PAZMANY NEWSLETTER
NUMBER 85
1st Quarter, 1992
Aircraft Designer:
Ladislao Pazmany
PO Box 80051
San Diego, CA 92138

Rates: $1.00/issue
($1.50 overseas)
Editor:
Jack McCombs
2510 Crest Avenue
Cheverly, MD 20785
Phone 301-773-1076

HAS IT BEEN THAT LONG?? I hate to admit it, but yes, it has. I plead several excuses for this well-over-a-year lapse in getting your newsletter out to you, none of which are all that justifiable, but -- well, you know how it goes. Lots of time at work (and the commute around here eats up about 8 hours a week by itself), work on the car, the house, and yes, even N75PL. But no, no health problems, accidents, or other calamities have befallen the McCombs family, other than I must have lost my "round tuit" for a while. And yes, for those of you who are wondering, your last newsletter should have been #84; that's the last one I turned out way back in early '89. And I do appreciate the expressions of concern from a few of you who have inquired, but as Mark Twain once said after reading his mistakenly printed obituary, "reports of my death (or any other disaster) have been greatly exaggerated."

One thing that has been taking up a fair amount of my time this past year was the renewal of my flight instructor certificate. This time around I used a new correspondence program that Jeppesen came up with, and I believe it took quite a lot more time than the standard 24 hour weekend course would. For any of you who are CFIs in need of renewal, I'm not sure I can recommend the Jeppesen correspondence approach unless you have an extremely long commute to get to one of the revalidation clinics. In any case, I'm all set for another two years. This may be my last renewal, however, as the FAA has continued to make it more and more complex, liability concerns have become ever greater, and the new guilty-until-proven-innocent drug testing system has been implemented. About the only thing that causes me to renew my flight instructor certificate is the difficulty of reinstating it if it lapses.

On another note, the McCombs household has added another FAA rating, or actually <u>two</u> ratings: Wife Anne is now an FAA Airframe and Powerplant Mechanic! As many of you know, Anne is the reason for our move from Wisconsin to the Washington, D.C. area, when the opportunity arose for her to work for the National Air and Space Museum aircraft restoration facility. That (and earlier work for EAA) work experience and twice weekly classes over the past year plus qualified her to take the battery of written and practical tests required for the ratings. As of October 22, 1990, Anne has both the FAA airframe and powerplant mechanic ratings. Guess who will be signing off the next inspection on N75PL?

Speaking of our "Paz," lately it has decided that the house and car have been taking up too much of my personal time and it wanted some new parts and attention too. Well, I hate being stuck along the side of the road when something breaks, especially when the road is 3000 feet below. So we're in the midst of doing some nice things for N75PL that it's been wanting for a while.

One of those things is to do something about cooling down the oil, and keeping the engine heat away from the fuel system. I have been using auto gas for some time now, which as you all know has a higher vapor pressure (boils easier) than avgas. I wouldn't mind using avgas, but there is no 80 octane on our airport - and I believe the use of the so called 100 octane "low lead" (ha!) to be potentially as bad as other non aviation fuels. Anyway, it appears that N75PL has been gradually finding such auto fuels more difficult to digest over the past year or so, judging from the symptoms such as erratic fuel pressure indications, difficult (or no) starting when warm, etc. After much procrastination, it's now time to install that oil cooler I've had for a while. (In fact, this was to be the day for much of this work, but for a balky electrical system on the car - and a rain storm which is preventing me from working on the car! See what it takes to get a newsletter out of me?)

The engine in N75PL, as many of you may recall, is a Lycoming O-235C, with a HUGE heat muff immediately in front of the oil sump and carburetor. The oil temp has always tended to run on the warm side - over 210 degrees F., call it 100 degrees C. With the carburetor bolted directly to the oil sump, you can imagine what happens to the fuel in the float bowl. Fortunately, so long as the engine is running, that fuel is continually being replaced by fresh, cool fuel.

