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NEWSLETTER

# Carb Heat

**Hot Air and Flying Rumours**

**Vol 30 No. 5**

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## *May 2000*

***Inside:***



***Next Meeting:***
**Thursday May 18, 2000 8:00 PM**
**National Aviation Museum**

presentation by fellow member Peter Ceravolo
Ring of Fire @ FL 250


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Just as I thought the weather was beginning to shine on us, along comes a solid week of rain. This has once again made the ground very soft, particularly in front of the row hangars, so please refrain from driving on it and chewing things up even further.

**Carp Airport Lease**

George Elliott has been making very productive use of his time preparing a draft agreement for presentation to the WCAA aimed at securing our future at Carp airport. I am pleased to say that this excellent Memorandum of Understanding has been favourably received by both the WCAA and associated staff at regional headquarters.

George deserves a hearty thank you for both his creative thinking and diligent, opportunistic work. I hope I can report on a signed agreement at the next meeting.

As a reminder, if you joined the WCAA last year don't forget to renew your membership before the May 24th AGM of the WCAA. It is essential that we don't drop the ball, and let the old crowd back in.

If you don't plan to attend the AGM, put George Elliott's and my name on the Proxy statement and give us a copy of the proxy so we can vote on your behalf.

**Toronto Aviation Show**

Dick Moore invited me to accompany him in his C-150 to the Toronto show being held at the Downsview airport this past weekend. Being temporarily embarrassed on the winged front, it didn't take much arm twisting on Dick's behalf.

Saturday morning saw us ready for a 6:30 AM departure, along with Ken Mackenzie and Rodney Stead. Unfortunately low ceilings halted the trip in a few miles and we rescheduled for Sunday.

Sunday morning saw better conditions and we were soon climbing for altitude. As we levelled out expecting to see our groundspeed increase to normal cruise values of 85 knots, we were dismayed to see 48 knots, close to 35 knots on the nose at 3,000 feet. A quick check with Kingston FSS revealed that things were much worse at 6,000 feet, 60 Knots, so we were resolved to 2,000 feet all the way to Peterborough to fuel up.

Several hours later, and more than just a wee bit numb, we were on final to Downsview and off to enjoy the show.

After four hours or so of window-shopping we were ready to catch those fabulous 60-knot tailwinds for home and experience unheard of ground speeds for a C-150 in the Lancair or RV realm.

As Ken Mackenzie taxied out for takeoff, Dick was rushing through his mag check and discovered to his dismay a totally dead mag. Unable to contact Ken who was on tower frequency by now, we were left to our own devices.

With the great help of the volunteer ground crew at Downsview (thanks Sally), we obtained the assistance of a Brampton flying club mechanic who helped us diagnose the problem as a truly dead left magneto. At the same time he replaced an alternator field wire that had failed enroute, solving another small problem that Mr. Murphy had laid at our doorstep.

After debating our options, we decided to stay and get the mag fixed before attempting the return journey. Fortunately one of my very good friends from the Brampton Flying club was home and able to pick us up, put us up for the evening, and get us to Leavens Aviation for a mag repair first thing Monday AM.

By 12:30 we were back at Downsview installing the mag and airborne a little over an hour later. We enjoyed a good tailwind to Peterborough, getting to practice our Oshkosh bound flying (marginal VFR). A quick bite of lunch, check the weather from FSS and onward at decreasing altitude, and tailwind component to arrive back at Carp at 4:30.

Dick had just had both mags rebuilt this winter, and it looked like both shared the same assembly error that lead to the left mag failure. Murphy was definitely working overtime this trip!

**April Meeting Summary**

**Junkyard Wars** lived up to its pre meeting billing, serving up light-hearted entertainment of a form of homebuilding gone mad!

If you missed it, I imagine Irving Slone can be sweet-talked into loaning the video to you.

**May 18th Meeting**

Our May 18th meeting feature topic will be **Ring of Fire @ FL 250**, an expose of the congruence of two passions of fellow member **Peter Ceravolo**, Aviation and Astronomy. Those of you who have met Peter know his infectious enthusiasm; those who have yet to have the honour will want to be sure to attend. See you there.

