas, N.M., and finish at the Santa Fe Municipal Airport.

The Colorado Chapter of the Ninety-Nines Inc., an international organization of female pilots, is sponsoring the event to promote safety in general aviation and interest in the Ninety-Nines' aviation programs.

A race kit of rules, entry forms and race materials is available for $3 from Mile High Air Derby, 14437 W. 32nd Ave., Golden 80401-1475. For further information, call 303-278-4435.

AIR PROGRESS
MAY 1971

WHEN YOUR AIRPLANE IS TOO OLD TO TRUST

Every landing, every jolt of turbulence, every stain of corrosion takes some small toll on the life of an airplane. Here are some ways to figure the safe lifetime of used planes.

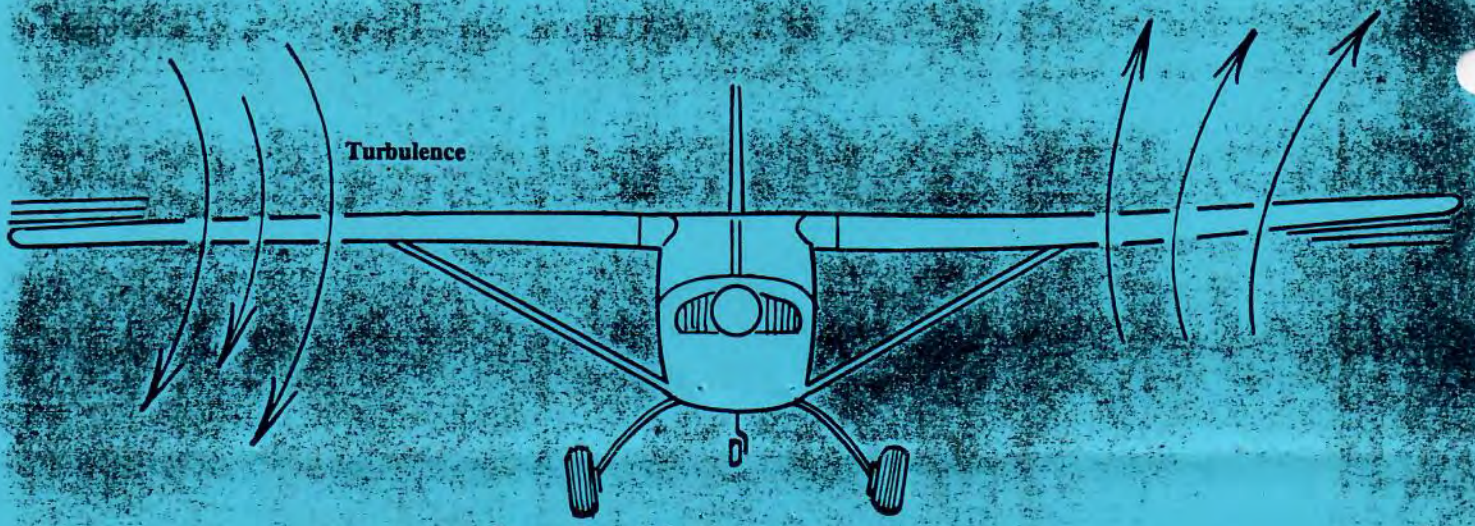
Buying a used airplane? Here's a choice little number, flown only 750 hours by a little old lady school teacher in Tulsa who used it to fly to school in Gotebo. Folks, this ship has never been more than 50 feet off the ground! How can you ask for a better deal? Only 750 hours at 50 feet. What a cream puff!

Right? No! Dead wrong. Why? It may be low time, but all of it was under a very high fatigue environment. All things being equal, it would be better to buy the same type of ship with twice that many hours, if they're cross-country hours by an executive at altitude. Logic? Well, 1,500 hours worth of 3-hour cross-countries is a lot easier on an airplane than 750 hours of half-hour trips at low altitude. Even though it has half the time, the old lady's school bus has made about 1,500 landings versus 500 for the executive job with twice the total airframe time; therefore, it has gotten three times the landing fatigue. Also, flying at tree-top level may have quadrupled the overall airframe fatigue as compared with the executive plaything at 8,000 feet. It's all a question of fatigue and understanding what's important and what isn't.

