EAA Mount Rainier Chapter 326 Newsletter

Thun Field - February 2006 86

Meeting Notice

Tuesday, February 14th, 7 PM
CAP Building, Thun Field

Program:
Arlington Education-Exhibit Center, Barbara Tolbert

Refreshments: John Glaisyer

From the Secretary

January 10th, 2006

Gordy called the meeting to order.

Paul Yarbrough let us know that he won't be able to continue Treasurer duties, and in true Chapter 326 fashion Norman Pauk has stepped up to fill the void.

Smitty gave the annual call for all hands to help out with the NW Aviation conference at the Puyallup fairgrounds. Setup on Friday afternoon, work slots on Saturday and Sunday, and tear down Sunday evening.

The program for January was Electrical System design and fabrication presented by me! Here are some links to some of the information presented for those that missed it:

http://gallery.karmy.com/v/akarmy/electrical/

http://www.aeroelectric.com/articles.html [Bob Nuckolls' stuff]

http://www.bandcspecialty.com/ [tools and supplies]

http://www.steinair.com/ [tools and supplies]

That's it for this month – Andy

Northwest Aviation Conference and Trade Show
February 25 & 26
Saturday 9:00 am – 5:30 pm
Sunday 10:00 am – 4:00 pm

Be prepared to sign up for a couple hours in our booth.

Mag Check & the Failed Plug
Andy Karmy

I had just completed my 100 hour scheduled plug cleaning, gapping, and inspection. Everything had checked out fine, but there was a bit of lead in the lower plugs. To be expected I guess. With them all cleaned out and reinstalled it was time for a run up check and then off to Portland.

The mag check seemed fine, with the normal drop on each side so with that it was time to head out. Now I don't know about you, but I was taught to simply look for a target of 50 RPM drop as you check each side during your mag check.

I have since found that with a modern instrumented airplane you have other options that will help diagnose what's happening. Now I switch my engine monitor to display all four EGTs. With 1800 RPM set and EGT stable, switching one side off will give you rising EGTs across all cylinders. This is because you are not fully burning all the fuel inside the cylinder, with some going out still burning in the exhaust header. This is what gives the rising EGTs. Now if you were to see one EGT not rising, you would know instantly that you had a plug problem and which cylinder it was. This is much better than simply…did I get 50 RPM.

Back to the story, off we go, RPM good, temps good, making full power, climbing out of Auburn. Passed Thun at 1500ft and started to lean out a bit with the power pulled back. Now somewhere south of Thun the engine started running rough. As your heart races and you start looking at the engine information to see what you should do, it's hard at first to make sense of the info you are being presented. What I saw was three good EGT's and one, the right rear, with a spiking EGT. At this point it was about 250deg hotter than the others. I'd never seen this type of indication. At times I've seen one a bit low due to mixture distribution with my carb, but never way hot.

I try a richer mixture, it gets hotter, hum that's strange, try leaner, engine gets rougher, hum… Try a slight reduction in power, things get smoother and EGTs trend towards a more normal indication. So I continue on… This might not have been the best decision I have made. I finally limped into Scappoose with an engine that won't run much above 2000 RPM and messed up EGTs. On the ground I did a quick mag check. Mag off, running on the electronic ignition everything seems fine. Switch to Electronic ignition off, mag on, WOW Backfire! Hum, seems we have a problem! Right rear starts to cool off as soon as I switch off the electronic ignition.

I pulled up in front of an A&P shop at the north end of the runway, pulled the cowl, borrowed a plug wrench, pulled the right rear plug on the top side (Mag connected, and right rear indicated by my EGT indication). Looking at the plug there is a short bar of lead welded between the electrode and the center. Totally shorted out! Flip it out of there, reinstall everything, mag check is good, off I go heading for home.

Engine runs smooth and normal all the way back to Seattle. Hum, what have we learned today. First, EGT is a great indication of what's going on inside your engine providing you're able to monitor all four cylinders. Second, when things are not going "normal" for crying out loud, set the thing down, don't keep pressing on as you figure out what's going on.

Fly safe out there – Andy Karmy, RV9A

Subaru Conversions

Racetech Inc, Calgary

These guys have an EJ22 Subaru turbo powered RV6A, equipped with SDS EM-4 4F engine management system. They have good racing credentials and a few opinions.

Turbos, Aircraft Engine HP and Fuel Burn Myths

Many people ask me why our Subaru engines are turbocharged, why not just use a larger naturally aspirated engine? There are 4 primary reasons:

1. Torque- Turbocharging is the most effective method to boost torque. Torque is what drives your prop. A naturally aspirated engine cannot hope to match the torque output of even a much smaller turbocharged engine.

2. Weight- With the addition of around 25 extra pounds for the turbo, intercooler and plumbing, the turbo system can deliver an easy and reliable 50 to 60% gain in torque and hp. This cannot be matched with a larger engine.