***Gary***

## *Lawnchair Man*
*submitted by Martin Poettcker*

**The Lawn Chair Man (true story)**

Larry Walters went to the local Army-Navy surplus store and purchased 45 weather balloons and several tanks of helium. He securely strapped the balloons to his sturdy lawn chair and anchored the chair to the bumper of his jeep and inflated the balloons with the helium. Larry packed several sandwiches and a six-pack of Miller Lite and loaded his pellet gun figuring he could pop a few balloons when it was time to descend. Larry's plan was to lazily float up to a height of about 30 feet above his back yard and come back down in a few hours. Things didn't quite work out for Larry. When he cut the cord anchoring the lawn chair to his jeep he streaked into the LA sky as if shot from a cannon. He didn't level off at 30 feet but 16,000 feet. At that height he couldn't risk shooting any of the balloons. So he stayed, there, drifting cold and frightened for more than 14 hours when he found himself in the primary approach corridor of LAX. A Pan Am pilot first spotted Larry. He radioed the tower and described passing a guy in a lawn chair…with a gun! Radar confirmed the existence of an object floating 16,000 feet above the airport. LAX emergency procedures swung into full alert and a helicopter was dispatched to investigate. The offshore breeze began to flow and carried Larry out to sea. Right on Larry's heels was the rescue helicopter. The helicopter ascended to a position several hundred feet above Larry and lowered a rescue line. Larry snagged the line, with which he was hauled back to shore. As soon as Larry was hauled to earth, he was arrested by waiting members of the LAPD for violating LAX airspace.

http://www.flightdata.com

## *When Metal Lets Us Down*
*by Mike Busch*

It's rare for an engine, propeller or airframe to fail catastrophically in flight. But when one does, more often than not, the culprit is metal fatigue. To make intelligent maintenance decisions, every aircraft owner needs a basic understanding of how metal behaves ... and why it fails. AVweb's Mike Busch offers a primer on the subject.

This article originally appeared in the June 1999 issue of Cessna Pilots Association Magazine.

fatigue isn't a subject that usually keeps me awake at night. For most of the 30-odd years during which I've been an aircraft owner, I figured it was a subject of interest mainly to metallurgists and aeronautical engineers and other Ph.D. types, not to mere mortal aircraft owners like me.

However, my interest in the subject was rekindled recently by a rash of maintenance problems I encountered with my 1979 T310R. The problems started showing up during my annual inspection last March. I did a compression check on my two 1000-hours-SMOH engines, came up with mid-to-high 70s on all twelve cylinders, and figured my jugs were doing just fine. But within an hour of starting the inspection, Phil Kirkham -- my IA for this year's ordeal -- called me over and pointed to a nearly imperceptible blue stain in the vicinity of the upper spark plug boss on the #5 cylinder of the right engine.

"Looks like we might have a cracked head," Phil told me.

"Boy, your eyes are sure better than mine," I replied. "I can just barely see what you're talking about."

"One way to know for sure," Phil said, reaching for an aerosol can of dye penetrant. Within a few minutes, there was no question that Phil was right. The head was definitely cracked, and the cylinder was trash. This was something of a watershed event for me, since the twelve cylinders on my engines were the original twelve that rolled out of the Cessna Wallace Plant in 1979. They'd survived 20 years, 3,000 hours, and one major overhaul. But now, one of them had let me down. Could the other eleven be far behind?

Given that the engines were only 400 hours from published TBO, I decided the appropriate course of action was to find a decent serviceable cylinder that would get me to major overhaul, at which time it was pretty clear that all twelve jugs would have to be replaced with new ones. I phoned Ken Tunnell at Ly-Con Aircraft Engines in Visalia, Calif., explained my situation, and he fixed me up with a nice-looking reconditioned jug for about half the cost of a new one. Ken runs a great engine shop.

I figured that the worst was over. But later in the annual, I discovered another serious problem. I'd removed my 310's retractable cabin step from the airframe in order to replace its worn pivot bushings. With the step removed, I got a good look at the big magnesium step support casting, and didn't like what I saw one bit. The casting had a serious fatigue crack that had grown to the point that the part was on the verge of fracturing in two. This one didn't require dye penetrant -- it was painfully obvious, even to my untrained eye. Cessna wanted $900 for a new one, but I managed to get mine weld-repaired (which is tricky business with magnesium, as you might imagine).

***It Ain't Over Yet***

After a month of wrench swinging that seemed like it would never end, I finally got the airplane back together. Phil signed off the annual and returned the plane to service, and I looked forward to 11 months of hassle-free flying. But it was not to be.

