EAA Mount Rainier Chapter 326 Newsletter

Meeting Notice

Tuesday, February 8th, 7 PM
CAP Building, Thun Field

Program: Mr. Dan Henderson of The Boeing Co. "Alteon Training" will be our guest speaker. He will be giving a presentation on the Boeing flight simulators. Should be very interesting. These simulators are the very latest state of the art. Dan is a supervisor there.

Refreshments: Toni Smith

Adjournment: TBA

From the Secretary

January 11th, 2005

Gordy called his first meeting to order. Chapter 326's new officers were introduced to the group.

The program was a presentation by Jerry VanGrunsven about the early years of Jerry & Dick and their flying adventures. Hearing the tales makes you understand why today they are all about safety!

NW Aviation Conference & Trade Show is on Feb 26th & 27th at the Puyallup fairgrounds. We need volunteers again as always. Get your name on the signup sheet to work the booth, or help setup / teardown.

Danna Burt is looking for a partner in building a Heath Parasol. He has the material and building location, but needs someone to help with the manual work.

Bob Fay gave a quick update on the Thun field Advisory Council. The Group is working to smooth issues & to provide input to county plans for development of the South Hill region. A position is open if anyone is interested in helping out with a pro airport view of the community.

That's it for this month! You're on your own in February as I'll be in London again!

Andy – Chapter 326 Secretary

Horizontal vs Vertical Induction

What do you get for extra bucks into the Superior XP-360?

Current pricing on the engine shows a $1,200 increase when going from carbureted to fuel injected and then another $1,000 increase to go forward facing from vertical. Forward facing induction is only available with a fuel-injected engine. The primary advantages of fuel injection over carbureted are no more carburetor ice worries, prolonged inverted flight capability, better fuel management at the engine bringing better fuel economy for the same power, when leaning.

The primary advantages of forward facing induction as compared to vertical induction are less frontal area from the engine which in some installations allows a sleeker faster cowl, the engine is 6 lbs lighter than a standard vertical XPIO-360 and the engine will produce 3-4 percent more power than the same engine with vertical induction. Depending on induction plumbing and setup you may be able to squeak out a little more ram air effect with the forward facing sump than with the vertical one which again may bring a bit more power to wide open throttle operation. The approximate $2000.00 increase in price over a vertical induction carbureted engine gets you a lot, if the above mentioned features are important to you but it gets you nothing if they aren't. Least that be the way I see it.

Mahlon Russell
Mattituck

More on SpaceShipOne

I *(unknown)* just had the extreme pleasure of speaking with Mike Melvill yesterday, the pilot of SpaceShipOne's first two flights above the Karman line of 100 km MSL, and with his wife. He gave a 45 minute presentation to the Aircraft Owners and Pilots Association conference in Long Beach on Thursday, and got a several-minute standing ovation. I was able to speak with him for a short while after his talk.

Since he was speaking to pilots, he didn't have to translate for the "general public" or pull many punches. He spent almost half of his time going over the flight controls and the entire cockpit layout inside of SpaceShipOne, explaining how it is flown. I think this is the first time this has been explained publicly in such detail, and it was amazing. There are actually four separate flight regimes, and each is flown differently. Just after launch, it flies like a piper cub, using a joystick and rudder pedals with mechanical linkages to the controls (no hydraulic assists). When it goes supersonic, the aerodynamic forces are too high to be able to move the stick, and the controls are subject to flutter. So they use an electrically powered trim system, flown using the "top hat" switch on the joystick and a couple of grips on the arm rest of the pilot's seat. (There are backup switches to the left of the instrument panel, which had to be used on one flight.) This moves the entire horizontal stabilizers, not just the elevons on the trailing edges. Eventually, they get high enough and the air gets thin enough that they can again use manual controls, although the response is totally different than lower down. But that goes away as they exit the atmosphere; the Reaction Control System nozzles are then used for maneuvering in space. Coming back down, the pilot has to reverse the sequence. There is no automated switchover of control systems; the pilot has to remember to move from one system to the next at the right times.

The rudder pedals are not linked. Each controls one of the two vertical stabilizer rudders separately. You can push both rudder pedals at the same time, and get a fairly effective speed brake, with both rudders canted outward. Push both fully forward and they engage the wheel brakes. But these are not very effective and are only really useful for steering input during rollout. The real brake is on the nose skid: a piece of maple wood, with the grain aligned down the centerline of the airplane. He said it was the most effective braking material they could find.

