Hangar Talk

The "Lightning" Newsletter

June 2009 - Volume 2, Issue 6

N325AL, the SLSA LS-1 – "Lightning of the Month"

Please submit a photo of your Lightning for future "Lightning of the Month" consideration.

The newsletter goal is **to get the word out** on happenings at Arion Aircraft, and **to give a voice** to Lightning **builders and flyers**. To be successful we need your inputs. So it is not only a way for the factory to provide Lightning news, but it is your newsletter as well, and its success will depend on you getting involved to spread the word and to help other builders and flyers. So think of this newsletter as an ~~-e~~xchange of information publication". Send your inputs directly to: **N1BZRICH@AOL.COM.**

Contents in this issue:

And now, the rest of the news.

Flight Testing Your Homebuilt

This month's lead story is a write up about the flight test program that I developed over a period of many years and have used, at least in some part, when I made the initial flight on eight different homebuilt aircraft. So it really is an effort that evolved over time as I refined the test profiles and recommended flight procedures and test elements. I have shared it with some of the Lightning community in the past and many have suggested that I publish it for others to use as well. So feel free to use all or any part that you find helpful. As always, I invite your comments and suggestions.

When you finish building your experimental amateur built aircraft you have accomplished a major milestone towards the overall goal of flying an airplane that you built yourself. However, in reality, the building of the airplane is just the first milestone of achieving the fun and excitement of flying your own creation. The next milestone is the actual testing of your project to ensure you have an airplane that is safe and fun to operate. For this milestone it should go without saying that the term ~~"sa~~fe to operate" includes both the airplane itself as well as the engine. So you will be testing and evaluating not only the flight characteristics of your airplane, but the engine performance as well.

The overall goal or objectives of your flight test program should cover three major areas: first**, to safely and systematically evaluate your aircraft's flight characteristics**, second, **to check your engine performance and reliability**, and third, **to develop performance data for your airplane**. This performance data is the information that you will use to produce your aircraft flight manual or pilot's operating handbook. It has been my experience from talking to lots of builders over many years that way too many of them just fly off the flight time without really testing their aircraft. Hours of flight time just flying around the local area does nothing to help them really know their own aircraft or it's specific flight characteristics or performance capabilities. Many of them didn't even know that they were required to develop a POH (or aircraft flight manual) for their own aircraft.

Several documents will be helpful in understanding what should be involved in any flight test program. I suggest you look at the FAA's FAR Parts 21 and 91, and their Advisory Circular 90-89A, Amateur-Built Aircraft and Ultralight Flight Test Handbook. Additionally, I would be remiss if I did not mention the EAA's Flight Advisor program. Like the EAA's Technical Counselor program that, hopefully, you used during the building portion of your overall project, the Flight Advisor can help you prepare for that first flight and the ensuing 40 hour FAA phase one flight test program. EAA Flight Advisors have a handbook called Before You Fly which they will use to help you evaluate your airplane, your personal capabilities, and perhaps develop a training program to prepare you for your first flight. They can also help you develop the test program specifically designed for your aircraft. They will help you evaluate your aircraft in every detail from such things as weight and balance to performance characteristics. They will also help you evaluate pilot preparedness and fitness, suitability of the airport, and documentation and utilization of data from the

test flights. His work with you will not end after the first flight. If you desire he will continue to communicate with you during all the test flights, and help you in the preparation of a Flight Manual (or POH) for your aircraft. Bottom line, he will insure you are ready for that first flight and will stress the safety and emergency procedures to be used if any problem should arise.

Since the EAA developed the Flight Advisor program the safety record on initial flights and also during the test program has greatly improved. In fact, some aircraft insurers will not insure your homebuilt on its first flight unless you have been working with an EAA Flight Advisor. In a recent Safety Wire (the official EAA Flight Advisor and Technical Counselor newsletter), it was stated that, —Up until the beginning of the EAA Flight Advisor Program roughly half of all homebuilt 1st flights resulted in some type of accident or incident." So it obviously is a successful program and I highly recommend you use it. If your local EAA chapter does not have a current Flight Advisor, call EAA and they will have a list of advisors that are near you and are knowledgeable on the type of aircraft you have built.

Over the years the flight test time requirements have changed. When I built my first airplane, a Pitts Special that I built from plans and first flew in 1977, the requirement was for 50 hours to be flown in a specific test area before the final airworthiness certificate would be awarded. As most of you know that requirement is now only 40 hours. However there is one other consideration that the current FAA rules allow; if your experimental aircraft has a certified engine and a certified propeller, the flight test hour requirement is only 25 hours. So if I built that Pitts today and used the same prop and engine, my flight test time requirement would only be 25 hours.

Another change that is now in effect is the inspection requirements. In the old days, an FAA inspector had to inspect and sign off all of your work before that part of the airplane could be covered up. So if you had a part that you fabricated that could not be seen after it was installed, that part had to be inspected and signed off. Quite often an FAA inspector would have to visit your project many times over the years as you built your airplane. Then when the aircraft was completed, it had to be inspected and signed off for the test period before the first flight could be made. After the successful test flight period you would finally receive the airworthiness certificate.

Today, because of the success of the EAA Technical Counselor program, the FAA uses the technical counselor visits instead of their previous —pre-cover" inspections and the only official inspection is the one performed prior to the first flight and it is normally performed by a DAR (Designated Airworthiness Representative) inspector. If he likes the looks of your work, and your —ready to fly" airplane (and all your paperwork), you get the final airworthiness certificate at that point and you do not have to see the FAA or their representative again.