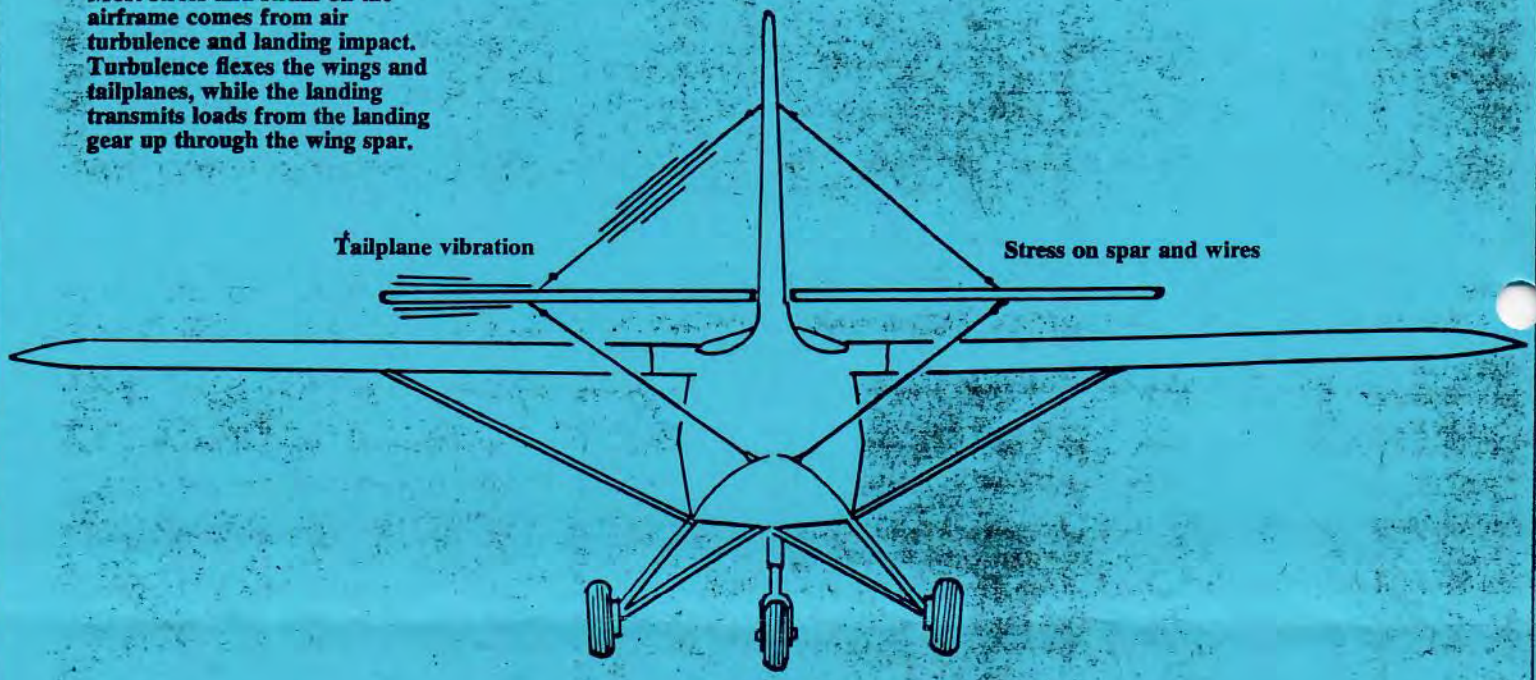
Everybody has a rough idea of what fatigue does—it makes airplanes fall apart. But very few of us in general aviation really know how it affects little airplanes and why. The most universally accepted definition says, "Fatigue failure: When any metal is subjected to repeated stress within its elastic limits, in the form of tension, torsion, compression, or torque, it may develop microscopic fissures or cracks at the point of maximum stress and eventually fail or break." It's a good definition—if you're an engineer. It's easier to explain fatigue on a coloring-book level than it is to come up with a precise definition for laymen.

