NEWSLETTER

Carb Heat

Hot Air and Flying Rumours

Vol 28 No. 4

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April 1998

Next Meeting:

Thursday April 16, 1998 8:00 PM

Aviation Museum (Bush Theatre)

President:	Gary Palmer	596-2172	gpalmer@nortel.com
Vice Pres:	L. DeSadeleer	727-0285	LdeSadeleer@KPMG.ca
Ops , Publishing, Tools:	Dick Moore	836-5554	rjmoore@uottawa.ca
Membership:	Barney de Schneider	225-6003	bdeschneider@sympatico.ca
Secretary:	Andy Douma	591-7622	adouma@ftn.net
Treasurer:	George Elliott	592-8327	gelliott@igs.net
Editor:	Charles Gregoire	828-7493	cbg@nortel.ca
EAA 245 Website:	http://www3.sympatico.ca/bdeschneider		

As I write this column, we seem to be past the worst of the winter weather, and the field has dried up exceptionally well. By the time you get this newsletter, it should be OK to use our normal rear entrance road. Nonetheless, I encourage caution, particularly after a heavy rain.

On Saturday past, I flew with Garry Fancy in Luc's RV-6 to Smiths Falls for the usual breakfast. The field at Carp was firm enough that Garry decided to move his Cherokee 140 back home.

During my normal investigative tour (snooping?) I found Dale Lamport's beautiful RV-6A undergoing final assembly. This is another work of art that should be zipping through the skies in May, powered by a 180 HP Lycoming O-360 and constant speed prop.

Don't be surprised if this column is missing next month, as I will be out of town for two weeks following our April meeting.

Spring Cleaning

It is that time of year again, and as usual, we will try to get a crowd together on the first Saturday after our May meeting. This year that turns out to be Saturday May 22nd, the week following the Victoria day holiday. If the weather gods permit, we can finally finish our paint job at the rear of our hanger, and hopefully we can also finish installing the ceiling in our workshop.

Look for more information from Dick Moore, our operations manager in the near future. Meanwhile please reserve Saturday morning May 22nd.

Also a reminder to always shut off the heat and electricity in the workshop whenever it is not required. It looks like we will have to install a spring timer assembly as we have for the air compressor.

Young Eagles June 13th

With summer fast approaching expect a call from **Russ Robinson** our new Young Eagles coordinator. I am sure you will support Russ in continuing our fine tradition of hosting first rate Young Eagles events.

Annual EAA Book Sale

The annual EAA book and video sale is on once more. This is an excellent opportunity to order those invaluable Tony Bingelis books, at savings of 40% or more. Order forms are included in the newsletter, and must be pre-paid to **George Elliott** by April 17th.

March highlights

The March meeting was surprisingly well attended considering the late winter blizzard we endured.

Major Claude Roy shared his adventures as a **Jet Hitch Hiker**, during his two-year stint as Base Controller at Bagotville PQ, 1995 to 1997.

This was a fascinating inside look at flight operations at Bagotville, and the view from the cockpit of an F-18. As usual, Claude was in his inimitable fine form, as he regaled us well into the evening.

Hanger 13 Visit

As if Thursday's blizzard wasn't enough, our visit to Hanger 13 at **Smiths Falls** airport on Saturday March 21st, just two days later was a reminder that winter wasn't finished with us. Those who did make the journey, were treated to a home builder's dream world of aircraft construction.

Starting with **Bob Crooke's** classic **Hatz biplane** we saw the attention to detail you would expect from a dentist. I haven't seen that quality of traditional wood construction since salivating over Lars Eif's impeccable Skybolt.

Next in sequence, and sophistication was **Stan Ironstone's Glasair III**, which should fly this year. This is a real rocket, and first class workmanship throughout.

Last, but definitely not least, we visited Joe Brodeur's hanger to view several of his projects, most notably a full scale **Supermarine Spitfire** project. Joe is another consummate craftsman, who also had a Piel Emeraude, and his very first homebuilt project sharing space with the Cessna 310 he rebuilt from the inside out.

April 16th Mtg. at NAM:

Our next meeting will feature a Float Flying video from EAA, that George Elliott assures me you won't want to miss. Our original FSS speaker had to reschedule for our May meeting, and hopefully we will be able to refresh our knowledge of weather briefings and flight plans then.