Once you have had your DAR inspection and received your airworthiness certificate, you are almost ready to start your 40 hour flight test period, which the FAA calls Phase One testing. For a Lightning homebuilt aircraft the requirement will be 40 hours since both the engine and prop are experimental in the US. Notice I said you are almost ready to start your phase one testing. The reason I said almost is because there are several things that should be successfully completed before any flights should take

place. For example, all aircraft and engine ground evaluations should be complete. Your Flight Advisor will have a list of these things, but you should have completed engine ground runs and taxi test, both low and high speed. You should have also coordinated with your ground crew and the tower if the initial flight is to take place at a controlled airport. Ground crew coordination should be such things as insuring they have a hand held radio to monitor your flight and that they are thoroughly briefed on the specific flight profile that you plan to fly. (I will cover this later in this article).

Linda and Mark doing an engine run.

You should also have some way to record any and all test data that you will acquire on your flights. Some people use the old pencil and notepad method, but that requires you to take your hand off the stick. A more modern way that I like to use is to have a voice-activated recorder. I have a very small one that I bought at Radio Shack some years ago that is a digital model, has a small lapel microphone, and it is voice activated - meaning that it turns itself on in the record mode when it hears a voice and then turns itself off when there is nothing to hear. Since your homebuilt will probably also have a voice activated intercom, just place that small lapel microphone inside one of the ear cups of your headset and then ~~-t~~alk to yourself" when you want to record some data. The recorder will activate itself when it hears your voice and record whatever you say - airspeeds, RPMs, EGTs, head temps, oil pressures, etc. You get the picture. When you land, you can play back the recording and you will have a complete log of test data **IF** you remember to ~~-t~~alk to yourself".

Olympus digital recorder with lapel mic.

Perhaps now is a good time to discuss the choice of airports to use for your first flight. It should go without saying that a short runway or an airport totally surrounded by buildings and houses is probably **not a good choice**. You want to give yourself every possible chance to have a good outcome if something goes wrong. To my way of thinking, a long runway (say 4 to 5 thousand feet) in a rural area with lots of open farm fields is a good choice. If that airport has more than one runway, then even better as it just gives you more options if you need to land quickly for whatever reason.

SYI - a great test airport and area

As to using a controlled airport, well I have done that also, but that airport was generally not too busy early in the morning and late in the afternoon and it was surrounded by a rural farm area. Just be sure

the tower guys know that you are on a first flight and what your overall plans are. One good thing about a towered airport is they often have emergency response vehicles right on the field or at least have a direct phone line to them. If you are making your first flight at a non-towered airport, just make sure your ground crew has a number to call if any emergency response is required. My suggestion on your ground crew would be to have very few people around. One or two people at the most is good. Any more and you might find yourself being interrupted by their comments or questions when you should be concentrating on the events at hand. If you have a qualified person to fly a chase plane, that is sometimes helpful during a test flight. There are often times or incidences when a second plane can be very useful to lead or provide support depending on the type of emergency or problem you might encounter. Just make sure the person flying the chase plane is well qualified in formation flying and also has a complete understanding of the airplane you are flying and the test profile you are working on.

Lightning Prototype and chase plane.

Now, some specific information on the flight test plan that I currently use. This flight test plan, as it currently is, was developed for the Rich VM-1 Esqual LS (Lightning Stuff), N31BZ, to satisfy the FAA 40 hour test program. The program that I devised for testing homebuilt aircraft is actually divided into **five individual phases** with each phase having specific objectives designed to systematically evaluate the flight characteristics, the in-flight performance data, and engine performance and reliability. As a reminder, the flight test plan should not be started until all ground evaluations, to include taxi test and engine ground runs, have been completed.

This five phase program is comprised of the following types of flights. **Phase one is the initial flight plus two** other flights. Phase **two is to build additional data on the aircraft and engine** performance. **Phase three is to determine all V speeds**. **Phase four is the structural and stability flights**, and **phase five is where you accomplish max gross weight and various CG test flights** as well as determine the max operating altitude. **NOTE: The flight hours associated with each phase is only a suggestion. You should fly whatever time is required to complete each phase's test requirements. Also, with the exception of phase one, you don't have to totally complete a phase before doing some of the requirements of another phase. For example, if weather precluded you getting high enough to complete some particular requirement, you might be able to do a different phase requirement at a lower altitude. Now that you have the basic list of the five phases, let's look more indepth at the various phases and the objectives of each.**

PHASE ONE is comprised of 3 flights and would normally total approximately **3 hours of flying time**. A very important aspect of the first 3 flights is that you should **remain in** what I call **the airport glide cone**. What I mean by that is that you should keep the aircraft in an area close enough to the airport so that you could safely glide to a landing if you happened to have an engine problem. If you are at a low altitude you would be very close to the airport. The higher you go the further out from the airport you could be. So you see your glide cone gets wider the higher you climb above the airport elevation. Later I will list the exact flight profile that I use for the first flight, or actually the first three flights. I normally repeat the first flight three times just to be sure of the flight characteristics of the aircraft and to verify all flight and engine data that I see on the very first flight. Another very important part of the first three flights is also to allow you (or the test pilot) to get used to the airplane – to calibrate your hands and feet so to speak. The specific objectives during my phase one are:

Verify aircraft handling qualities in pitch, roll, and yaw.

Verify engine operation – Oil T&P, CHT's, Fuel Pressure & flow, EGT's, etc.

Verify pitch trim operation.

Verify flap operation.

PHASE TWO (Hours 4 to 10) is designed to build additional data on aircraft and engine performance.

Accomplish airspeed accuracy checks from near stall to cruise, and with flaps up and down.