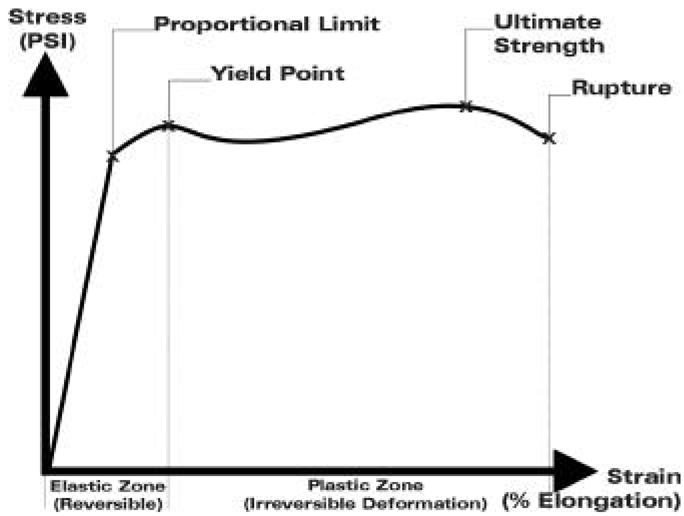
In late April, I was flying up to Bend, Ore., to visit the Lancair Columbia 300 factory and have a close look at the newly certificated 300-hp composite speedster. About an hour into the three-hour flight, I noticed a thin reddish streak starting to develop on the top of the right engine nacelle. Unless it was bug blood, red fluid in that location could only come from one place: my red-dyed-oil-filled propeller hub. Sure enough, upon landing at Bend, I verified that the red liquid was indeed coming from the right prop hub. As I write this, the prop is at the prop shop being torn apart. The verdict isn't yet in, but one theory is that the source of the leak may turn out to be a tiny fatigue crack in the retention nut that secures the #2 blade to the hub.

While all this was happening, I was deeply immersed in the ongoing TCM CSB 99-3 crankshaft debacle. Early in 1999, TCM became aware of seven crankshaft fatigue failures in factory reman 520- and 550-series engines. These failures were extraordinary for several reasons: they all occurred in new Vacuum Arc Remelt (VAR) cranks with very low time, and they all occurred in virtually identical locations in relatively low-stress areas of the crankshaft. Forensic investigation revealed that the failures had been caused by a stress riser created by a faulty tool used to press counterweight hangar bushings into the crankshaft during manufacture. The result was a massive inspection program affecting the entire 1998 production of new and reconditioned 470/520/550 crankshafts, and the scrapping of nearly 15% of those crankshafts.

So, with my airplane AOG and propless, and my e-mailbox full of messages from disgruntled TCM engine owners, I decided to do some reading on the subject of metal fatigue. It turned out to be a pretty interesting subject.

One of the best write-ups on this subject to be found anywhere appears in John Schwaner's "Sky Ranch Engineering Manual," available from Sacramento Sky Ranch Inc. ($19.95, 1-916-421-7672). Much of the following discussion is derived from material in Chapters 1 and 7 of this excellent book.

***Stress and Strain***



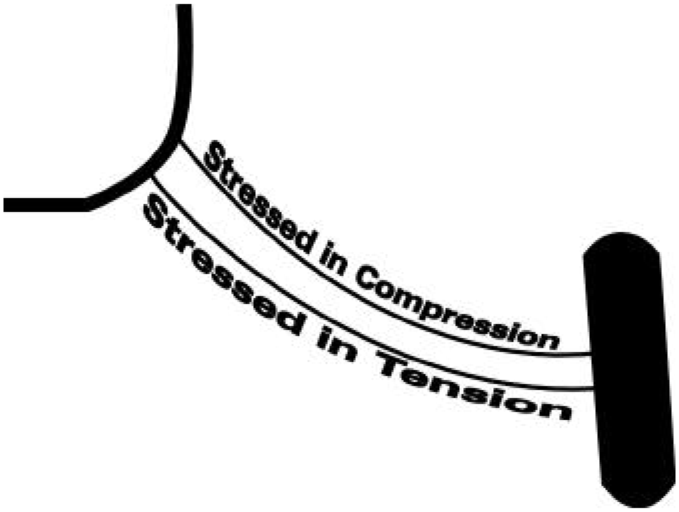

Consider what happens when you apply force to a piece of metal: It deforms. The force you apply is called stress, and the amount of resultant deformation is called strain. The relationship between stress and strain is what defines the structural properties of the metal. (See Figure 4.)

The deformation of a metal part in response to stress may be either elastic or plastic. Elastic deformation is temporary -- when the stress is removed, the metal returns to its original shape. The flexing of an airliner wing or the spring steel main landing gear on a single-engine Cessna are examples of elastic response to stress. The slope of the stress/strain curve determines the elasticity (stiffness) of the metal.