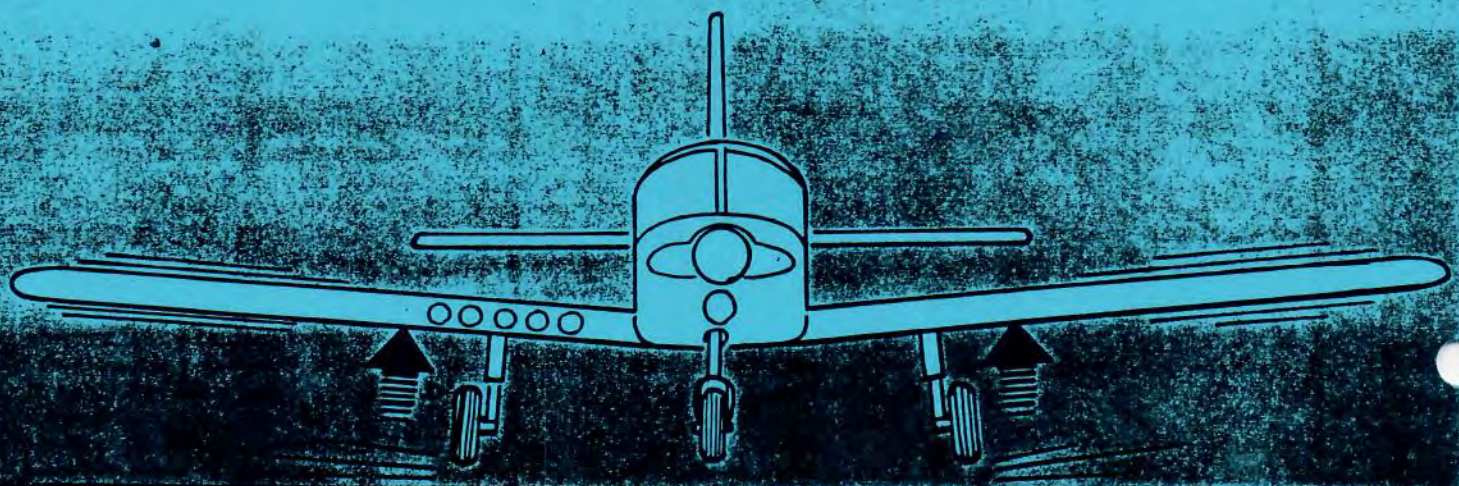
The example most often used in explaining fatigue is the wire-in-the-vise routine, and not wanting to break tradition, we'll use the same. We stick a 10-inch piece of wire in a vise, leaving about half of its length protruding. For any discussion of aircraft fatigue, we have to assume we're going to stay within the metal's elastic limits. That means we're only going to bend the wire in such a way that it doesn't stay bent. If we push it too far, we exceed its elastic limits and it stays bent. In an airplane, that means if we exceed the maximum G force, something will bend and stay that way. If it merely bends, we've exceeded the material's yield point, but if it breaks, we've exceeded its ultimate strength, and there should be no need to translate that into airplane talk.

So, we're going to start tapping th



Most stress and strain on the airframe comes from air turbulence and landing impact. Turbulence flexes the wings and tailplanes, while the landing transmits loads from the landing gear up through the wing spar.