3. Altitude performance. Even if you had a much larger and heavier naturally aspirated engine, it would start losing power as soon as you left the ground. The turbo has far superior hot and high performance as well as superior climb and cruise power at altitude. Speed above 15,000 feet is improved considerably.

4. Reliability. Because the turbo engine develops more torque everywhere in the powerband, you can use much lower rpm to achieve the same power. This reduces the inertial stresses on the engine considerably. High rpm causes far more wear than the extra cylinder pressure of a low boost turbo system. It is important to remember that inertial stresses vary as the square of the rpm. Heat stress is of little concern with a properly designed water and oil cooling system. Stock camshafts can be used with low valve spring pressures, soft ramp rates and factory reliability. The high lift, rapid opening aftermarket camshafts used by certain Subaru converters are a proven reliability concern.

It is best to take some manufacturers claims with a grain of salt. Simple math can often tell you if their claims are BS.
Torque X RPM divided by 5252 equals hp. Hp X 5252 divided by RPM equals torque. Reduction ratio times torque equals prop torque.

One company claims 180 hp at 5900 rpm out of a naturally aspirated EJ22. This is highly unlikely as the engine would have to develop 160 ft/lbs of torque to achieve this figure. Even with extensive head work and a camshaft change, this is not going to happen at this high rpm. The peak torque might be 160, but not at 5900 rpm. The stock engine develops maximum torque at 4400 rpm and only develops 126 ft/lbs at power peak (5400 rpm). Typically, head work and performance cams will develop slightly more torque than stock at a somewhat higher rpm. 34 ft/lbs at 500 more rpm just won't happen in real life. Performance cams almost always have more valve overlap which usually has a negative impact on fuel flows. A well matched turbo system can and does recover some energy from the exhaust and reduces pumping losses on the intake stroke substantially to achieve better fuel flows.

Another company provides all the figures which you can work back and forth, but the prop torque does not come out right and their figures are just plain hard to swallow with an admitted 8% loss in the belt type redrive (their figures). Just be careful about what you get for all this money. You may be disappointed.

Lately Chev aluminum V8 engines are being offered to power various aircraft. One company claims their package including prop, all accessories and coolant is the same weight as an IO-360 Lycoming with C/S prop. I figure the Lycoming at about 455 lbs., theirs is 538. Claimed hp is 375 at 4400 rpm yet they use the identical IVO propeller that we use on our 180hp Subaru which is not enough to absorb the full hp of our engine at flight altitude and speeds. Granted we turn ours to 2200 rpm and they turn theirs to 2600 but calculated maximum absorption is on the order of less than 300 hp at this rpm. How can the engine put out 375? Torque at the prop is claimed to be 525 ft./lbs. yet with a 1.7 redrive ratio, this should be 760. Fuel consumption is claimed to be 15 gal./hr. at max power which represents a SFC of .24 lbs./hp/hr., better than virtually every diesel engine built today. How? Finally the TBO is set at 3500 hours yet the engine has never accumulated even 1/5 of this time. These values are all highly suspect even at a glance.

Yet another Subaru converter publishes what are said to be actual test results of hp, torque and fuel flow on the EJ22 and EJ25 engines. These figures have no basis in reality in my opinion. For instance if we take the figures for their EJ25 engine at 5200 rpm, they claim 189 hp, 396 ft./lbs. of torque at the prop flange with a 2.12 to 1 reduction ratio and a fuel burn of only 8.9US gallons/hr. How do they get a SFC of .282 lbs./hp/hr.? The volumetric efficiency comes out at 133%. Not bloody likely! Their EJ22 at the same rpm develops only 114hp (75 less hp with only 300cc less displacement!!!!) yet somehow, mysteriously, still develops 321 ft./lbs. at the prop flange with the same redrive ratio. How? It should have only about 242 ft./lbs. The EJ25 somehow develops 189 ft./lbs. at the crank at 5200 rpm, naturally aspirated from 2.5 liters. Pretty impressive. Boy, Subaru should fire their engineers and hire these guys!!! Can you believe anything from a company which publishes information like this?

I was looking at many of the Subaru aircraft engine sites a couple of days ago. One company offers their engines with a mechanical fuel injection system, extolling the virtues of this over EFI and the fact that there is no computer or sensors to fail yet they use a microprocessor based ignition system with a failure prone magnetic crank sensor. This is simply illogical nonsense.