I look forward to seeing you Thursday April 16th at the **National Aviation Museum**, 8:00 PM start.

Gary

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Young Eagles Fly Day

by Russ Robinson

You may have noticed a change of the organizer for the Young Eagles Program in the Chapter. After a number of years of organizing this event, Lars Eif has stepped aside due to other commitments (mostly his project is moving along very quickly). As the replacement organizer for the Young Eagles (I appeared to have volunteered for the job at the meeting that I didn't attend), I would like to extend to Lars a hearty "thanks" for all his efforts which have made this annual event such a success.

The 1998 Young Eagles Fly Day is scheduled for **Saturday June 13** (with a rain date of Saturday June 20). Again this year we will be looking for volunteer pilots and ground crew to make this event a success. If you would like to help, please put your name on the volunteer sheet which will be available on meeting night, or the sheet posted at the Carp Hangar or call Russ Robinson (831-2485) or Jim Robinson (830-4317). We are planning to organize a "thank-you" Bar-B-Que just for the volunteers following the event.

For those of you who surf-the-web, you might like to check out the EAA Young Eagles page and check the "world's largest logbook". All Young Eagles flights (so far more than 360,000) are recorded with both pilots and Eagles listings.

Piston Element of NASA GAP Program (Cont'd)

by Gregory Travis

A version of this article appeared in the March 1997 issue of aviation consumer. This article was obtained off Greg's primemover web site www.prime-mover.org/engines/ This is the continuation of the article which appeared in last month's newletter.

Overall engine configuration

Current aircraft engines are built with an opposed configuration. That is, each bank of cylinders lies directly opposite the other bank. This gives the engine a low profile - namely, it allows the pilot of a single-engine aircraft to see over the engine while still allowing adequate propeller ground clearance. With a "V" configuration, the engine must either be inverted (which poses oil control problems) or must use an offset drive to power the propeller.

The opposed engine configuration also has some inherent internal balance advantages over the "V" configuration. In the opposed configuration, each bank of cylinders provides an inertia balance to the other bank. There is no need for additional static counterweights as are necessary with a "V" configuration. The elimination of several pounds (often tens of pounds) of counterweights is a significant weight benefit of the opposed configuration.

Finally, because of their steady-state operation, aircraft engines can control damaging torsional vibrations through the use of pendulous dampers. As opposed to the viscous dampers used on most automobile applications, pendulous dampers do not remove torsional energy from the crankshaft and dissipate it as heat. Because of this they are not only more efficient, but they don't have to be overbuilt (read: heavy) so as to not overheat in high-output applications.

But what about electronic fuel injection?

Much is made these days of sequential, multi-port, fuel injection systems prevalent on automobile engines. Surely, the argument goes, fitting such a system on an aircraft engine would improve its fuel consumption. After all, look at the MPG ratings of today's cars - their engines must be really economical!

But this argument overlooks several facts, all of which stem from the usual operating environment of the automobile engine. Automobiles have been able to boast increasing MPG values not because their engines have become more efficient but, rather, because automobiles themselves have become drastically lighter and more aerodynamic. It now takes much less horsepower to propel the average sedan down the interstate than it did twenty years ago. For example, today's Ford Taurus sedan needs approximately 21 horsepower to cruise on a level highway at 65 MPH while the 1974 Volvo 144 required 30 for the same speed.

Furthermore, the advantages of sequential electronic fuel injection are found mostly in low-RPM, low power situations such as stop-and-go city driving. It's in such situations that spraying fuel only when the intake valve is open can reduce emissions, increase fuel economy, and improve smoothness. Above a certain power output and/or RPM, however, sequential fuel injection systems revert to what is, essentially, a continuous injection pattern. At medium-high power settings there simply isn't enough time to get all the fuel needed if the injector is open only when the intake valve is so the injectors must spray fuel continuously; even when the intake valve is closed. Continuous port injection is the system used on most injected aircraft engines. That continuous injection has no performance advantage over sequential injection in aircraft applications is borne out by the fuel consumption numbers when the engines are compared at equivalent power outputs.

As for mixture management, remember that an aircraft with a four-probe EGT system installed has the most sophisticated closed-loop mixture management system available in the world. Utilizing full wetware artificial intelligence processing, the system is able to not only maintain optimum air/fuel ratios in cruise operation but to also predict changes in fuel mixture long before they're actually needed and based upon a plethora of factors. I'm talking, of course, of the human being flying the aircraft and the mixture control.