Mike said that he gets hit with about 3Gs kicking him backwards as soon as he lights the rocket motor. He's supersonic within about 9 seconds later. But he immediately starts to pull up into an almost vertical climb. So he also gets over 4.3Gs pushing him down into his seat just from that maneuver. The combined force is "very stressful" and Mike says it's "important not to black out" at that point. He's going 1880 knots straight up within 70 seconds. On re-entry, the aircraft goes from being absolutely silent while in space to generating a deafening roar as it hits the atmosphere again. He's going about Mach 3.2 by that time, and has to survive about 5.5Gs for over 30 seconds, and lesser G forces for longer than that, as it slows back down. It sounds really intense, both as he explains it and on the radio.

A couple of interesting side notes: SpaceShipOne has a standard "N" registration number; but it is licensed as an experimental "glider". Apparently there was a huge bureaucratic hassle trying to license it as a rocket powered spacecraft, which they just sidestepped by calling it a glider. I asked him if it had a yaw string; he laughed and said that would have burned off. By the way, the registration number is N328KF, where 328K is the number of feet in 100km. (White Knight is N318SL - Burt Rutan's 318th design.)

Mike says that the flight director system (called a TINU) was developed completely in-house by a couple of 28-year-old programmers, and is absolutely fantastic to fly. That's why they don't need a yaw string. But I had heard over the radio that Brian Binnie had re-booted the TINU just before the landing approach during the X2 flight, and it took quite a while for it to come back up. So I asked Mike what that was about. He said that during re-entry, the TINU loses its GPS lock. So it keeps trying to go back to catch up, re-interpolate and compensate for the missing data, and this keeps it a little behind in its actual position calculations. The pilot has no straight-ahead vision at all, so they have a real issue landing: they can't see the runway! The way they do it is to fly directly down the runway at 9000 feet; then they do a (military style) break and fly a full 360 degree pattern right to the landing. The TINU gives the pilot a "blue line" to follow and a target airspeed (which produces a given rate of descent). If the pilot follows the blue line, right to the break point and through the two 180 degree turns, it will put him right onto the runway at what ever touchdown point he selects. But the TINU has to be absolutely current when this is going on. So at something above 15,000 feet they reboot the TINU and get it re-synched with the GPS satellites again before setting up for the landing!

He also talked in detail about the rocket motor, and had photos of its insides after firing. The nozzle throat actually ablates as the motor burns, enlarging the interior throat diameter as the burn progresses. He described the problem they had on the June 21 flight: The rocket motor nozzle was skewed by about ½ degree to one side. This generated a surprisingly high lateral torque trying to turn the aircraft. If it had been up or down pitch rather than lateral, the controls could have handled it; but the lateral yawing forces were too great for Mike to compensate as the atmosphere thinned. The result was that he was pretty far off course. Mike says he reached apogee, rolled the spacecraft over, and was surprised to see the Palmdale VOR directly beneath him. That was 30 miles away from Mojave and a long glide home. He says its amazing how fast a relatively small deviation can produce large distances when you're going Mach 3! For one of the static burn tests, they had fire and safety crews all standing a mile away, ready to duck if anything went wrong. In the middle of the test, Mike and Burt Rutan walked up to the front of the motor assembly and felt the pressure vessel that contains the N2O. Mike knew he was going to have this same thing strapped onto his back soon, anyway, and he wanted to know how much it vibrated, how hot it got, and how loud it was. It was deafening, literally. It turns out that, with the nozzles they use at high altitudes, it's actually not that noisy inside the spacecraft. But he still wears hearing protection.

Scaled Composites seem to have fabricated quite a bit of the rocket motor themselves, including the N2O tank (which is also the structural core of the spacecraft) and the nozzle casings. It would be interesting to hear exactly what parts SpaceDev designed and what they manufactured.

E-MAG / P-MAG Again
A New Electronic Ignition

This subject was in the December newsletter but there wasn't enough room for all of it. The preamble is repeated but the stuff after pricing is new.

Most of the information here is culled from the EMAG website
http://www.emagair.com/

This is a new entrant to the field. Until now we have had LASAR and FADEC for type certified aircraft (and experimental); and Lightspeed (Klaus Savier) and Electroair (Jeff Rose) for experimental only.