Accomplish climbs and descent checks to check engine cooling (CHTs, oil temperature and pressure). The overall goal is to be able to perform a full throttle climb of five minutes and have all engine parameters remain ~~in~~ the green".

Accomplish fuel consumption checks from 55% to 75% power.

Start initial steps to expand the overall flight envelop.

PHASE THREE (Hours 11 to 25) is basically to continue to expand the overall flight envelop and to start gathering the data that you will later use to build a flight manual or pilot's operating handbook for your aircraft. Specifically you will:

Determine stall speeds with full fuel tanks.

Determine best rate (Vy) of climb speed.

Determine best angle (Vx) of climb speed.

Gather data for flight performance charts (Speed vs. RPM, Fuel Flow charts, Range charts, etc.)

PHASE FOUR (Hours 26 to 35) is where you really start to learn the flight characteristics and to fly the aircraft to the corners of the performance envelop.

Accomplish stability and controllability checks.

Test longitudinal, lateral, and spiral stability.

Accomplish flutter test for the complete speed range and at all flap configurations.

Check high AOA maneuvering.

Test accelerated stalls – 30, 45, and 60 degrees of bank.

PHASE FIVE (Hours 36 – 40):

Max gross weight tests –

Start at 1100 lbs - use 20% increases from 1100 lbs to gross weight.

Verify performance parameters at max gross weight.

Check clean and dirty stall at all CG locations and all flap configurations.

Check service ceiling.

Complete performance charts if not already completed.

Now that we have covered all the objectives in each of the suggested flight test phases, let's take a look at the specific flight profile for phase one. Here is a specific outline of what I suggest you should accomplish on your first flight in your newly completed Lightning.

-1st TEST FLIGHT:

Takeoff:

- Note distance and lift off speed.
- Quick assessment of pitch and roll immediately after liftoff and before you get too far down the runway.
- Climb out at 95 to 100 mph
- Check engine #s – Oil temp and pressure, fuel flow/pressure, and all other temps.
- Assessment of trim

Turn to crosswind:

- At end of runway or at 500‘ (for an 800‘ traffic pattern), whichever comes later.

Climb to altitude:

- Checking engine numbers during climb.
- Continue climb to still air (5,000‘ AGL) while remaining in the glide cone.
- Keep speed below **140 mph** (90% of max cruise speed – 153 mph).
- Look for CHT drop of approx 30 and accompanying Oil temp drop.

Investigate power effects on trim:

- Power slowly to idle – check trim operation.
- Power slowly to max – check trim operation.

“Near Stall” Investigation:

- No Flap
  - 85 mph - check yaw / roll / pitch effects + trim effects.
  - 75 mph – check as above
  - 70 mph – check as above
  - 65 mph – check as above
  - 60 mph – check as above
  - Note: No slower than 60 mph on this flight.

- Flaps to ½:
  - 85 mph – 60 mph - check yaw / roll / pitch + trim effects as above.

- Flaps to full
  - 85 mph – 60 mph – checks as above

Practice approach at altitude:

- Below 100 mph start flaps down
- Maintain 500‘ per minute rate of descent @1.3 x Vstall (52 mph) = 67.6 mph -use **70 mph.**
- Reduce power and nose up to level flight slowing to 1.1 x Vstall = 57.2 mph - use **60 mph** for this flight.

Actual Landing:

- Normal pattern, full flaps.
- 70mph on final.
- 60 mph when landing assured.

Post Flight:

Record your thoughts (and data) while the flight is fresh in your mind. And complete a thorough inspection of the airframe and engine.

-2nd TEST FLIGHT:

Repeat entire first flight profile to confirm initial findings.

-3rd FLIGHT:

Continue flight characteristics validation and complete engine reliability and engine performance checks before moving on to phase two and before departing the airport ~~-~~glide cone". **Develop a specific profile for this flight depending on what additional data and information is required to complete phase one of the flight test.**

- Check Oil T&P, Fuel P&FF, RPM and Manifold P from 55% to 75%
- Check engine operation on both tanks.
- Check carb heat at various speeds and power settings.
- Note: Keep speed below 90% of max cruise (153 mph) = 137.7 – use **140**

Final Note: Specific flight profiles like the above should be developed for each test flight in phase two through phase five depending on data and information gathered up to that point in the overall flight test plan. Good luck, fly safe, and have fun.

News from the Factory:

SLSA "Lightning Sport" Update:

I received this from Nick on 14 May: Dan Johnson from LAMA (Light Aircraft Manufacturers Association), who used to and still writes tons of articles for EAA, flew the Lightning LS-1 yesterday and put it thru its paces. Wind was 140 at 15 gusting to 20 but we flew and he was amazed at how well the thing flew in all that wind, and how it felt like a big plane - not a toy, as he puts it. He said he really loved the airplane and how it performed as good as the rules would allow. We couldn't keep from making a few WOT runs at 140 knots for fun, and he said that it is incredible that this engine will run 3300 RPMs all day and does not

even sound like its working. Actually we were turning 3330 and it kept running like a top. If you get a Rotax above their red line they sound like they might explode! Nick

Lightning Sales Update:

Here are the latest kit sales numbers and flying status from Mark:

Customer	Fuselage #	Dealer	Notes	Flying
Prototype	1	Shelbyville	N233AL	Flying 3/3/06
Skipped	2			
Hobbs, Greg	3	Shelbyville	N430GH	Flying
Green Landings	4	Green Landings		Flying
Ferguson, Earl	5	Shelbyville	N17EF	Flying '06
Discher, Rick	6	Wisconsin		
VanHeeswyk, Jerry	7	Hobbs	N625JV	Flying '08
Hoffman, Tom	8	Wisconsin	N155AL	Flying 1/6/08
Mantell, Tex	9	New York		
Sorenson, Duane	10	Shelbyville		Flying '08
Dewey	11	Green Landings		Flying
Sahr	12	Shelbyville	Damaged in Bonanza accident	
	13		Number not used	
Davis, John	14	Shelbyville		Flying
Bowen, Rick	15	Shelbyville	N727RB	Flying
Cooper, Joe	16	Shelbyville	N396JC	Flying
Borchart, Dennis	17	Lightning Australia	19-4962	Flying
Tholhuesyn	18	Lightning Australia		
Dunbar	19	Lightning Australia	8 cylinder Jabiru	Flying '08
Mathias, Linda	20	Shelbyville	N59JL	Flying 2/28/07
Keith, Charlie	21	Green Landings		Flying 4/30/09
Wachtmeister, Albert	22	Green Landings		Flying
Heavy Fuselage	23	Shelbyville		
Heavy Fuselage	24	Shelbyville		
Heavy Fuselage	25	Returned to Custom		
Thompson, Johnny	26	Hobbs	N8WN	Flying
Hubbard, Bill	27	Shelbyville	N316H	Flying
Pritchard, Ernie	28	Hobbs		Home
07 Demonstrator	29	Shelbyville	N323AL	Flying
Disher, Peter	30	Lightning Australia	VH-PD1	Flying 11/08/08
Keen,	31	Lightning Australia		
Morrison, Anthony	32	Lightning Australia	19-5301	Flying 6/2/08
Chesbrough	33	Lightning Australia		
Fry	34	Lightning Australia		
Belie, Steve	35	Lightning Australia		Flying 12/23/08
Borchardt, Dennis	36	Lightning Australia		
Grubb,	37	Lightning Australia		
Hoffman, Tom	38	Wisconsin		
Cleavinger	39	Shelbyville	N213RC	Flying
Nunes, Claudio	40	Brazil (Shelbyville)		
Goad, Jim	41	Shelbyville	N166JG	Flying
Jab Power Solutions	42	Shelbyville		

Langley, Jim	43	Green Landings	N730AL	Flying 7/26/08
Fisher, William	44	Hobbs	N838BF	Flying 1/6/08
Ricks, Ed	45	Ricks		
Applegate	49	Hobbs		Home
Ritchie	46	Shelbyville	ZK-TDT	Flying 8/15/08
Browns	50	H&S Aviation	N716MZ	Flying 6/24/08
Sundquist	48	Ship to Yakima, WA		Home
Carlisle	51	Green Landings		Flying 3/25/08
Kennedy	52	Shelbyville		
Eynon	53	Shelbyville		
Peters, Fred	54	Hobbs	N617BP	
Mefford, Walt	55	Hobbs	N881WP	Flying 11/13/08
Borchart Stock 3	56	Lightning Australia		
Borchart Stock 4	57	Lightning Australia		
Mitchell, Peter	58	Lightning Australia		Flying 10/26/08
08 Demo	59	Shelbyville	N324AL	Flying 4/1/08
Russia (Shramenko)	61	Shelbyville		
Nelsen, Lynn	60	Shelbyville		Flying 8/20/08
Lenox, Wayne	63	Hobbs (build in TN)		Flying 6/27/08
Mendenhol, Walter	62	Hobbs	N8938T	Flying 9/5/08
Stanley, Davey	64	Shelbyville		
Borchardt Stock 6	67	Lightning Australia		
Patterson, Wayne	65	Lightning Australia		
Ellis, Selwyn	66	Lightning Australia		
Borchardt Stock 7	68	Lightning Australia		
Borchardt Stock 8	69	Lightning Australia		
Borchardt Stock 9	70	Lightning Australia		
Hass, Bob	72	Green Landings		Flying 4/13/2009
Pennington, Gary	71	Shelbyville	N34YZ	Flying 11/30/08
Corkum, Reginald	76	Shelbyville	N290AW	
Strahan, William	75	Shelbyville	N197RW	Flying 12/19/08
Winkler,	73	Green Landings	N428GW	Flying 11/11/2008
Bryant, Paul	74	Shelbyville	N82PB	Flying 11/10/2008
Beatrice, Pat & Carl	77	Shelbyville		Flying 4/4/2009
LSA Demo	78	Shelbyville		Flying 4/11/2009
Krizman	79	Shelbyville		
Hobbs (Fuselage only)	80	Hobbs		Fuselage only
Cudney, Richard	81	Green Landings		
Crouchley, Greg	82	Green Landings		
Demo	83	Green Landings		
Total delivered	**78 kits**	**Total flying 42**	**53.8% Completion rate**	

Current Lightning Dealers:

Arion Lightning, LLC, contact Nick Otterback, Shelbyville, TN, 931-680-1781, www.flylightning.net

Lightning Southwest, Greg Hobbs, Marana, AZ, 520-405-6868,

Green Landings Flight Center, Ryan Gross, WV, 304-754-6010, www.greenlandings.com

Lightning North Central, Tom Hoffman, Neenah, WI, 920-836-2318

Lightning Northeast - Jabiru Power Solutions, LLC, Dave Jalanti, NY, dave@jabirups.com

Sport Plane Dynamics, Ed Ricks, Glendale, AZ, 623-695-9040

Lightning Australia, Dennis Borchardt, Kingston SE, South Australia, 08-8767-2145

Lightning Brazil – Cimaer Ltd, Claudio Nunes, Brazil 24 900-000, 21-2637-3605, 21-9451-9700

Russia and CIS – AVIA-NIANIA, Moscow, Russia, + 7495518-62-75, avianiania@mail.ru

News from the Dealers:

Lightning Southwest:

Once again Johnny Thompson has sent us an update from Greg Hobbs:

Greg taxied for a while and had much lower temps. Will fly in AM. We did two minor mods to help lower air pressure in the lower cowl. On Greg's bird he took the Arion mod to cover the oil pan fins and capped the outlet into a hose that goes to the cabin heat valve and either heats the cabin or ports out the bottom. I built a fiberglass chamber that bolts to the air outlet of the oil cooler and vents the air at the bottom of the cowl also. Let you know how it works. Will send pictures. Johnny

Note that Greg's airplane does not have a muffler, so his scat hose from the oil sump duct provides cockpit heat.