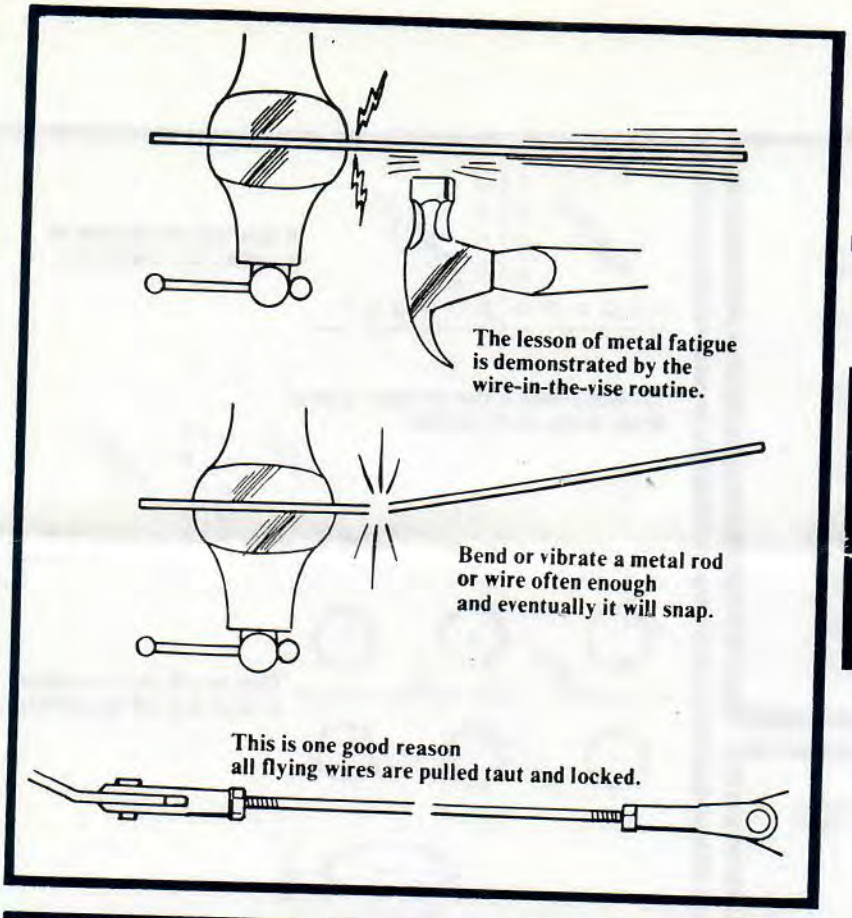


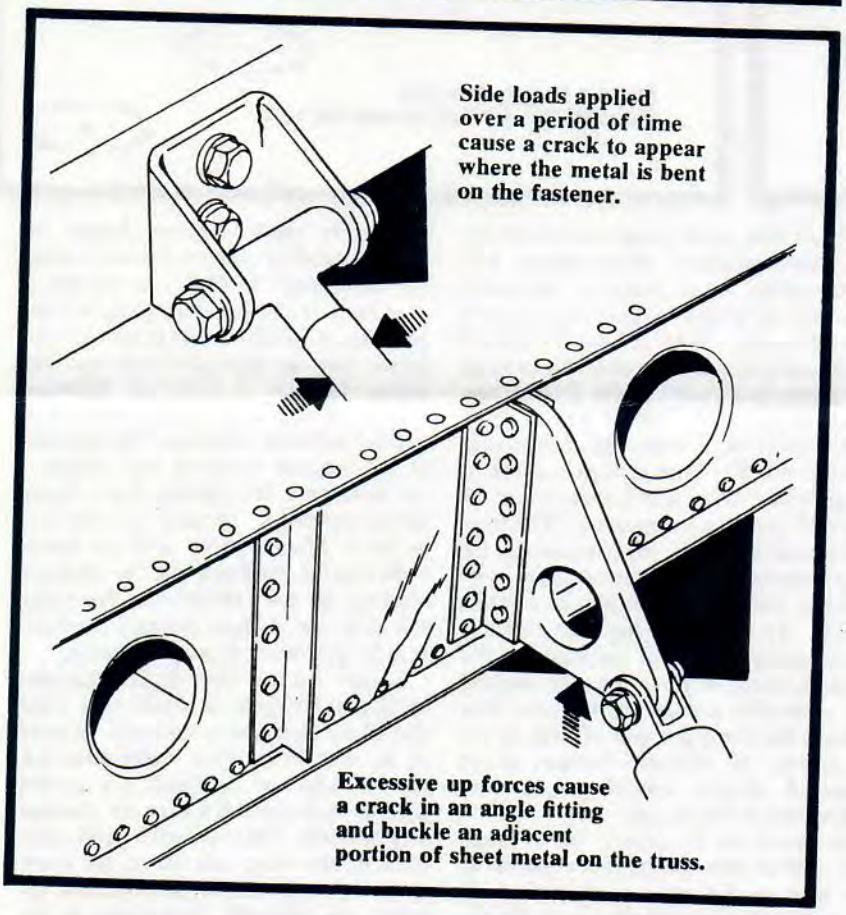


ILLUSTRATIONS BY HANK CLARK

TOO OLD TO TRUST

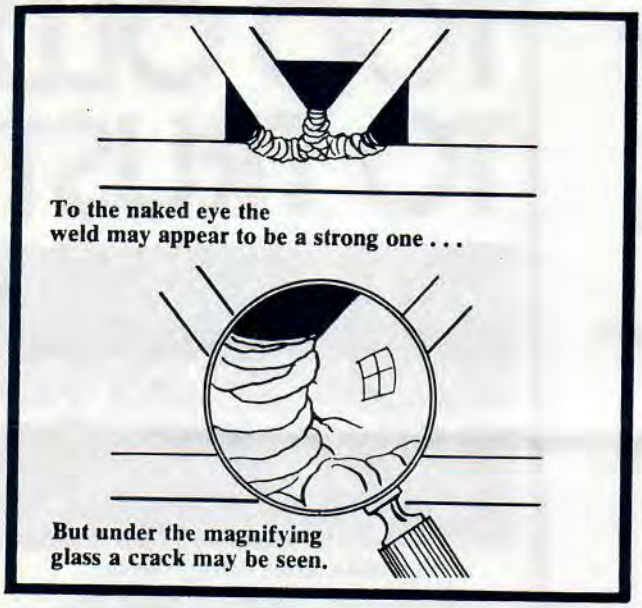
Frayed cables, dirty rivets, microscopic cracks in welds and angle plates: all serve as telltale hints that something is going awry inside.