E-Mag is a next-generation electronic ignition, designed to serve as an upgrade or replacement for traditional aircraft engine magnetos. P-MAG is a self-powered version (internal brushless alternator), whereas E-MAG requires external electrical power.

Otherwise they are basically the same and the term E-MAG is used in general.

E-Mag is selling now just for experimentals. They are working on FAA certification

E-MAG Ignition base price $645.00
P-MAG Ignition Self-Powered version of the E-MAG. $895.00

New stuff…
Mode Options
You have the option of operating your E-MAG in either of two modes, depending on the ignition you use.

Mag Mode
If running your E-MAG in tandem with a traditional magneto, Mag Mode will bypass E-MAG's variable timing calculations in favor of fixed 25 degree (or other as ordered) base-line timing. This way, both ignitions fire in unison. During start-up, firing is always at TDC. Note: Mag Mode is an option (not required) when running alongside a magneto.

Variable Mode
On standard E-MAG ignitions, this mode will allow timing to vary depending on engine rpm. On "M" designated ignitions, MAP sensor input is also used. Mode settings are changed by a switch located under the ignition coil.

Of all the E-MAG innovations, the self-powered "P-MAG" model is the most significant. It solves the largest single issue faced by all electronic ignitions - their need for an uninterruptible power supply. Power back-up strategies that a) compromise ignition effectiveness, b) solve only half the problem, or c) require additional maintenance are less than ideal. Next-Generation ignitions need a better solution.

So what does a next-generation electrical back-up need to do (better)?

- Above all, it has to be reliable. When it's needed, it has to work - period.
- It should operate for as long as needed. Whether it's the last 10 minutes of a Sunday pleasure flight, or you're crossing the Atlantic.
- It should be maintenance-free. Benign neglect should not prevent it from working.
- On the rare occasion it's needed, it should automatically engage without operator intervention.
- A simple and convenient pre-flight check should confirm it's working properly.

P-MAG offers a unique solution. Instead of backing-up the aircraft buss, the P-MAG produces its own power at cruise speeds and uses the aircraft buss as the back-up. With this arrangement, dual electronic ignitions can be run "clean". No back-up batteries and no back-up magnetos.

- P-MAG has a built-in permanent magnet (brushless) alternator that adds no (zero) mechanical contact/wear parts to the system.
- Operating time on the internal alternator (primary) is virtually unlimited. If the primary fails, operating time on the aircraft buss (back-up) is also virtually unlimited.

Q: Are there plans for a certified ignition?

A: Yes. We started the project with certification in mind.

Q: When I run dual electronic ignitions, do I need two P-Mags, or can I run one E-MAG and one P-MAG?

A: One E-MAG and one P-MAG is what we consider "standard dual configuration", which should be quite adequate. However, given the small difference in price, many builders are opting for dual P-MAGs. Their reasoning is that one P-MAG is already "required" (in dual installations), so the only question is whether or not to invest $250 to make the second ignition self-powered. One E-MAG and one P-MAG should be fine, but it depends on how you make that value choice.

Q: Can I run one traditional magneto and one E-MAG?

A: Yes, but... This is an inexpensive way evaluate an electronic ignition and start your transition. You can wait on the second one, but you should consider converting it sooner rather than later. Engines are designed for simultaneous firing from two plugs. If you set the E-MAG to operate in Advance Mode, it's plugs will fire either before or after the plugs from the magneto most of the time. The cylinder will fire on which ever plug fires first. You do have the option of setting the E-MAG to operate in Mag Mode so it will match your magneto timing. You will, however, lose the advantages of variable timing. But at least you do have the choice.

Q: Can I prop-start with an E-MAG? How about with a P-MAG?

A: Yes and no. Even the P-MAG model needs some source of outside power at start-up. If you are prop starting because the battery is "low", there is plenty of power for the ignition. If you're battery is "almost" dead (you only get a faint glow from the cabin light) you probably have enough power for the ignition. However if you're battery is removed or is absolutely/totally dead, you cannot prop start with the electronic ignition and "no" outside power. It doesn't take much. We get plug plug spark (on the bench) with only a 9 volt flashlight battery.

RV-7/7A & RV-9/9A Service Bulletin

Van's has issued a modification to tip up canopy structure for these aircraft. http://www.vansaircraft.com/pdf/sb05-1-1.pdf

End

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