Another company advertises that their Subaru conversions will cut fuel flow in half compared to conventional aircraft engines. Again, this is utter nonsense. This implies that their Subaru conversions achieve specific fuel consumption figures of something on the order of .23 lbs./hp/hr. This is far lower than the best direct injection diesel engines available today which have 23 to 1 compression ratios and much higher thermal

efficiencies. This is a thermodynamic fantasy on any Otto Cycle engine. How these figures are arrived at is a mystery and casts doubt on any other claims made. Subaru's own engineering data quotes a best BMSFC of .46lbs./hp/hr. for their EJ series engines so unless these guys can run their engines at 30 to 1 air/fuel ratios, this claim is downright false. They also claim 180hp at 5800 from their 2000cc engine. This represents a VE of 142%. Again, the factory Subaru engineers must all be idiots since they can't achieve figures like this.

The biggest load of BS I see on most alternative engine sites is probably on fuel flows. Below are some representative SFC (specific fuel consumption) figures for various engine types. SFC describes how much fuel is burned in pounds per hour to produce 1 hp. One US gallon of Avgas weighs about 6 lbs. SFC is one measure on how efficient an engine is. The lower the number, the more efficient.

Automotive engines .40-.50
Small Lycoming/ Continental engines .42-.47
Large injected Lycoming/ Continental engines .37-.45
Turbo compound engines .34-.39
Light Diesel engines .27- .30
Industrial diesel engines .23-.27

The thermal efficiency of an engine is largely determined by its compression ratio and the type of fuel it burns. Diesels use about double to triple the CR of most gasoline engines and burn fuel that has a higher energy content per pound, therefore they have much higher thermal efficiencies than gasoline Otto cycle engines. It is IMPOSSIBLE for conventional Otto cycle engines available today to approach the SFCs that diesels offer. If you read of some gasoline engine making 200 hp that only burns 10 US gallons/hr., this is an SFC of .30 and complete BS. Best not to believe any other claims that this company makes about their engines.

http://www.sdsefi.com/aircraft.html

1st Annual Northwest Formation Clinic 2006

Friday June 30th — Sunday July 2nd
Redmond, Oregon (KRDM)

In response to the large and active Northwest RV community (home of Van's Aircraft), and the growing interest in formation flying, this event is being organized by local RV pilots Mike Wilson and Randy Lervold. Although we're from the Portland area, we chose Central Oregon because of its consistently good weather and wide open spaces. We believe the Redmond Airport will prove to be an excellent venue for this event.

The purpose of this clinic is to advance formation skill levels and discipline of all involved. The seminar will be held for all skill levels: beginner, intermediate, and advanced. Stu McCurdy of FFI will conduct the Friday morning ground school and then briefings for each flight. On hand will be some very experienced formation pilots to help train and mentor the newbees and intermediates.

There is a fee of $150 for logistics, lunches, an event-shirt for each participant, ground transportation, and other organizational expenses. Please note that this is an RV-focused event. For safety reasons, we can only accommodate other aircraft types if you have enough like aircraft to form a flight (2-4 planes). Aircraft will NOT be mixed.

For more information on formation flying and FFI, see this AvWeb article on formation flying. Please see the remaining pages of this site http://www.romeolima.com/FormationClinic/ for all other event information. We hope to see you there!

Bird Strikes

Q: How frequent is a bird strike to the windscreen when said avian creature must first pass through the 76" diameter, 180 HP meat grinder?

A: Consider the width of the blade compared to the area of the propeller disk. A lot is going to get through. 2500 RPM is 42 RPS. With a two-bladed prop that is 84 blades-per-second. The "hole" between blades going by is then open for 12 ms.

If the bird is traveling at 160 kts or 370 fps and has a length of 1 foot, it is going to take 3.7 ms to pass through your prop arc. That implies to me that most birds will likely pass through your prop arc without ever being touched by a prop blade.

And it doesn't matter that much that the prop chops said bird into two pieces. The combined momentum of the two pieces doesn't change and will still likely hit your windscreen with effectively the same impact.

My guess is that it doesn't matter one bit. That sucker is still going to give your windscreen one hell of a whack.

Brian Lloyd

A minister dies and is waiting in line at the Pearly Gates. Ahead of him is a guy who's dressed in sunglasses, a loud shirt, leather jacket, and jeans.

Saint Peter addresses that guy, "Who are you, so that I may know whether or not to admit you to the Kingdom of Heaven?" The guy replies, "I'm Joey Shasta, retired pilot, of Pittsburgh, PA." Saint Peter consults his list. He smiles and says to the pilot, "Take this silken robe and golden staff and enter the Kingdom." The pilot goes into Heaven with his robe and staff.

Next it's the minister's turn. He stands erect and booms out, "I am Joseph Snow, pastor of Saint Mary's for the last 43 years." Saint Peter consults his list. He says to the minister, "Take this cotton robe and wooden staff and enter the Kingdom."

"Just a minute," says the minister. "That man was a pilot and he gets a silken robe and golden staff. How can this be?"

"Up here, we work by results," says Saint Peter. "While you preached, people slept; while he flew, people prayed."

End

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