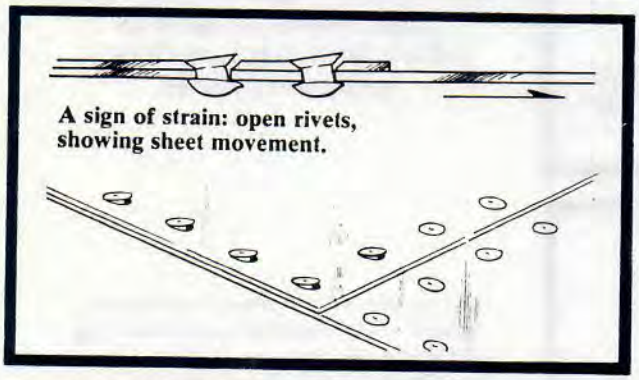


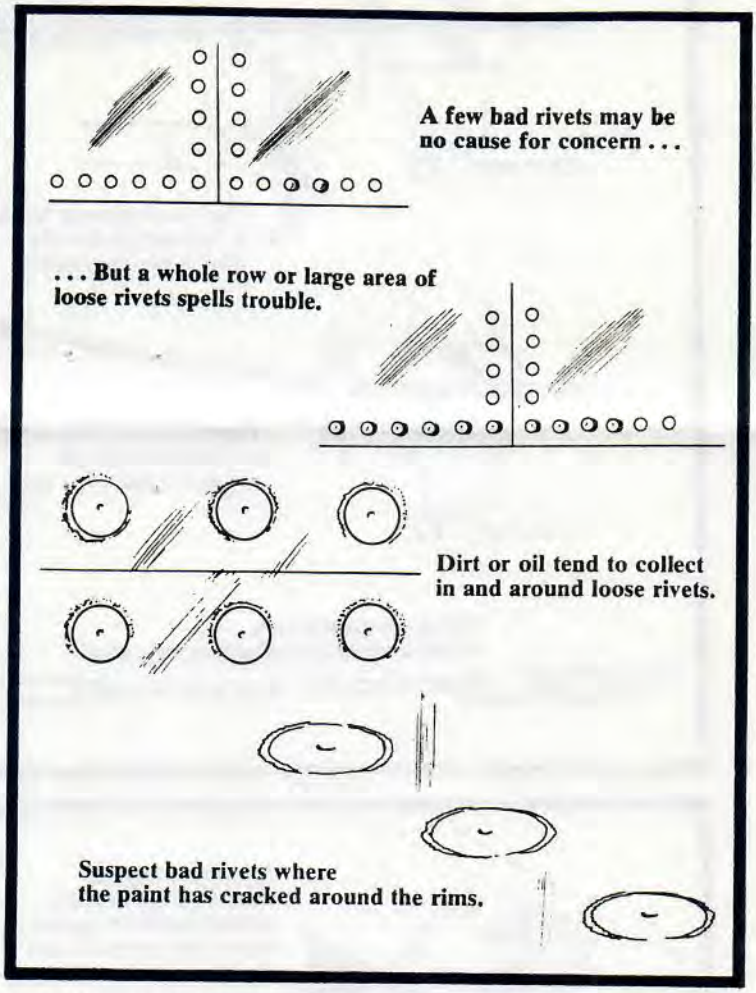


end of this wire, flexing it and making believe it's an airplane wing. We keep tapping it, making sure we don't exceed the elastic limits. Eventually, after an entire afternoon of tapping, the wire suddenly breaks at the point where it comes out of the vise jaws. If we didn't bend it permanently, why did it break? It fatigued.

If we assume a cycle to be completed when the wire returns to the starting point, we can say that we induced at least one cycle every time we tapped it, and usually more as it vibrated back and forth. The harder we tapped the wire, the more severe the cycle, the more it was forced from neutral, and the closer it came to its elastic limits. Every material has a point, a number of cycles, at which it will finally break, and this is especially true of aluminum. A whole lot of little cycles, or a smaller number of big ones, or a combination, will break it clean. Inside the wire, one side of it is being asked to expand and is under tension; the other side is being forced to get smaller, so is under compression. Because the forces inside the material aren't equal or going in the same direction, the crystals have to slide out of







line a little. We can picture the interior crystalline structure as a tray filled with marbles, with the sides of the tray moving in opposite directions. One line of marbles (crystals) will shoulder up against another, while the next line over may go the other way, developing what's known as a "slip plane" between them. It's actually a tiny crack where the metal on one side goes in an opposite direction from the other. Eventually, as the metal is bent back and forth, one slip plane hooks up with another and you soon have a crack, and a piece of the airplane falls off.

No material in the world is without its flaws, and the crack always starts at one of these flaws. It might be a bit of impurity in the metal, but more often than not it's a scratch, dent, intentionally drilled hole or relief, or some other surface imperfection. Even the smallest irregularity fouls up the stress flow, making it concentrate as it runs around the flaw, much as a river compresses as it goes around a boulder. Even if the metal is perfect when the airplane is built, corrosion can always sneak up on it and make it a mass of pits. These imperfections are called "stress raisers" because they cause stress concentrations in their immediate neighborhood. Understanding stress raisers is important because all fatigue failures start at some sort of stress raiser! A sharp V-shaped notch or a thin crack raises the stress at its point by a factor of 20! Even a normal, intentionally drilled hole is good for at least three times the normal concentration. So, even though a crack is stop-drilled, there is still three times the normal stress to worry about. The shallower and smoother the irregularity, the less concentrated the stress. Not only does a notch or crack act as a stress raiser, but by reducing the effective cross-sectional area of the member, the same amount of force must be resisted by a smaller amount of material that boosts the stress per unit of area up to, or above, the ultimate strength of the material, shortly spreading your airplane all over the county.