When metal is stressed beyond its elastic limit or yield point, the result is permanent (or plastic) deformation -- when the stress is removed, the metal does not return to its original shape. The ability of metal to be bent, stamped, forged or extruded into a desired shape -- as well as its ability to bend before it breaks -- are the result of its plastic properties. On the other hand, once a metal part is placed in service, it's obviously important that it not be subject to stress in excess of its yield point.

When you think about it, this combination of elastic and plastic properties is what makes metal behave like ... well ... metal. Many other familiar materials -- whether flexible like rubber or brittle like glass -- are almost entirely elastic at ordinary temperatures, and become plastic only when heated. Other materials like clay or putty have little or no elasticity, and deform permanently with the slightest force.

***Tension and Compression***



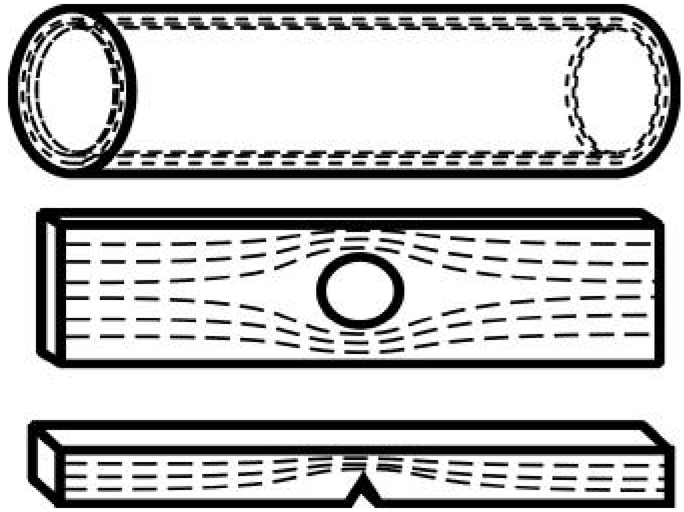

When we think about applying stress to a metal part, we usually think in terms of tension -- in other words, applying a load that tries to pull the metal apart. Cylinder studs and crankcase through-bolts are examples of metal parts that are loaded in tension. Aluminum alloys may have tensile strengths between 20,000 and 80,000 PSI, while high-tensile-strength steel can withstand 200,000 to 400,000 PSI or more.

If a metal part is subject to tensile stress in excess of its elastic limit, it may start to crack. Over time, the crack may grow to the point that the part fractures in two.

Tension isn't the only kind of stress, however. We may load a metal part in compression. Sufficient compression stress may exceed the elastic limit and result in permanent deformation of the part. However, metal normally doesn't have a well-defined yield point in compression, so compression doesn't normally cause cracking or fracture. (Extremely hard and brittle metals may shatter under excessive compression, however.)

In real life, metal parts are often subject to complex combinations of tension and compression stresses. When a part such as a wing spar or spring steel landing gear leg is subjected to bending loads, for example, certain areas are stressed in tension while other areas are stressed in compression. (See Figure 5.) The same is true of parts subjected to torsion or shear loads. In such cases, we tend to be more concerned with the areas of the part subjected to tension, because those are the areas that are most likely to crack and fail.

***Stress Concentration***



When a metal part is placed under load, stress is almost never uniformly distributed through the part. Instead, it concentrates in certain areas. Naturally, those areas of stress concentration are where the part is most likely to crack or fracture.

When a part is subject to bending or torsion loads, almost all of the stress (tension and compression) occurs at the surface of the part. That's why many airplane parts are hollow rather than solid. A hollow tube is very nearly as strong as a solid rod of similar size, but the hollow tube is much lighter in weight. . The principal disadvantage of a hollow part is that, if stressed beyond its elastic limit, it tends to fail much more suddenly and catastrophically than a solid part.