However, one thing that no one had noticed, even after all the inspections the airplane had been through, was that the fuel line between the gascolator and the primary fuel pump (electric on this engine - there is no mechanical pump drive from the engine) is routed to within a few inches of the cabin heat box on the firewall. This means that the heat radiating from that unshielded box - and the hot air issuing from the dump opening on the bottom - are directly affecting the (uninsulated) aluminum fuel line! The original builder had installed firesleeve on the Aeroquip line between the pump and the carburetor, but for some reason had not done this for the other section of aluminum fuel line described above. You can bet that it now has a section of firesleeve on it!

Another plan in the works is to insulate the heat muff itself. I had purchased some insulating tape (for use on automotive exhaust systems) some time back, but once again my "round tuit" let me down and I had never installed it. Well, the same company also makes a blanket material for insulating turbochargers, so the tape has been exchanged for the turbocharger insulating kit. It should be easier to trim the blanket for the proper

fit, and easier to remove and install at inspection time. A bit of this material around the cabin heat box on the firewall should also help, and perhaps a duct from the heat dump opening to take the hot air down toward the cowl flap opening will also help.

****

It is now January 23, 1992 as I continue the above saga - after yet another year away from the newsletter. Anyone know where I can find some ten day long weeks with 30 hour days in them? Anyway, all of the above was accomplished before and during the annual inspection in the spring of '91, in addition to the usual routine things one does at that time - check mag timing, change the oil, clean the screen, take everything apart (the PL-2 is a fine all around design, but let's face it - there are easier airplanes on which to perform inspections!) and put it all back together, etc. One minor aside here that I found rather interesting: Over the years since we purchased N75PL from the original builder back in 1980, I think it was, I've found a couple of odds & ends in the airplane that shouldn't have been there. It appears that the original builder was kind of like the surgeon who leaves some of his tools inside the patient when the job is done. For instance, while digging around under the panel shortly after purchasing the airplane, I came across a socket driver (screwdriver handle on a square end shank to accept sockets for driving nuts & bolts - you know the kind). I also found a 1/4 inch drive socket somewhere in the interior at some other point.

Well, the really interesting find waited until the latest annual inspection. I had pulled the two inspection plates near the leading edge of the stabilator in the fuselage tailcone, and was peering up at the base of the vertical fin attachment. There was some sort of object protruding partially through one of the lightening holes in the bottom rib in the vertical fin, but it wouldn't fit past the top stringer in the fuselage, which essentially bisects the vertical fin base. After much poking and prodding with various tools and wire, I determined it to be a light bulb socket, with prongs for insertion into a standard electrical outlet!! Apparently the original builder had been using the socket (with light bulb) as a drop light or inspection light, and had buttoned up the vertical fin with the socket still inside! Well, after removing the fairing on the top of the vertical fin and performing much fishing with safety wire, I managed to secure the socket and fish it out through the top of the vertical fin through the lightening holes in the ribs.

Wait, there's more. I started thinking that such a socket would do no one any good without a light bulb - so where was the bulb? I hadn't found any sign of it yet. After more searching with inspection mirrors, wire, etc., etc., I concluded that yes, there was a light bulb in the vertical fin, but it was located in the bay above the bottom bay. Apparently what had happened was that the original builder had installed a bulb in the socket and used them for a drop light during construction. Somehow, the

electrical cord was disconnected and the bulb and socket were forgotten and left inside the second bay of the vertical fin. The reason they never showed up before is that they were screwed together, and the combination was too large to pass through the lightening hole in the rib to fall through where it could be seen protruding into the fuselage until the bulb became unscrewed from the socket, thus allowing the socket to drop to the bottom of the fin.

So, what about the bulb? It appeared that the bulb would pass upward through the lightening holes in the ribs, and out through the top of the vertical fin. After much fussing around trying to get ahold of the thing, I ended up breaking it. That made it much easier to get the larger components out (bigger shards of glass and the base of the bulb), but still left some smaller pieces of glass loose in the vertical fin. At this point I believe we have all of them out of there, with the possible exception of some not much larger than grains of sand. The moral of the story is, make sure you remove all those tools when you're ready to close up an area - and take inventory before you actually do the closure work. Buyers beware - there are things that no reasonable inspection will ever turn up, and you won't find out about until perhaps years later.