Computerized mixture control is important in a highly dynamic environment (such as street driving where you can't expect to manipulate the mixture AND avoid the shopping carts) but much less important in the typical steady-state cruise environment found in aircraft. Since both systems (hardware vs. wetware) can perform equally well at determining cruise mixture settings it's sometimes hard to justify the extra expense, complexity, and weight of the automatic system in an aircraft.

IT'S NOT FOR LACK OF TRYING

Still, both major manufacturers and a number of other players have tried to introduce new design engines into the marketplace in years past. In the 1960s, Continental embarked on an ambitious project called the Tiara engine.

This engine was supposed to be both cheaper to manufacture as well as cheaper to operate than existing engines. It incorporated several innovative features such as a combined camshaft and propeller drive, torsional vibration control via a quill shaft, and fuel injection. Because of the reduction gear, propeller noise was low and propulsive efficiency was high. The engine was certified and went into production but buyers were few and far between. Operationally, the engine wasn't significantly different from others (it was supposed to be slightly lighter but that didn't pan out) and no one cared about noise in the 1970s. Continental's John Barton says that, in a way, the engine was before its time. Today, with more stringent noise standards, it might have had a fighting chance.

Continental tried again in the 1980s with their line of liquid-cooled Voyager engines. Development for these engines was underwritten by the U.S. taxpayer as the government needed an engine that could operate efficiently at high altitudes for the then-secret CONDOR program. Turbine engines lose power as they climb and they have extremely high fuel consumptions at low power settings and the government needed an engine that could loiter at 80,000 feet for hours. It turned to Continental to build the engine which subsequently became Continental's Voyager (after the Rutan aircraft which used one and circled the globe unrefueled) line.

The Voyager engine has been offered to the public as both a replacement for the Cessna 414's air-cooled engines as well as a replacement for the standard engine in the Bonanza. Neither has sold terribly well - RAM claims to have not sold a 414 conversion for over a year and a half. Part of the engine's problems can be traced to teething pains, many of which may have been caused by the mandated use of Mobil-1 oil (the policy has changed). But the fact remains that the engine offers little over the older air-cooled engines to justify its higher price.

Lycoming's changes have been mostly towards manufacturing ease. The infamous "76" series engines (O-320-E and O-360-E engines) were introduced to take advantage of a new computerized crankcase line which Lycoming had bought. Prior to that was the 541 series, notable for its similarity to Continental's designs (against which Lycoming was furiously competing at the time), and its lack of a separate accessory case which was a cost-saving measure. In the 1980s Lycoming experimented with autofuel in their existing engines as well as going so far as building a diesel engine based on their current configuration and the revolutionary SCORE engine (see below).

Porsche and Mooney tried with an engine derived from the 6-cylinder 911 auto engine. The project was abandoned when it turned out that the engine, as installed in Mooney, was heavier and had poorer fuel specifics than did the Lycoming it replaced.

Other manufacturer's have tried to break in to the market with various variations on auto engine conversions as well as radical departures such as the Dyna-Cam and Rand Cam engines. None have, so far, been commercially viable.

BUT CHANGES ARE COMING

We've seen that current aircraft engines aren't quite as technologically backwards as the common wisdom would believe. In fact, for their application, they're actually excellent performers but that doesn't mean what we see is what we'll get forever. Two significant trends are developing in the industry. One trend has to do with how we control our engines and the other one with how we fuel our engines.

Digital Engine Controls

The first trend is that the single-lever power control is back and it's back with a vengeance. The basic idea is that, instead of having three misshaped and greasy knobs to play like an old pump organ, there is just a single lever which the pilot positions according to his power needs. Computers take care of all mixture management, prop pitch, etc. automatically adjusting each for optimum engine efficiency without possibility of engine damage.

Currently, there are no less than three companies working on so-called FADEC (Full Authority Digital Engine Control) for certified engines. FADECs are "full authority" in that the power lever manipulated by the pilot is not physically directly connected to anything on the engine itself. Rather, the power lever serves as an input to the FADEC computer and the computer then operates servos which move the mixture, prop, and throttle controls on the engine. FADECs usually also control spark timing directly. Thus the FADEC has "full authority" to place the engine in whatever configuration it wants and there's nothing the pilot can do about it save hope the FADEC pays some attention to the power lever position.