So much for the theory. We now can see how all this affects the airplane. If we look at the wing as that piece of wire, we can visualize the cycles it's going through and the way these cycles change and are induced by everything that surrounds the airplane. You can cause very small vibratory fatigue cycles by standing under a Cessna's wings and screaming "PIPER!" at the top of your lungs, vibrating the panels. It's impossible to build a vibration-free airframe, but the manufacturers try. The engine itself is a pulsating vibration source and causes a certain amount of normal airframe vibration. The extreme of self-induced vibration and fatigue is the helicopter. It's nothing but a flying fatigue-generator because of the tremendous lift pulsations and the downwash beating constantly on the fuselage, creating its own turbulence. Necessity has made the chopper industry the leader in fatigue research and evaluation.

Except for all the gizmos actually holding the engine in place, very little else of the airframe is seriously affected by its vibration. What really tires out the airframe are the loads it's carried and the turbulence it's bounced through in its lifetime. The more often, and more severely, the wings are flexed, the more the muscles that hold the airframe together are fatigued. Turbulence is the hammer and the airplane is the wire, and it's always being beaten upon. The other constant that beats on our air-

TOO OLD TO TRUST

planes is the ground. We all hit the ground at least once every time we come down from flying. How hard we hit it is another thing again. An absolute grease job unloads the wings slowly and smoothly, but not many landings in an airplane's career can be called grease jobs. Normally, a landing is the toughest part of an airplane's job.

It's now easy to see why some airplanes are going to be a lot more weary than others. Two airplanes with exactly the same total flight time may have lived entirely different lives, and the fatigue they've accumulated, and the strength they have left, may be drastically different. Airplanes have to fatigue, no matter what, but it's usually a minor consideration. However, a high fatigue rate is an occupational hazard in certain fields of aviation. We said that landings are one of the more severe cycles most airplanes go through, so the more landings the airplane has made, the more parts there will be with well-developed slip planes. Now, this doesn't mean that at precisely a certain number of hours, the complete airplane is going to suddenly turn into one big crack and disintegrate. All this means is that this particular airframe is going to be more critical in inspecting for stress raisers. A notch may not have to be very big to cause a crack to start. Airplanes that have been trainers, or air taxis, or anything else that calls for a lot of landings, should be extremely well inspected before buying. Fortunately, there isn't really too much to worry about because trainers almost never get close to their maximum fatigue life because they get so beat-up in bouncing around the pattern that fatigue never becomes a problem. Although aviation is good at making an old product last for a long time, it seems only the strong of the species survive and the others die for lack of maintenance and love.

Airplanes that spend a lot of time in turbulence are also susceptible to fatigue. Occasional turbulence can be bad, but as long as it doesn't exceed the elastic limits of the airframe, everything's all right. What is of more concern is the airplane that has been operated constantly in moderately rough air. Pipeline patrol airplanes are like this. They spend most of their life at telephone-pole height and pick up even the weakest ground turbulence. It may not be great, but it's constant, putting the airframe through many times the normal number of stress cycles.

When you're thinking about plunking down your bank roll for a used airplane, it's too bad you can't walk up to it, reach inside, push a button, and have a slightly hollow, metallic voice come out saying, "Hello. My name is Cessna November 9318 Alpha. I was born in October, 1948, and have flown exactly 2,317 hours and 14 minutes. I flew air taxi for 1,437 hours in 1951-'53. The rest of my life has been cross-country at an average altitude of 5,377 feet. I've been owned by four FBOs, one doctor, and two other individuals. I've been ground-looped once, and in the third rivet hole from the top of the repair on the left end of the landing gear torque box is a stress raiser approximately .080 inches deep. There is another one in the right wing spar 10.025 inches from the tip. I feel fine except for a tired feeling around my left rear spar. I'd appreciate it if you'd take a look at it, please." No such luck! Airplanes can't talk, and sometimes their owners don't, or won't, communicate much better. Each airplane's background usually has to be gleaned from a title search, a careful perusal of the 337 forms, which should show any major damage, and from carefully inspecting the airplane and trying to interpret what the signs of old age are trying to tell us. Rarely are logbooks any help, because some of them are absolute masterpieces in fiction and ambiguity. Logs can't tell us how well the airplane was flown anyway. We can draw our own conclusions about the airplane's history by getting a 10X magnifying glass, a screw driver, a pair of coveralls, and inspecting the machine closely.