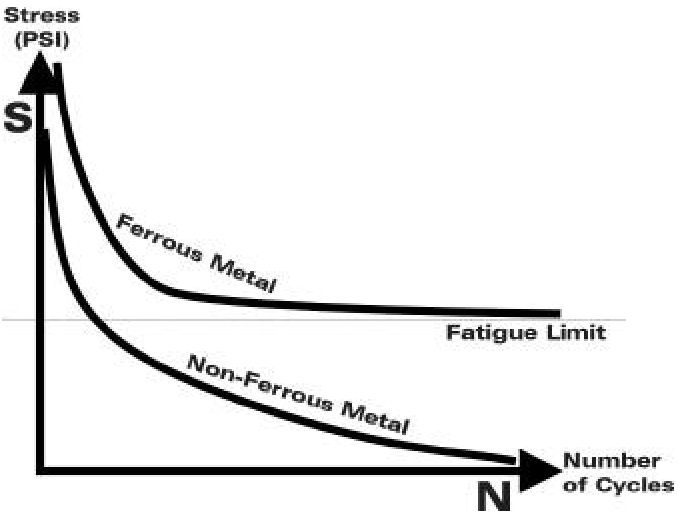
The same principle explains why I-beam and C-beam structures (commonly used for wing spars) carry virtually all their load in the top and bottom "caps," and very little in the "web" area that connects the two. It also explains why it's possible to put "lightening holes" in parts without weakening them significantly

Stress is also concentrated at -- and magnified by -- any geometric discontinuities in the part, such as corners, holes, notches, threads, scratches, nicks and pits. Such discontinuities are commonly referred to as "stress risers" and are almost invariably where fatigue cracks begin. (See Figure 6.)

Think about the last time you struggled to rip open a bag of potato chips or peanuts, for example. The thin plastic or cellophane material of the bag is nearly impossible to tear unless you're fortunate enough to locate the tiny "open here" nick -- or to create such a nick yourself with a pocket knife or your teeth. The nick concentrates the stress enormously, and makes the bag easy to open.

So it is with metal: A tiny and seemingly innocuous nick, scratch or pit may act as a stress riser that concentrates the surface stress enough to cause the part to crack and ultimately fracture. Simple surface roughness may be enough to weaken a part significantly, which is why highly stressed parts are usually machined or polished to a smooth finish. In time, corrosion pits may mar this smooth surface enough to permit fatigue cracking to begin.

***Metal Fatigue***




Take an ordinary paper clip, straighten, and then bend it back and forth repeatedly until it breaks in two. What happened? You just demonstrated metal fatigue.

If you'd examined the bend point of the paper clip under a microscope as you bent it back and forth, you'd have seen one or more microscopic fatigue cracks develop on the outside radius of the bend -- the portion subject to tension stress. As you repeated the bending cycle over and over, you'd see the crack grow with each cycle until the paper clip finally fractured.

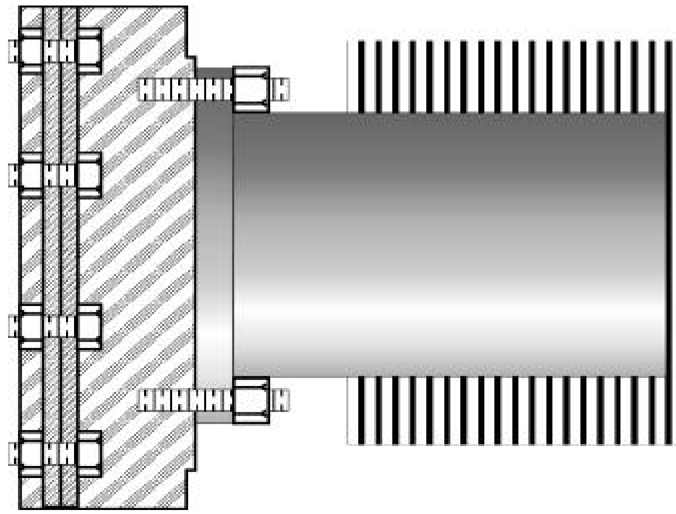
Surprisingly, it is not necessary to stress a metal part beyond the yield point in order to generate a fatigue failure. Fatigue cracks can develop even when stresses remain well within the elastic limit of the metal, given enough cycles. The lower the stress level, the more cycles it takes before a fatigue fracture will occur. This can be plotted in the form of what engineers call an "S/N curve." (See Figure 7.)

A heavily loaded steel part can be expected to endure ten million cycles or so before failing from metal fatigue. That might sound like a lot, but a connecting rod, crankshaft throw or cylinder hold-down stud gets that many cycles in about 140 hours of flight time.

With steel, there is a stress level below which fatigue failures do not occur: the *fatigue limit*. A part loaded below the fatigue limit may eventually develop fatigue cracks, but they won't grow to the point of fracture. Therefore, a steel part (such as a crankshaft) can theoretically remain in service forever, provided it doesn't corrode or wear beyond service limits.