Which brings me to my next topic concerning N75PL, speaking of things that don't turn up for years. As I noted when I started on this particular issue many moons ago, we've been experiencing fuel delivery problems with N75PL for a while. Nothing real serious, just things like hard starting when it's warm and the like. We have since completed the various projects I described above - oil cooler, fire sleeve on all fuel lines, insulation blanket around the cabin heat muff - and accomplished the annual inspection (and light bulb removal) last spring while completing all of the above.

As noted above, wife and A&P mechanic Anne took responsibility for the annual condition inspection. (In the U. S., an Authorized Inspector - AI - or authorized maintenance facility must perform annual inspections for certified aircraft. However, for homebuilts the inspection is called a "condition inspection" and an A&P may sign it off. About the only difference is that we don't have detailed manuals on the airframe inspection procedure for N75PL from the manufacturer.) Anyway, Anne made sure all the T's were crossed and the I's were dotted, and found that over all the previous years we've had the airplane (11), <u>none</u> of the mechanics or shops doing the inspection caught one outstanding airworthiness directive on the carburetor. (Yes, since it's a homebuilt, AD's are not technically mandatory. However, if it's on a piece of standard equipment in the airplane - such as the engine - we go ahead with the compliance anyway.)

Seems that our Lycoming O-235 C1B has been around since the '50's when it was originally installed in a Piper Colt. The Marvel Schiebler MA-3 carburetor had been around since those days also. Seems that a few years back, there was an AD calling for

replacement of the composite float with a metal float. All the other mechanics said, "no problem, this carburetor is so old that it originally had a metal float installed anyway". Yes, that was true, so far as it went. However, Anne went back through the engine logbook completely, as she should have in her first inspection of any airplane, and found reference to another AD from back in the '60's, as I recall, requiring removal of the original metal float and replacement with a composite float. Seems that someone way back when, had complied with that AD and replaced the original metal float with a composite float - and the later AD requiring the reinstallation of an original metal float had never been complied with! So, N75PL had a composite float in its carburetor, which was apparently not entirely compatible with some of the goodies they're putting in fuels these days - especially the octane enhancers used to take the place of the tetraethyl lead in "low lead" 100 octane avgas. So, the carb was removed and sent off to Carburetors R Us, or some such place in Texas, as I recall. (The carburetor has done more flying in the past two years than the rest of the airplane.) The throttle and mixture shafts were rebushed and the plastic venturi replaced at the same time, so we now (theoretically) have a nice, fresh, legal carburetor on N75PL.

After all of the above, some time was spent on the ground to see if everything ran alright. The time was well spent, since I had to swing the freshly rebuilt compass anyway. Ever had a compass fail in flight? It creates an interesting distraction when you raise the nose to climb, and the fluid starts running down the face of the instrument panel. But that's another story. Anyway, after three or so runs on the ground with a couple shutdowns and heat soaked restarts to see how it would do (just fine, which was certainly different than past experience), it was time for a test flight. Off we go, to make rectangular patterns around the airport at slightly above pattern altitude to see if anything interesting would happen.

It did. After 20 minutes or so, the engine stumbled a bit, upon which I richened it up somewhat, thinking I had leaned it a little too much. I had closed the cowl flaps, leaned the mixture and was running at around 75% power, to try to heat things up as much as normally possible in order to check out our previous incipient vapor lock problems. The fuel pressure remained good, with no noticeable fluctuations or problems. After another few minutes, the engine just plain flat quit on me. At that point, it was no problem to land, of course, but when I stopped after rolling out, we found fuel dripping from the carburetor air box. Obviously, the float level was too high for some reason and the poor engine was flooding. This didn't show up on the ground for some reason, perhaps due to the lower power settings; I just don't know.