Lightning Northeast:

The following came in from Dave Jalanti on 15 May and includes the photos he sent:

Hi Guys,
Nick, you wanted me to send a couple of pics showing what I did to hopefully get a little more heat from the carb heat muff. I thought Ben and Mark and Buz would like to see them too. I threw in an extra pic to show you about where I am with the air ducts and other stuff.

In case it isn't clear, I cut a half round from the lower edge of one side of the cabin heat muff so it could be rotated down around the exhaust pipe a little more. This allowed room for the carb heat muff to slide in under the heat shield under the carb. I also cut a half circle out of one end of the carb heat muff so it can fit around the inlet for the cabin heat muff. This combination of changes makes for a longer carb heat muff. Yes, I know there are extra slots for the large hose clamps. The first slots I cut were directly in line with the 3 welded tubes that receive the header pipes..... dummy!

Let me know what you think. (be nice... I'm old and frail)

Dave Jalanti
Jabiru Power Solutions, LLC

News from Builders and Flyers:

This month's first builders and flyers news item comes from Pat and Carl Beatrice. You know from the last issue that they have now completed and flown their Lightning. Here are Carl's words on the building process and how they are both enjoying their Lightning.

My wife, Pat, and I signed on the dotted line in September 08 to build a Lightning using the Builder Assist program at Arion Aircraft, in SYI. However, we delayed starting the build process until February 09.

On February the 16th we flew to Arion and under the skillful supervision of Mark, Mike and Nick, we started to put the pieces together. We were also blessed to have Dave Jalanti, Northeast Lightning and Jabiru dealer, assisting us. Dave was a tremendous help.

We stayed in Shelbyville just over a week preparing and putting parts together. Then on February the 24th we flew our RV6A home while the Lightning went for paint, upholstery and electrical. During part of the time we had the pleasure of having Buz Rich to consult with and also assist in the build. It was real neat watching it all come together. We put in some fairly long days and worked through some weekends (We're both 76 years old.)

As Sun N Fun time approached, Mark and Mike had to devote most of their time to finishing the SLSA as well as pack for the trip to LAL. We would also like to offer a very special thanks to Jason Biggs from the Jabiru side of the business who volunteered to help us put the finishing touches together. We'll are ever grateful to him.

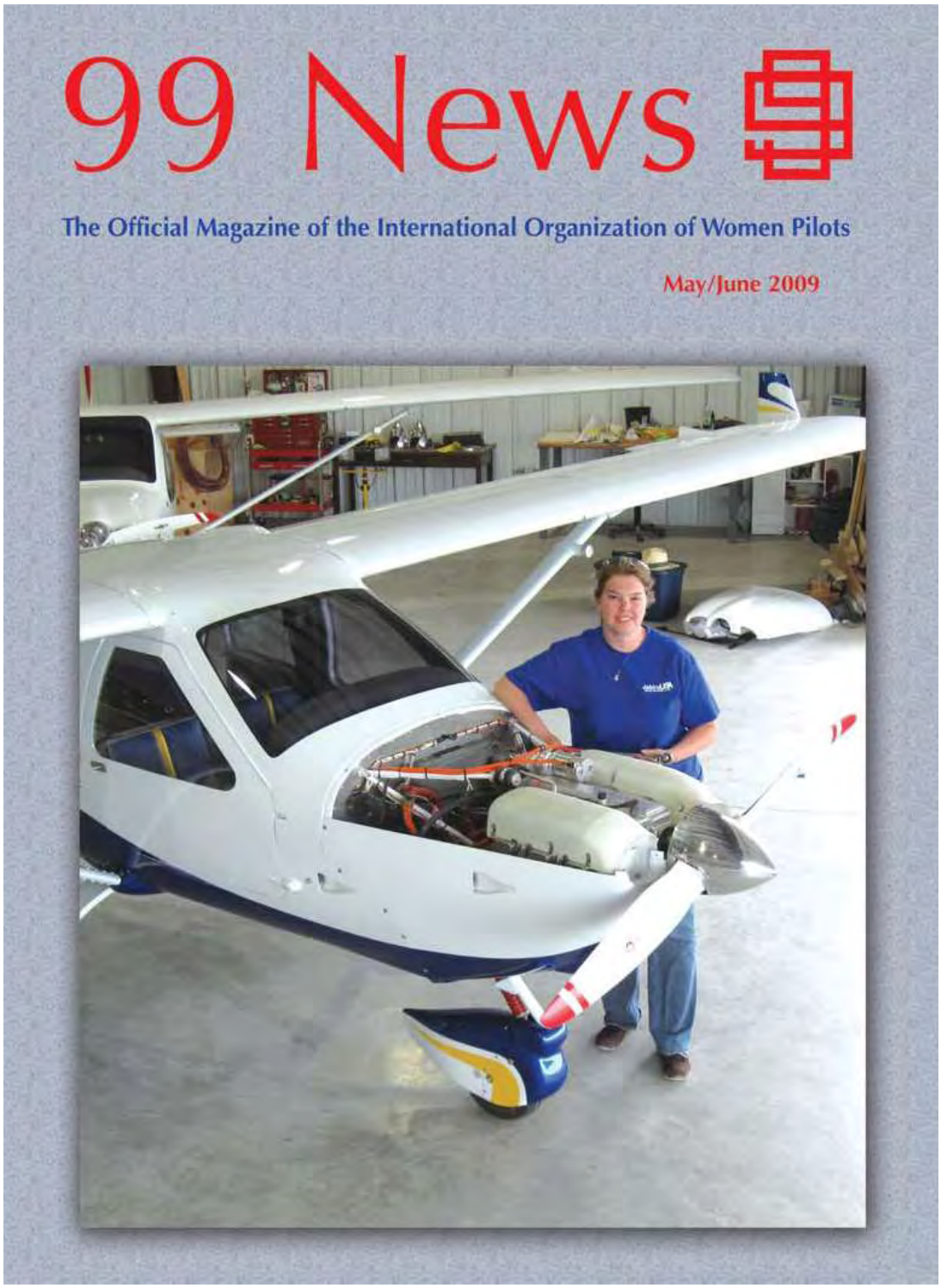
On April 5th Buz Rich did the honors of making the first flight for us. It flew well, with only a few minor discrepancies. I flew the rest of the Phase 1 test time at SYI. On April 24 we flew it to Sanford, Maine, which is its new home.