FADECs are conceptually simple devices but, like so many things, difficult to deploy in real-world aircraft situations where one must worry about rain, lightning strikes, software bugs, and power failures. Nevertheless, FADECs have been used for years as turbine-engine controllers in airliner and military service. Don't let the fact the former always has multiple engines and the latter utilizes an ejection seat stop you from running out and getting one for the family Skyhawk.

I asked Lycoming, who is furiously testing Hamilton-Standard FADECs on their engines at the Williamsport plant, what they perceived as the advantages of FADECs. The simplicity of single-lever control was one answer. However the other answer, frankly, surprised me. Lycoming's position is that the FADEC will enable a 10-20% fuel savings on existing engines in block-block fuel use.

In addition to the advantages of advanced ignition timing at cruise and low powers, Lycoming feels that the FADEC will do a much better job of aggressively leaning the mixture both in the climb as well as the descent portion of flight. Thus, while cruise fuel specifics might not be much affected over that achieved by normal leaning, significant benefits will accrue during climb and descent periods where the average pilot sorely ignores his leaning duties.

Interestingly, Lycoming bases this opinion on information they acquired when testing an electronic fuel control on their engines over a decade ago. That project never went into production but flight tests showed a block-block fuel savings of over 15% when standard pilot technique was used Continental also developed and tested an electronic fuel control in the same period but it's unclear what their results were.

The Hamilton-Standard unit which is being evaluated by Lycoming completely replaces the traditional Bendix/Precision fuel servos and the magnetos. The unit incorporates "batch" style electronic injection and hall-effect electronic ignition. Lycoming's position is that single-lever power control is the wave of the future and that incorporation of a FADEC to their traditional line of engines will modernize the engines.

Unison industries, maker of Slick magnetos, is rapidly developing their LASAR electronic ignition into a full-fledged FADEC unit. Already the LASAR system, using only ignition timing advance, has improved the BSFC of carbureted Lycomings by 0.04. On the injected IO-360-A Lycoming Unison claims an even greater improvement of 0.06 which places the total IO-360-A cruise fuel consumption well below the 0.400 mark. LASAR's ignition timing can be quite aggressive with advances of nearly 40 degrees possible in certain situations. Contrary to some belief, the LASAR system will begin advancing the ignition timing even at very high engine power levels so long as cylinder head temperatures remain within limits (LASAR now includes a cylinder head temperature probe).

Unison's Brad Mottier says that Unison is working with Precision on a conversion kit which would allow Precision's fuel injection units (used on most injected Lycoming engines) to be controlled by the LASAR system's processor. Unison says that production LASAR systems already incorporate the parts and software to perform full FADEC functions but that adapting existing fuel controls to use them will take some time. Current plans call for the mixture control function of the LASAR system to operated in a so-called "open loop." In an open-loop, the computer cannot take advantage of engine sensors, such as EGT, to optimize the mixture. Instead, mixture settings are derived from a lookup table in the system's memory which correlate RPM and manifold pressure with known mixture settings. Since the settings are static, the system cannot automatically account for variances in individual engines (such as wear) or environmental changes (such as humidity). However, Mottier and Unison engineer Dean Mechlowitz say that development of a closed-loop system with full autothrottle control is under development. Mechlowitz doesn't feel that electronic fuel injection will help much with cruise fuel specifics but, like Lycoming, feels that it will go a long way to help fuel consumption during climbs and descents where the pilot is often too busy to keep up with the mixture knob.

Toyota is also working with Hamilton-Standard to develop the FADEC for Toyota's new aircraft engine.

Return of the monster piston engine

Both Toyota and Orenda are taking a serious look at introducing all-aluminum V8 engines to the GA scene. Toyota has certified its Lexus 350-horsepower V8 automotive engine and is busy flying it on a Piper Malibu in an exhaustive test program. Very few details about the program are available but, according to one insider, there are precious few automotive parts left in the engine.

Toyota is serious about the market. Articles in the Japanese press report that Toyota intends to build an aircraft factory in the United States to build a four-seat aircraft. Is this the platform for which Toyota has been developing their engine? Are Witchita, Williamsport, and Mobile about to experience what Detroit went through in the 1970s?