In sharp contrast, aluminum and other nonferrous metals have no fatigue limit. No matter how low the stress level, eventually the metal will suffer a fatigue failure if it is subjected to enough cycles. This means that aluminum parts are inherently life-limited. For some parts, such as wing spars, the frequency of stress cycles may be so low that the predicted life is ridiculously long. But for high-cycle parts, such as cylinder heads, crankcase halves and propeller blades, the fatigue life is very significant, as my cracked #5 cylinder head demonstrated.

***Torque and Preload***



It is crucial for fasteners that undergo cyclic tension loads -- such as crankcase bolts and cylinder hold-down studs -- be torqued properly to ensure that they don't fatigue and fail. Here's why.

Consider the cylinder whose flange is attached to the crankcase by studs and nuts, as illustrated in Figure 8. Each time the cylinder goes through its compression and power strokes, the cylinder tries to pull away from the crankcase. At a peak cylinder pressure of 1,000 PSI, each firing load on a 5.25-inch bore is over 20,000 pounds. Since there are eight hold-down studs for each cylinder, each sees a peak load of around 2,500 pounds. At cruise RPM, this happens 1,200 times a minute. Imagine that the cylinder hold-down nuts were torqued to establish a "preload" of only 2,000 pounds. During each combustion cycle, at the moment of peak stress, the stud would be subject to cyclic stress of an additional 500 pounds, which might cause the stud to elongate slightly (in accordance with the stress/strain curve). This is a bad thing for two reasons: The cylinder base flange and crankcase mounting pad will be subject to fretting, and the hold-down studs will experience stress cycles that could eventually result in fatigue failure of the studs.

On the other hand, suppose the cylinder hold-down nuts were properly torqued to establish a preload of 3,000 pounds. Now, even under peak stress conditions, the cylinder base flange remains firmly in contact with the crankcase mounting pad.

The hold-down studs remain under a constant 3,000 pound stress, and are not subject to cyclic fatigue cycles.

Believe it or not, broken cylinder hold-down studs may be caused by something as innocuous as *paint*! It is essential that no paint be applied to the cylinder-to-crankcase mating surfaces, or to the cylinder mounting flange where the hold-down nuts attach. If any paint is present when the hold-down nuts are torqued in place, the paint film will eventually wear away, relieving some of the initial fastener preload. If the preload decreases to less than the peak cyclic stress, then fatigue cycles and fretting damage may occur.

Propeller spinners and spinner bulkheads are also places where inadequate preload is often responsible for fatigue failures. These parts are subject to extreme vibration, and require sufficient preload to overcome cyclic stress that can result in fatigue failure. In most McCauley constant-speed prop installations, spinner preload is adjusted with fiberglass shims inserted between the propeller dome and the forward spinner bulkhead. When fatigue cracks occur at the spinner or aft bulkhead, it's almost always because there are not enough shims installed to provide the necessary preload.

***Internal Stress***

Another way to help protect parts from fatigue is to build them with built-in stress that counteracts some of the externally applied stress that results from loading. Since fatigue is always caused by tensile stress, generally at the surface of a part, fatigue resistance can be increased by inducing internal compressive stress at the surface.

One way of accomplishing this is to compress the surface material of the part by subjecting it to high-pressure rollers or shot peening. Rolling is commonly used to increase the strength of propeller blades and to create high-strength threads, while shot peening is used on high-stress engine parts such as connecting rods.

Another technique is called "nitriding," and used to caseharden crankshafts, camshafts, cylinder barrels, gears, and other highly stressed steel parts. The parts are baked in an oven in an atmosphere of ammonia gas. The heat releases atomic nitrogen from the ammonia, and the nitrogen combines with the metal at the surface and to a depth of .020 inch or so. Since the nitrogen atoms occupy normally vacuous space in the crystalline structure of the steel, they produce compressive internal stress that increases strength, hardness, and resistance to wear and fatigue.

A nitrided part such as a crankshaft is best thought of as being like an egg: a relatively elastic core surrounded by a very thin, very hard, very brittle case. The outer nitrided layer gives the crankshaft greatly improved wear-resistance. However, just like an eggshell, the brittle "nitride case" can crack easily if subjected to excessive pressure (which is exactly what caused the recent massive TCM CSB 99-3 crankshaft recall).

Furthermore, while fatigue cracks normally occur at the surface of a metal part where they can readily be detected, a nitrided or shot-peened part may develop subsurface fatigue cracks that cannot be detected during visual or dye penetrant inspections. This is why sophisticated non-destructive testing (NDT) techniques such as ultrasound and X-ray must often be used to inspect these parts for fatigue.