We hope to have many happy flying hours in our Lightning. A very special thanks to Nick, Mark and Mike for all their great input.

Carl Beatrice

Pat and Carl's instrument panel is on the left and both of them laying down on the job on the right.

Next is an update on Arion's own lady test pilot, Katie Bosman. In a past issue of the Lightning newsletter we had an article about Katie telling about when she went to work for Arion and her duties there. That article has now been picked up by the 99s and is now in their magazine. Below is that article along with photos that show other famous Lightning pilots and builders.



Katie Bosman with Lightning builder Earl Ferguson.

Life as a Lady Lightning Test Pilot: The Light-Sport Transition

By Katie Bosman
Intercollegiate Internet Chapter

As a Middle Tennessee State University flight instructor, I landed dozens of times at KSYI in Shelbyville, Tennessee. Between bounce-and-goes and VOR approaches, I often spotted small, flashy looking aircraft on test runs orbiting the field at a safe altitude or glistening in the sun during taxi tests. The high-wing Jabiru Special Light-Sport Aircraft (S-LSA) and its slippery looking, low-wing cousin, the Experimental Arion Lightning, are both built on the small airport nestled among Middle Tennessee's rolling horse farms. I became an on-call corporate pilot in July 2008, but by mid-August, I was tired of the boredom between calls. My desire for a part-time pilot position pulled me to explore the Shelbyville test-pilot and CFI market.

I wasn't sure what the Lightning was or how it flew, but it looked like something fast, maneuverable and beyond my capabilities. Even though I first soloed in a Taylorcraft seven years ago, most of my 900 flight hours have been in tricycle-gear trainers. Worse yet, I've spent most of the last two years in the right seat watching students do all the flying.

My corporate job involved flying a Pilatus PC-12 — a 9,000-pound turboprop with a yaw damper. So when I walked into Jabiru USA Sport Aircraft, handed owner Pete Krotje my resume and heard him say, "Great! You can start flying the Lightning next week," I broke into a cold sweat. My first thought was to say "Don't you want me to start in something easy to fly like a Jabiru?" But something about Pete's quiet, steady gaze just compels a person to shut up and say, "Okay."

My first flight with CFI and test pilot Nick Otterback in the Lightning demonstrator N324AL was a thrill and an eye-opener. While the Lightning was more agile than anything I've ever flown, I was sure that

I could indeed fly it, but I also knew that I had to knock two years‘ worth of rust and dust off my stick-and rudder skills.

I had no idea my feet were so sleepy until I did my first stall in the Lightning. Sure, it‘s docile if the ball is centered! Your feet get no rest flying this airplane. Turns are sloppy without rudder. Unlike many of the trainers I‘ve flown, you really see the nose slew around when you don‘t use the rudder properly. Climb performance suffers without the right amount of rudder to counteract the torque of the 120-horsepower Jabiru engine.

And then there are landings. It seemed like whole hours were spent with Nick telling me ―right rudder, right rudder" in ground effect. Finally, one day he said ―Okay, too much right rudder," and I got the idea shortly afterward. The airplane has a tricycle gear, but it‘s not built for the skiddy drop-ins and bounces that most trainers are subjected to. Its lightweight and responsive controls raise the bar on landings, emphasizing mistakes while making smooth touchdowns sweeter.

My transition training felt like my pre-solo days all over again. I practiced with Nick for several days over the course of two weeks. Some lessons went well, and some were mediocre. One was downright ugly. But the struggle was a good thing. It helped me as a pilot and as an instructor. Transition training is easier when the instructor understands the problems of the student. My students, Lightning customers, vary in experience from new private pilots to 26,000-hour 767 captains. Some make the Light-Sport transition easier than others, but most suffer from the same problems I had.

Learning the ways of the light-sport aircraft reminded me that all those little things pilots read about and instructors preach about are true. Many traditional trainers are designed to dampen the effects of lazy feet, the tendency to over-control and inattentiveness to aircraft attitude. It‘s easy and almost okay to be lazy in a draggy, sloppy trainer. On the other hand, Lightnings, like many homebuilts and LSAs, are designed to be light and responsive. The Lightning is a great little airplane that demands nothing extraordinary from its pilot, just some basic respect for the principles of aerodynamics. Crisply coordinated turns and smooth landings in a Lightning are satisfying experiences, especially when the control movements required to be smooth become second nature.