Orenda is taking a novel approach. Instead of having to compete with existing reciprocating engines, they've decided to position their engine as a turbine-killer.

The Orenda 600 is a 600HP (500HP continuous) aluminum V8 of roughly 750 pounds (not including cooling system). For certification ease, the engine uses standard aircraft magnetos and fuel injection. They are quick to point out that the parts used in the engine are all from aerospace vendors - not automotive sources. Orenda claims a BSFC of 0.42 for the engine which, given the target horsepower, seems reasonable although the Orenda's bore is only 4.44 inches. For comparison, the 400 horsepower (continuous) eight cylinder IO-720 from Lycoming has a

5.125 inch bore and a BSFC of 0.40. The Orenda is also a little heavier than the Lycoming at 1.5 lbs per horsepower vs. the IO-720 at 1.42 lbs per horsepower. Still, the addition of electronic ignition could well bring the Orenda's BSFC below 0.40. The Orenda also incorporates dual turbochargers which will allow it to make its rated power to 20,000 feet while the Lycoming is naturally aspirated. The turbos exact both a weight and an efficiency penalty from the engine.

Diesel engines

Probably the biggest development in the past decade is Continental's announcement, with NASA, that they are going ahead with development of a two-stroke diesel aircraft engine. NASA recently awarded $9.5 million dollars to Continental in a competitive bid that pitted Continental, Lycoming, Zoche, and other engine manufacturers against one another. In winning the bid, Continental pledged to design, test, and deploy a new 283 cubic inch, 200 horsepower, four-cylinder, direct-drive diesel engine on a Piper Seneca within three years. Continental's target fuel consumption for the diesel is a reasonable BSFC of 0.36.

Why diesel? The main reason is fuel. While aviation gasoline (AvGas) isn't going anywhere soon, it's clear the fuel's long-term viability is in serious question. Europeans are used to paying several times the amount we enjoy in the United States for fuel and in other parts of the world it's being eliminated completely. For companies such as Piper and Cessna, which hope to be able to derive a significant portion of their revenues overseas, having to equip their new planes with engines for which fuel is or soon will be unavailable isn't a viable option.

A diesel engine will be able to use airport jet fuel. Thus fuel availability won't be a question for such an engine in the future. Also, jet fuel is significantly less expensive than AvGas which should reduce overall operating costs.

Diesel engines are no novelty to either Lycoming or Continental. Both firms built large diesel engines for the military during the 1960s and Continental built an air-cooled diesel radial as a tank engine.

Continental

Continental's diesel is of the traditional opposed-engine design but similarities with other aircraft engines end pretty much right there. On the diesel, each opposing pair of cylinders are situated directly opposite each other (instead of being staggered as on gasoline engines) and share a common crankpin through a slipper rod arrangement. With proper application of static counterweights the four-cylinder engine should thus be free of the nemesis of traditional four cylinder engines - an unbalanced secondary moment vibration. Furthermore, since it is a two-stroke engine, the Continental engine has a piston fire every 90 degrees instead of every 180 as happens in a four-stroke gasoline engine. The combination of these two design traits should make for an extremely smooth four cylinder engine.

In addition to the above, the Continental engine also features liquid cooling, roller tappets, and a scroll type belt-driven supercharger. It is Continental's intention to produce retrofit kits so that the engine may replace their traditional air-cooled gasoline engines. Thus the current form-factor of the diesel engine closely matches the existing engines. The diesel engine generates its maximum power at only 2200RPM so it should go a long way towards providing a quieter environment both in the cockpit and on the ground. The roller tappets drive pushrods which open and close the exhaust valves (yes, there are two per cylinder). Intake is via forced induction through ports in the base of the cylinder.

It is also Continental's intent that the new engine be extremely economical to manufacture. To that end, they've designed the engine with, essentially, only two major assemblies. Each crankcase half incorporates the cylinders and head assemblies as part of the casting. The cylinder barrels will incorporate stainless-steel inserts for the pistons and rings to bear against. The engine will also incorporate dual alternator mounts, an air-conditioning compressor mount, and three standard accessory pads. Continental intends to expand the line with a 400 horsepower six and a 600 horsepower eight cylinder engine at some time in the future.