Start your inspection with a dirty airplane and inspect rivets in the leading edge, on the spar face in the gear wells, between the gear legs on the belly if it's fixed gear, on the bottoms of the wings in front of the flaps, and anyplace else where rough handling would show up. What we're looking for is an indication of rivets that are excessively loose and working too much. All airplanes are eventually bound to have a loose rivet here and there, but an airframe that's lived a hard life will have more than a few. All of the stress that's being directed through castings and sheets is concentrated at the joints, usually bolts or rivets. If the airplane is subjected to repeated high stresses that are starting to fail rivets, either through fatigue or overstressing, it can easily be detected. If the airplane hasn't been painted, bad rivets can be detected by the ring of oil and dirt that has collected around them. That's why we inspect rivets before washing the plane. Capillary action draws the oil into the crack under, or around, the rivet head and dust collects on it. On a painted airplane, if the head and sheet are moving opposite directions, the paint usually cracks around the rivet head. Don't worry if there are only a few loose-looking rivets, but don't even think about buying it if a sizeable percentage of the rivets in any one area appear to be loose or there are some with the heads sheared off or pulled through the sheet. It's not the loose rivets you can see that should worry you. It's the ones you can't see, inside the airplane, that are scary. If there are some on the outside, there are bound to be more on the inside.

After going over the rivets, strip the airplane down. Pull off every single fairing, inspection panel, and cover, washing and degreasing everything thoroughly. The results of excessive fatigue are easily hidden by even the smallest amount of dirt and oil. Be especially sure to clean around welds and bolts. One of the real problems in aircraft fatigue is that the parts carrying most of the load, such as wings and tails, are also the ones that have the most stress raisers in the form of lightening holes, intentional serrations, and other interruptions to stress flow. Because these are also the biggest parts and the hardest to inspect adequately, you can only do a general inspection of these areas, and then concentrate on the most highly stressed portions such as spar bolts, strut fittings, and fuselage carry-through structures.

In this careful inspection, we are looking for two things: wrinkles caused by overstressing, and possible cracks due to fatigue. The wrinkles are usually easy to spot because they will run diagonally across wing skin bays between ribs, or between stiffeners on the spar face. A wrinkle that is other than a factory-introduced "can," or looseness of the sheet, tells you that something inside has moved in one direction and not moved back—it has yielded. In checking for fatigue, use the magnifying glass to go over the spar bolts, motor mount welds, attach fittings, and anything else that is obviously highly loaded and easy to get at. Be fanatical about inspecting those parts that would break your neck if they should fail. Well-developed fatigue shows up as tiny cracks radiating from rivet or bolt holes. Anywhere there is a reasonably sharp corner on a fitting or a tight radius bend in metal is another place to look for cracks. Recently, rear spar fittings appear to be getting more than their share of AD notes on fatigue failures, as are horizontal tail spars. These look like good candidates for magnifying glass inspection, as are control surface hinges and the areas where the landing gear attaches.

See Part 2 of "When An Airplane Is Too Old To Trust" in next month's issue.

POTLUCK PICNIC
FLY-IN

Longmont Airport

July 12 10 am - 2 pm

EAA Chapter 660

SOFT DRINKS WILL BE AVAILABLE

* Airplane Rummage Sale
* Plane Scales ($5 per airplane)
* Bar-B-Que Grills Provided
* Come Out and Join The Fun

$1.00 donation per person

Directions: Take I-25 north from Denver to Hiway 119 (Del Camino-Longmont exit) to the city of Longmont (3 miles), turn right on Main Street and go six blocks to Ninth Avenue. Turn Left on Ninth and follow it to Airport Road. A left turn will head you toward the airport.

Families Welcome !

Chapter 43 Newsletter
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1986

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