Meanwhile, my poor mechanic and wife had her heart in her throat while all this was happening. My main thought about all this was, "Oh, no, why does this have to happen on the first flight of the airplane after her first inspection signoff?"

Well, we towed it back to the hangar and it was time to return to square one in our troubleshooting procedures.

The bottom line on all the above is still unresolved at this writing, some nine months or so later. But I think we can safely say that we had at least a few problems, each of which was masking the others at least to a certain extent. First of all, I still believe that the oil temp. was too warm, and that the work we have done to reduce the oil temp. was well worth it. On the above flight, it never exceeded about 185 degrees F. on the gauge, and that was at ambient temps. in the 80's. (How accurate is the gauge? - Good question. I don't know the answer.) However, we now have an excessive fuel pressure problem that never showed up before. I suspect the reason it didn't show up is at least partially due to the previously hotter temps. under the cowl, which were serving to drop the fuel pressure due to some incipient vapor lock. I'm guessing that the two factors tended to balance each other to a certain extent, but I have no way of knowing for sure.

Another change in the equation is the freshly rebuilt carburetor. It's possible that the old carb. had an effect on all of the above, too. All this goes to show that you can't change only one thing - you invariably end up affecting other things downstream from your initial change. In other words, when trying something new, it's best to try just one thing at a time rather than changing several things at once. Unfortunately, we didn't have that option this time around, since we knew we had to reduce the temps. under the cowl, and the AD on the carburetor float required compliance. Hence, two changes affecting the fuel system at one time.

Next question: Was the carburetor rebuild properly done? Don't know, haven't had a chance to find out yet. Just because it was done by an approved repair station with all the proper tools and equipment, doesn't mean they can't make mistakes. However, before making accusations, we have implemented yet another change in the system. (!) As noted above, the fuel pressure was in the bounds of reality before the changes to reduce oil temp., but I have found that the fuel pressure is now considerably higher than it used to be. (How accurate is the gauge? - See above for oil temp. gauge.) Anyway, it now indicates around 6 to 8 psi, and upon further research, it seems that the MA-3 carbs. as installed on the O-235 are intended to operate nominally at about 2 to 3 psi. Remember, this system was originally a gravity feed system, probably operating on only one psi.

So, we now have yet another gadget in the fuel system: We have installed a pressure regulator downstream of the two electric fuel pumps (primary and backup). However, we now find that with the fuel pressure regulated to about 3 psi, that the only way to keep the engine running is with the primer. Since experimenting with all of the above, the weather has turned colder and it's no fun trying to sort such things out in the cold. However, we have some thoughts on the matter, beginning with disconnecting

the fuel line at the carburetor and turning on the pump(s) to check fuel delivery. At least with two electric pumps this is feasible without running the engine. Assuming we can get at least ten gallons/hour out of one or the other pump, then it would appear that our problem is the carb. Next step: Check the inlet screen, and then mount a can on top of the engine and try a run using gravity feed. These steps are fairly simple to perform and should at least pin down the portion of the fuel system which is causing the problem. Of course, the way things have been going, it will probably turn out to be more than one problem and will still be a real nightmare to sort out. We'll keep you posted on all this as it evolves.

But enough of the problems of N75PL: It's time to catch up on all the correspondence which has accrued since the last newsletter. First, the answers to the burning questions raised way back when, in newsletter #84. (Yes, as you all now realize, that really <u>was</u> the last issue, since this one is #85.) Anyway, I enclosed cards requesting information concerning each of your PL projects - percent completed, engine, prop, equipment, performance, etc. I've received an excellent response, with approximately half of the cards returned. This is extremely good for such surveys, so I understand. So, what does the average PL builder install in his airplane and how does it fly? Well, I'm not sure there is an average for any PL, but I'll see if I can come up with some answers here anyway.