Lycoming

Lycoming was disappointed that it didn't win the NASA bid but that hasn't stopped it from looking towards a "fuel-driven" engine as well. Lycoming had already experimented with alternative engine configurations and fuels during the 1980s when they partnered with John Deere and what was left of Curtiss-Wright to build the 400 horsepower SCORE rotary. The SCORE was to be a stratified charge omnivorous rotary engine (hence its name) which could run on jet fuel, as well as gasoline, and which weighed significantly less than existing engines. Because of its stratified charge (in which an extremely lean mixture is set afire by a much richer mixture), the SCORE engine was able to produce BSFCs of 0.40-0.43. These numbers are very good for a rotary engine as they are notoriously fuel thirsty engine development at Curtiss-Wright in the 1960s

Unfortunately the engine got heavier as development continued. Particularly troublesome was the fact that the SCORE required a huge turbocharger and that added weight. Because of the stratified charge, the engine was "air-thirsty" and, even with turbocharging, lost power as altitude was gained. The realization that the engine would not be as competitive on a weight basis as had been hoped occurred just as the general aviation market was collapsing. As a result, Lycoming cancelled the project in the late 1980s after spending over six million dollars on development.

At about the same time that it was working on the SCORE engine, Lycoming adapted one of their traditional engines to the diesel cycle. They plan on pulling this four-cycle engine out of the closet and running it again early this year as an internal research project. Using what they find from their research, they may enter production with the engine or they may decide to partner with another firm to develop a new or adapted two-cycle diesel engine.

Lycoming, as is often the case, is proceeding much more conservatively with regard to production of a diesel engine. Their intention is to spend a little bit of money now on research before committing themselves to a major new initiative. On the one hand they acknowledge the need to find an alternative to engines which must use AvGas. On the other, they are not sure the market will support a reasonable return on investment (or any return at all) on new-design engines.

Zoche

The other potential player in the diesel engine game is Michael Zoche AB of Munich, Germany. Zoche points out that a major reasons for a market for their engine is the situation with AvGas in Europe. With a combination of lower BSFC and the ability to burn Jet-A, the aircraft owners in Europe should be able to rapidly amortize the cost of converting to the Zoche.

Zoche has developed a family of 2, 4, and 8 two-stroke radial diesel engines. All are turbocharged and feature exceptional power-to-weight ratios (the main benefit of the two-stroke). The Zoche, like the Continental, uses a slipper bearing; there are no master and slave rods as on a traditional radial. Because of this and because it too is a two-stroke, the Zoche should also prove to be an exceptionally smooth engine.

The ZO 01A is typical of the line. It has four cylinders, weighs 185 lbs, and produces 150 HP with a BSFC of 0.365. Zoche is simultanously certifying this engine in the United States as well as Europe and anticipates a 2,000 hour TBO. A unique feature of the Zoche is its pnumatic starting system - said to cause the engine to transition from stopped to running almost instantly.

Tim Coons, of Mooney Modworks fame, plans to run the eight-cylinder 300 horsepower ZO 03A next year in a Mooney 252. Coons claims the Zoche has half the frontal area of the equivalent opposed aircraft engine and half the fuel burn. Tim feels that the diesel's BSFC curve is not so much a curve as it is a plateau. In other words, diesels have poor BSFCs at low relative powers (like all engines), but that BSFCs are relatively steady for moderate and high power settings and don't exhibit the characteristic "bucket" normally found with reciprocating gasoline engines.

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Is there a market?

Suppose we did decide that a radical redesign of the current crop of aircraft engines was technically justified. Now it's time to go to the beancounters and try and make a business case for investing millions in this new engine.

And we are talking millions: Continental will spend over $20 million developing their new diesel engine, Lycoming spent roughly the same amount (in today's dollars) developing their SCORE engine of the mid 1980s. Well over $10 million has gone into the Orenda engine over the years. If you think these numbers are impressive realize they're but a fraction of the amount Detroit would spend to develop an all-new piston engine for one of their cars.

Unfortunately, for the past decade or so, the industry hasn't needed more than about 600 new engines per year from each manufacturer. Is it realistic to sink $20 million into engine development with such a low volume production? After all, if we have a generous 10-year amortization of development costs and we ignore the time value of money, that represents over $3000 per engine sold. Even that figure is hopelessly optimistic as it assumes that, immediately, all your new engine production will switch over to the new model; an assumption that's not going to bear fruit unless your new engine represents a significant advantage over the previous models.