The skills I‘ve learned at Jabiru USA are not brand-new, but flying the Lightning has refined the stick-and-rudder skills I‘ve always had to a level that I‘ve never experienced before — a level that‘s a challenge and a thrill to share with my transition students.

Katie flies the Experimental Arion Lightning.

Katie sent the below message to the 99s to provide information on the other photos that were in the article.

The other picture (Silver Lightning in flight, side view) was taken by Pat Beatrice (possibly also a member of 99s) with Buz Rich at the controls of the photo plane, and the one of me in the cockpit with Earl Ferguson was taken by Buz Rich. It would be neat to add the caption to the photo of Earl and I because he achieved a world speed record in his Lightning. (Unfortunately, I can't claim him as one of my transition students though!)

KT

As part of Katie's duties at Arion she often is called on to fly off part of the Phase One 40 hour test time. She just recently completed flying off the time on one of the last Esquals (N155JM) that was built there. The builder of this aircraft was unfortunately killed in a farm accident and the aircraft is now owned by a close friend and NASA associate, Craig Sumner and his son Aaron. The photo below shows Katie and Aaron in the Esqual on the first passenger flight after the 40 hour test period.

Below is Craig's message to Katie after that flight and then one to me about the same flight:

Katie,
Aaron had a great time flying with you Tuesday! Thanks for giving him his "dollar" ride in the Esqual. OK, we are full court press on finishing our licenses! We will contact you to get our transition time. Thanks

again for all you have done to complete the 40 hour requirement, Katie. I really appreciate the attention to detail you provided to improve the overall safety and performance of our Esqual.
Have a good day!
Craig

Buz,

After taking delivery of my Esqual last week, Katie Bosman took my son Aaron up for a ride. No sooner had they cranked the engine and did their flight control checks, they shut the engine down. The passenger side seat belt was wrapped around the elevator shaft causing the elevator flight control to bind. Amazing what good check list discipline does for us all.
Craig

Craig E. Sumner
Chief Engineer,
Space Shuttle Propulsion Elements, United Space Alliance

Next is a photo of Bill Strahan in his new jet, kit # 75. Bill is still flying off his phase one test time requirements at SYI. Bill, how about writing something for the newsletter letting everyone know what you think of your new Lightning?

The next message is from the Lightning high altitude expert, Dick Cleavinger from Bolder, CO.

HI Buz

We talked at sun-n-fun about trim on my lightning. I have been using a lot of flap offset to achieve roll neutral flying. You suggested aileron trim might be a lower drag option.

Today I set the flaps to neutral and taped a tab to the right aileron. It is 13in long, 2 in wide and has 14deg ramp. In flight it raises the aileron quite visibly. It is not near enough to correct the roll bias of the airplane.

You may remember that I flew to SYI in June 08 to correct this problem and to install the elevator trim tab and servo. Nick told me then that the wings measured true. Do you know of any other effect that can cause such a gross roll bias?

On a different subject, my wheel shimmy problem appears to be cured. I installed wood/glass stiffeners on the gear legs. Sorry I didn't document that change with pictures. It‘s all covered up now and I don't dare take off the leg fairings for fear they will never go on again'

The wheel pant balancing caused more shimmy with than without and I took the weights out (one bb at a time with a Dremel). So it appears that; axel shims, 6 ply tires, tire/wheel balancing, wheel alignment (to true in my case), and gear leg stiffening, all help the shimmy problem.

Cheers

Dick Cleavinger
n213rc, Lightning #42

Next, my message back to Dick. When Dick gets this all sorted out I am sure he will write up an article for a future issue of the newsletter.

Dick,

Before I respond to your trim question, let me make an assumption (tell me if I am right) and then let me ask a few questions. My assumption is that you are trying to get the thing all trimmed at your normal cruise speed (because trim will change as you go faster or slower). Now, a few questions for you. What is the ball doing at that speed? If it is not centered, what happens when you do center it? Ideally, you want the ball centered and no roll at your cruise speed.

Several things can cause the ball not to be centered. You may have one rudder cable a little tighter than the other and that may cause some interference. Also, gear leg fairing alignment (nose and mains) can cause some yaw trim issues. Same goes for wheel pants. Those being off can cause some yaw issues, and as you know, yaw can induce a roll.

Now some more trim questions. You have a pronounced roll with both flaps full up. Are you sure they are both up exactly the same? Take a straight edge and lay it from the wing to each flap in several locations to make sure they are both exactly in line with the wing. If they are not - fix this. You can also check this with one of those neat digital levels, first on the wing and then on the flap.

Another thing to try is lowering the flaps in small increments while in flight. Does the amount of roll stay about the same, or does it get more of less pronounced? Of course some really calm air is critical for all of these checks. Also, note the speeds so you can try it again as you try various corrections.

Some questions about the aileron trim tab you installed. By the way, that is a darn big tab. Is it the "hidden" wedge shaped type that we talked about or the standard ugly tab stuck on the trailing edge until you get a chance to put on a hidden one? Anyway, with the aileron up that much, the other one must be down some as well. Where is the stick? Bottom line, you want the stick to be centered left and right when you get the roll corrected. Remember you can adjust where the stick is by changing the length of the aileron push pull tubes.

One other thing for you to consider; try closing up the gap between the aileron and the wing with some vinyl tape. Just make sure you can still get full aileron throw both ways. This trick was really effective on aerobatic aircraft for getting more effective ailerons. Sealing up the gaps also seemed to lower aileron pressures somewhat.