First of all, how long does it take to build a PL-1 or -2? Most respondents replied with "too long," "years," or some other similar answer. I can dig it, considering how long it has taken me to complete some relatively minor work on N75PL. When you not only have to assemble the components, but also fabricate the components in the first place, the time really goes up. Anyway, after eliminating responses such as **Fred Bouffard's** one billion hours (come on, now - it only **seemed** like it, Fred!) a fairly realistic average seems to be somewhat over 3,000 hours. A couple of us guesstimated exactly 3,000 hours, while **Hans Nielsen** came up with precisely 3,135 hours. Insofar as maximum time spent (no, Fred, I'm not buying your one billion hour estimate), **Frank Kreuzer** put in 5,000 hours building C-GQUS. No one admitted to anything less than 3,000 hours total construction time.

What kinds of engines and props are going on your birds? At least there seems to be a majority opinion on this matter. Of the responses returned, 19 admitted to the type or rating of the engine installed (or planned to install). Of the 19, eleven have Lycoming O-320s of various types, with those split fairly evenly between the 150 and 160 horse versions. Props for these powerplants showed a lot of variation, from a 74/62 down to a 68/68. Most opted for a standard certified prop from a Cessna 172 or the like, such as a McCauley 70/69, although some are using pitches down to 63 or even 62 inches with such props. All but one of these PLs with the O-320s are PL-2's, by the way.

The second place engine, numbers wise, is the Lycoming O-

290, with three PL-2 builders/flyers opting for O-290D's and a PL-1 with an O-290G. There are two of us flying PL-2's with Lycoming O-235's (**ED BOOTHE** and myself), and a couple PL-1's with a Continental C-90 (**JIM LACINA**) and a Continental O-200 (**BOB BRADLEY**).

So, how fast do they go? Well, I'll give you some numbers, but please keep in mind that these numbers don't tell the whole story - partly because I didn't get it from the respondents, and partly because I didn't ask. There just wasn't room on the card to ask for info. regarding every condition or parameter. You'll notice that I didn't ask about empty weight, for example. This is partially due to the lack of room on the card, and also partially due to the fact that with most homebuilts it changes over time, not to mention the biggest factors such as passenger weight and fuel load. Anyway, homebuilts (and factory builts, for that matter) are like people - they tend to get heavier with age. Whether you would consider the various additional avionics goodies which account for a lot of that gain to be "fat," I don't know, but that's where a lot of it comes from with airplanes. Remember, those older weather radar and de-icing boot systems you guys are installing weigh a bunch! Even when such things are balanced out in the equations, there are other factors which enter into the picture. For example, some of you are using flush rivets at least on all forward portions of surfaces, if not over the whole aircraft. I don't know how much speed gain this would account for, but there's undoubtedly some.

With all the disclaimers aside, let's see what sort of numbers we came up with. The fastest of the bunch is **DAVE PANTON's** PL-2, C-GQUK. You might recall that Dave was the previous newsletter editor (and overall was likely a bit more timely than yours truly!), and also has the highest time PL of any of you responding, at over 1300 hours in the air (probably more by now). Dave has made several round trips between his home in Windsor, Ontario, Canada (next door to Detroit) to British Columbia - that must be about 4,000 miles round trip. Anyway, he's had ample time to thoroughly check out the performance of his PL, and finds that max. cruise comes out to 155 mph! Call it 135 knots, for you "knotty" types. Mind you, this is with an O-290D Lycoming, too, although Dave has tweaked his PL a bit with landing gear and wheel fairings and an Ellison throttle body injector type carburetor. I wouldn't be surprised to find that the Ellison puts the power into the range of a stock O-320, or around 150 horsepower or more. This is with a McCauley 70/63 prop, by the way. With this combination, the climb rate (again, no parameters given) is 800 ft./minute.

Many of the rest of you speeders are content to fly around 140 mph (120 kts), with one at 137 mph. Those of you falling into this speed range all have O-320's. Three of you provided this speed, and two of those have PL-2's equipped with wheel fairings. The props are all in the same ball park, being McCauley 70/62 or 70/63. Two of you were at 127 and 125 mph, and in fact the slowest of the O-320 set has the highest pitch prop, at

70/69. There must be something more to this last aircraft/engine/prop combination than I see on the card to account for those numbers.