How about new engines from other companies, besides the big L and C? Frankly, you have to be either very clever or seriously insane to try and break into the certified engine market at this point in time. Lycoming and Continental have had the advantage of being able to incremental increase the reliability of their engines over decades. They've also built their reputations for reliability within the same generous amount of time. Remember that the first opposed engines from each manufacturer in the post-war period had TBOs expressed in hundreds, not thousands, of hours. Each has had the luxury of detail refinements to their engines, as well as years of field experience, that set current TBOs in the 2,000 hour range. That TBO figure is now the bar above which all competitors must immediately jump in order to be perceived as contenders. Set your TBO below equivalent offerings from the big two and people will ask what's wrong with your engine? Set it above a prudent value and risk gaining a reputation for not reaching TBO. Damned if you do and damned if you don't as they say.

Another factor barring entry to competitive firms are a lack of decent distribution and support networks. No one will want to buy your engine if they can't get parts quickly in an AOG (aircraft on ground) situation. If you're counting on sales of parts to provide a significant revenue stream (as Continental and Lycoming do) then forget about it being a factor for a decade or so when the 2,000 hour engines finally start coming back to the factory for rebuilds.

This phenomena is, by no means, limited to the certified engine market. Imagine trying to break into the commercial jetliner market at this point. The venture capitalists would laugh you out of the boardroom. Airbus has spent an amount equivalent to the purchase price of the southern hemisphere trying to do just that and still hasn't made money. Likewise, image trying to carve a niche in the personal-computer industry if you don't want to use Microsoft products running on Intel hardware. Good luck.

And it doesn't seem reasonable to expect that radically reduced prices for engines will herald a new day in the GA market either. The price of the certified engines in today's airframes ranges from approximately 15% (Cessna 172 class aircraft) down to 7% (Beechcraft Bonanza) of the total purchase price of the aircraft. Even the obscenely expensive TIO-540-AE2A (list price about $100,000) is less than 10% of the total cost of the Malibu Mirage into which it goes. The point is that even if Continental and Lycoming gave their engines away for free it wouldn't have much effect on the prices of new aircraft nor could we expect piston aircraft prodiction to jump from 576 aircraft in 1995 back to 1978's 17,000 aircraft just because of a 7-15% price reduction.

Conclusion

Significant changes are afoot in the aircraft engine business. As we seen, it looks like our engines are finally getting electronic controls and something is being done about the fuel issue.

But questions remain on both fronts. Will single-lever power controls increase the GA market by bringing in pilots who don't want to mess with throttle, prop, and mixture controls? Or will they be seen as expensive, heavy, unneeded additions with limited macho appeal? After all, there is a precedent in aviation which goes against refinements which demand less skill from the pilot. Pilots have traditionally shunned innovations such as tricycle gear, the centerline-thrust twin Cessna 337, Mooney Porsche's single-lever power control, and computerized airliner cockpits which they perceive either as taking them out of the loop or of requiring fewer skills. One aviation writer, when told of the FADEC developments, said "I don't want a single lever power control, I was something that increases the utility of the aircraft. I want thunderstorm protection!" Another manufacturer of supplemental fuel products for aviation piston engines worried about being left out of the engine-control loop without the traditional mixture and prop controls.

As for new-engine development such as that by Continental and Zoche. Will these longshots payoff in the years ahead by increasing the piston general aviation aircraft's utility? Or will both firms find themselves in dire straits in years hence when their tremendous investment doesn't pay dividends and the industry continues to slop along at production levels more appropriate for oil tankers than it is for a durable consumer good?

Gregory R. Travis

Greg can be reached via e-mail at greg@littlebear.com. He also maintains a web-page devoted to reciprocating engines of all types at:

http://www.prime-mover.org/Engines

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Control wheel yoke assembly from Piper Tomahawk

Engine, VW 1600cc completely rebuilt
Garry Fancy (613)-836-2829 01/98

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:

cbg@nortel.ca 01/98

EAA Chapter 245 Membership Application

NEW:___ RENEWAL:___ DATE:__/__/__
EAA NUMBER:.....................
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NAME:...
ADDRESS:...
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AIRCRAFT &
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OTHER AVIATION AFFILIATIONS:
COPA:____ RAAC:____
OTHER:____________________________

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