***What's It All Mean?***

Our metal airframes, engines and propellers are made from an eclectic combination of materials with widely varying characteristics. Steel parts -- like crankshafts and accessory gears and tubular engine mounts -- should theoretically be able to remain in service forever, provided they are loaded below their fatigue limits, and protected from excessive wear, damage and corrosion. Aluminum parts, on the other hand, have no fatigue limit. If they are subject to cyclical stress (as most are), they have a finite service life and must be inspected regularly for fatigue cracking.

Cylinder heads are particularly vulnerable to fatigue failure, as I found out firsthand. If you think about it, cylinder heads have just about everything going against them, fatigue-wise. They're subject to an extraordinary amount of cyclic stress. They're made of aluminum alloy so they're inherently life-limited. They operate at high temperatures, which lowers the yield point of the metal and accelerates the effects of fatigue. (The fatigue strength drops rapidly with increasing temperature, particularly as CHTs rise above 400° F.) They're manufactured with rough surfaces and machined with cooling fins and threaded areas and all sorts of holes, all of which provide stress risers where fatigue cracks can originate. And, they're constantly bathed with hot and highly corrosive exhaust gas which further weakens and pits the surface of the head, particularly in the exhaust port area where many head cracks start.

Frankly, it's amazing that they last as long as they do.

An old rule of thumb states that once a cylinder has made it through two TBOs, the likelihood of fatigue cracking increases significantly. The published TBO for my TSIO-520-BB engines is 1,400 hours, which puts my 3,000-hour jugs a bit beyond twice TBO. So you could say that my cracked #5 cylinder head occurred right on schedule, so to speak.

The question is: Was this a fluke, or are the other 11 cylinders going to follow suit before long?

It's not worth trying to get heroic with weld repairs to a cylinder heads of the vintage that mine are. Best to accept the fact that they're long in the tooth and bound to give up the ghost sooner or later -- probably sooner. Between now and major overhaul time, I'll have to watch my jugs like a hawk for the tell-tale signs of fatigue cracking -- mainly subtle fuel and oil stains where there shouldn't be any, and cooling fins that go "plunk" instead of "ping!" With luck, I'll nurse ‘em along ‘til overhaul time, at which point they will wind up as scrap metal to come back as somebody's Coca-Cola can.

What about my cabin step support casting that nearly fractured from fatigue? There are some lessons learned there, too. Although this part is buried under the floorboards and very difficult to inspect, it is subject to extreme cyclical stress every time someone enters or leaves the cabin. The casting is made of magnesium, a material that is more granular and brittle and prone to rapid cracking than aluminum. The crack originated at a sharp corner of the casting that was not properly radiused during manufacture to minimize the stress concentration at that point ... but it is now, after I spent an hour filing and polishing it before reinstallation!

Most importantly, this casting was out of sight and out of mind. It wasn't on any Cessna 310 annual inspection checklist, and none of the experienced twin Cessna mechanics I talked to remember ever making a practice of trying to inspect it. That's going to change, at least on my airplane.

***Postscript***

As for my propeller hub that started throwing red-dyed oil, the problem turned out not to be fatigue-related after all. Instead, it turned out to be caused by loss of torque on the #2 blade retention nut, caused by -- can you guess? -- the presence of *paint* on the threaded area of the hub when the prop was assembled during the previous overhaul. Turns out that the prop shop had hired a new fellow in its paint shop, and apparently he didn't realize that it was a no-no to paint the hub threads. The paint film gradually wore down, causing a loss of preload, and could have developed into a life-threatening situation if not detected early. The problem didn't show up until three years after the overhaul, in the form of a tiny leak of the red-dyed oil that's there specifically to make hub cracks detectable. Much to its credit, the prop shop re-overhauled both of my props at its expense.

## *Military Stops Degrading Global Positioning System Accuracy*
## *from http://www.avweb.com/newswire/*

With the "flick of a switch" at the Air Force Space Command this week, your GPS navigation box just got better. As of midnight GMT on Monday, the Department of Defense turned off selective availability (SA), the intentional degradation of the GPS signal that has been supplied to civilian users worldwide. Instead of a 300-foot accuracy, civil GPS users can now expect accuracy to within 100 feet or better. No changes are necessary in anyone's GPS nav boxes to take advantage of the improved signal. Immediate benefits to aviation users include better situational awareness on the ground at airports while taxiing, and more reliable performance from GPS-based terrain avoidance systems while in the approach and landing phase.