While we're on the subject of O-320 powered PL's, what about climb rate? Here is where the O-320 group really shines, of course. First, a few words on the theory behind climb rate, with which you may already be familiar. Climb rate is determined (among other things, of course) by the excess power available over than required for level flight under those conditions of airspeed, angle of attack, etc. I don't really know what the power required for level flight for a PL is at the airspeed/angle of attack used for best climb rate, but it's probably on the order of about 60 horsepower or so. This means that you guys with 150 hp have 90 extra ponies available (depending on your prop, etc.) to make your PL's go up, whereas someone with a C-90 would only have an extra 30 horses for climb. So even though you don't triple the horsepower in going from 90 to 150 horses, you do triple the surplus power available for climb.

In fact, this is roughly how the numbers work out. The numbers provided by the O-320 crowd ran from 1100 ft./minute up to 1700 ft./min. (I assume this last figure was at less than max. gross weight.) The average seems to be around 1500 ft./minute. The two O-290 types who provided a climb rate only came up with 800 ft./minute for their airplanes, whereas us O-235 people can climb at an average of around 600 ft./minute. There is an interesting anomaly here, though, for the two Continental powered PL's - at 90 and 100 hp, they can climb at 900 and 1100 ft./minute! The 69/56 and 69/52 props have a lot to do with this, since they allow the engines to turn faster and develop closer to their rated horsepower, but also both of these are PL-1's and I suspect are considerably lighter than most PL's. For example, **Jim Lacina's** N85VB weighs only 836 pounds with some Terra radio gear, which is 84 pounds less than N75PL weighs.

So, how fast do the lower powered PL's go? We've already noted **Dave Panton's** C-GQUK as being speed champion of the bunch, and his is the only O-290 for which I have numbers. The two of us with O-235's don't do all that badly, though. Presently (that is, when I get it flying again) N75PL is capable of 125 mph at the appropriate density altitude to provide 75% power at full throttle. This is within 100 lbs. or so of max. gross weight. I have no landing gear fairings on the airplane, and someday a set of those will go on and the speed should go up further. **Ed Boothe** also has an O-235-C1 in his wet wing PL-2, and quotes two numbers for his cruise - 132 and 125 (mph?). I assume one is max. speed and the other is at 75% power. Ed also has wheel fairings, as well as any cleanup which may have resulted from the removal of the tip tanks. Yes, I understand that these numbers don't fit the equations exactly as one would expect, but I suspect most of the reason for that is that different conditions were used to get the numbers. We all know of pilot handbooks which are wildly optimistic; well, it's just that the manufacturers spent a lot of time and money to determine the right condi-

tions to look good.

As for the Continental powered PL-1's, they don't do badly at all. Would you believe 115 and 122 mph cruise respectively for 90 and 100 hp PL-1's? Their respective climb rates are 900 and 1100 ft./minute, too, as noted above. Looks like they built in a lot of lightness, to get that kind of performance. Of course, **Jim Lacina's** flush riveting no doubt helps a bit, as does the exceptionally light empty weight of 836 pounds. These two airplanes are fairly well equipped with avionics, too.

****

Well, there you have it: An up to the minute summary of how all those other PL's fly. For those of you who are building, you now have some idea of what you can expect in the way of "real world" performance. Over the last year plus since I cranked out the last newsletter, of course I've received a lot of correspondence which needs to be addressed in the newsletter, as well as photographs which can be included. But that will give us all something to look forward to for next time. My work schedule has shifted somewhat, which leaves me with a couple hours a week in the mornings to work on projects such as this. Here's hoping this schedule continues; it's nice to get back to thinking about our airplanes again!

--Jack McCombs,
PL Newsletter Editor

Jack & Anne Mc Combs
2510 Crest Ave.
Cheverly, MD 20785
301-773-1076

NO. VA 220 CM 19 MAR

29 USA

Ladislao Pazmany
P.O. Box 80051
San Diego, CA 92138

N/A