***...But They Can Turn It Back On For The Bad Guys...***

The discontinuation of SA was made possible by the development of techniques that allow the military to restore the intentional "dithering" of the timing signal on a regional basis, when required by national security concerns. This would effectively deny the increased GPS accuracy to unfriendly users in that particular area. The military has long used the precision of the GPS signal to guide expensive "smart" munitions. Arthur Money, assistant secretary of defense, was intentionally vague about how the regional degradation system would work in times of crisis, but did say that if the improved GPS signal were denied to a region such as the Balkans, that users in Athens or Frankfurt would not be affected.

The timing of the decision caught most GPS users by surprise. The Clinton administration had committed in 1996 to discontinue SA for civilian users by 2006, and the implementation was not expected for several more years. Besides the obvious benefit the SA-free GPS signal offers to terrestrial and airborne navigation users, emergency responders will now be able to locate more accurately the origin of "911" calls from the next generation of cellular phones, which will be able to transmit GPS coordinates. There are also benefits to the telecommunications industry from having access to atomic-clock timing broadcasts accurate to within 40 billionths of a second.

***...So, Whither the WAAS?***

It would be nice if we could all start flying precision GPS approaches this week, but the newly improved satellite signal is still not enough to get us there. Basically, the removal of SA has no immediate effect on the FAA's slow, but ongoing, progress toward providing local-area and wide-area GPS augmentation systems (LAAS and WAAS). While SA signal degradation is the single largest source of error for GPS, there are other sources, including satellite orbit errors, GPS clock variations, and atmospheric effects. Whether the deletion of SA can allow modification of any of the requirements for ground-based reference stations remains to be seen.

WAAS and LAAS are differential correction systems that can further correct the GPS signal. The FAA would like to have accuracy down to about 10 feet or better for precision approaches. Most important, the present system has no integrity monitoring -- there is no way to notify a pilot to break off an approach if there is an anomaly or failure of the satellite signals. Other GPS programs include plans for a second civilian GPS signal channel on new navigation satellites by 2003, and a third signal by 2005.

## Classifieds

**Place your ads by phone with Charles Gregoire @ 828-7493 or e-mail to cbgregoire@sympatico.ca Deadline is first of the month. Ads will run for three months with a renewal option of two more months.**

**For Sale, Garmin GPS90 - $500.00 (firm)**
**David Clark H10-40 Headset - $200 or best offer**
**Win Cotnam (613) 592-2224 05/00**
**wbcotnam@sympatico.ca**

**The West Carelton Airport Authority (Carp) advises that they are taking names from those interested in renting space in a proposed 20 bay T-hangar bldg. They have about 11-12 names, and are looking for a 75% initial occupancy before they commit to breaking ground. Cost looks like $175-$200 per month. Those interested can call 839-5276 or fax 839-5390 for an application or further info.**
**Maj.GT.Rippon**
**DMP 4**
**(613)995-2684**
**e-mail: mail094a@dnd.ca**

**Wanted, One Pre-Amp coupler for a King 8002 Loran, rectangular type. Ernest B. Colbert,**
**E Mail: ecolbert@mfi.net or**
**Phone or Fax 1-352-625-3793 03/2000**

**For Sale/Trade**
**- Continental C90-12 with logs for sale or trade for Lycoming O-320 (may consider O-290D or D2)**
**- Vacuum pump and drive for Continental O-200.**
**- Pair of new 500X5 Rosenhan wheels, brakes and tires.**
**- Some 4x8 sheets 1/16 & 3/32 aircraft plywood**
**Lionel Robidoux 613-738-1066 01/2000**

## Articles Wanted

**I am always interested in receiving submissions for this, your, Newsletter. You may bring articles to the monthly meetings or mail information to the post office box or send me an e-mail attachment at:**

**cbgregoire@sympatico.ca 01/2000**

## EAA Chapter 245 Membership Application

NEW:___ RENEWAL:___ DATE:__/__/__
EAA NUMBER:.....................
EXP Date:__/__/__
NAME:............................................................
ADDRESS:......................................................
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AIRCRAFT &
REGISTRATION:............................................
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COPA:____ RAAC:____
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**Annual Dues**: January 1st to December 31st. (porated after March31st for new members/subscribers).
Associate Member ____: $30.00 Newsletter plus Chapter facilities
Full Member: ____: $55.00 Newsletter, hangar, workshop, tiedowns
Newsletter subscriber ____: $30.00 Newsletter
Note Associate and full members must also be members of EAA's parent body in Oshkosh WI, USA

Make cheque payable to:
EAA Chapter 245 (Ottawa)
Mail to - P.O. Box 24149, 300 Eagleson Road, Kanata, Ontario, K2M 2C3