Glad to hear you have solved the gear leg shimmy problem.

Blue Skies,
Buz

Safety Items:

Here is a follow up article by Johnny Thompson on how to prevent a fuel vapor explosion caused by static electricity like he had on one of his Lightning tanks. He has developed a mod that

should prevent any other Lightning builders from having to face this kind of serious happening. Below is Johnny's "how to do it" article:

The explosion on my aircraft has been depressing, several more months of down time and more money. In aviation when an accident happens we look at danger to life, cost of damage, how often the same accident has happened in the fleet and then how much it would it cost to fix the problem. It comes down to money versus hazard and the possibility of the same exact accident happening again. This is what I think of the cap grounding strap.

On aircraft with cap already installed in wing and has been fueled at one time I feel a modification could be more dangerous than not doing the modification I will do the following:

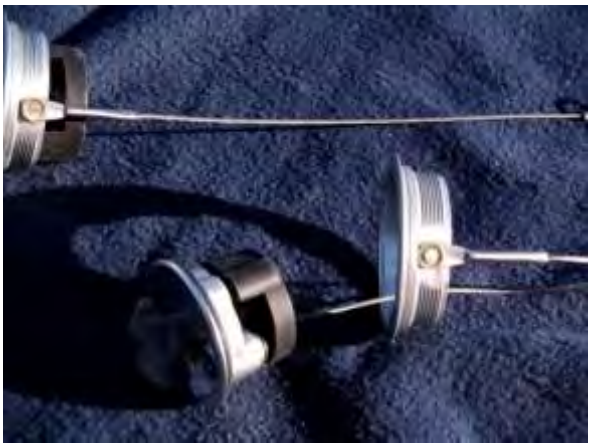
1. Whenever removing or installing the cap, especially if fuel is low or empty. I Approach the fuel cap and place a thumb or a finger onto the housing ring without touching the cap; I keep touching the ring and then unlock the cap and remove. I try to always place a finger onto the housing ring before I remove or install the cap. I always have that finger be the last to be removed.

2 If I defuel the aircraft for any reason I will keep the aircraft grounded

3. After the aircraft is defueled and I will be working on or around the fuel tank I follow procedures in various FAA and Fire safety publications. FAA's Airframe & Powerplant Mechanics "General Handbook" (available from Jeppesen and others) suggest using a dry nitrogen gas to purge the tank or a 5 lb CO2 fire extinguisher discharged slowly into the tank. I use nitrogen. I do not purge the tank if I am doing a Weight & Balance and refueling when finished. I have noticed with fiberglass tanks even after a year the fuel smell and some vapors are present. Be careful.

For caps at time of build:

Materials: MS20668-2 Eye End (This works very well on the older deep housing. I will look for a different terminal with a 1/8" hole for the new housing)
34124 Ring Tongue Terminal
9 inches of 1/16th SS cable
AN426A-4-8 Rivet
AN960-6L washer



New housing:
The pictures shows where the 1/8" countersunk hole must be located, not much room. The head of the rivet must be flush or it will catch on the plastic of the fuel cap. It is difficult to countersink without the proper tool. An angle grinder is used with sanding disk to flatten the top of the MS20668-2. Remove the threads and flatten the housing as shown. Install the rivet in the housing making absolutely sure the rivet head is flush. The smallest amount exposed will interfere with the plastic part of the fuel cap during install or removal. The cable is installed into the 34124 ring tongue terminal and crimped with a quality crimper. The ring tongue can easily be replaced if it breaks over time. After inserting the cable into the MS20668-2 Eye End crimp with crimper but if tool is not available lightly but firmly hit with a small hammer twice on two sides. Don't beat it up, just make the cable secure for life as a future repair will be near impossible. The rivet is installed in the housing, end eye and then washer AN960-67 with 1/8 hole. Use a rivet squeezer to set the rivet or use rivet gun. The rivet used is a soft 1100 so very easy to set. Job took me about 1 hour total. When finished I disconnected the cap from the cable to install the housing into the wing.

This incident will cost me months of flying, a paint job and a vacation I can no longer afford. It could have been a lot worse. One thing I will never let slide again, GROUND THE AIRCRAFT WHILE IN THE HANGER. I know better. I was not working on the plane. I just wiped off some dust from my new paint job, walking by and saw some dust, bent over with a rag in the right hand and placed my left hand on the fuel cap so not to get finger prints on the paint. Boom!!

This past week Greg Hobbs has been updating his demo aircraft and repainting. He has been testing ways to ground the aircraft and found connecting to metal glassed into the wing/fuselage during manufacture reduces static buildup. What's ironic about this he's using the grounding cables and reels that I brought from my previous home/hanger! Wish I had done that.

Safety is everyone's responsibility. It's only as safe as the builders make it.
Johnny Thompson, N8WN, still parked, Marana (Tucson) AZ.

NOTE: Just so everyone knows exactly what Johnny is talking about, static electricity refers to the buildup of electric charge on the surface of objects. The static charges remain on an object until they either bleed off to ground or are quickly neutralized by a discharge. Although charge exchange can happen whenever any two surfaces come into contact and separate, a static charge will only remain when at least one of the surfaces has a high resistance to electrical flow (an electrical insulator like a fiberglass wing). The effects of static electricity are familiar to most people because you can see, feel and even hear the spark as the excess charge is neutralized when brought close to a large electrical conductor (for example a path to ground), or an area with an excess charge of the opposite polarity (positive or negative). The familiar phenomenon of a static 'shock' is caused by the neutralization of charge.

As everyone probably knows, the air in Arizona is normally pretty dry, and static electricity is more prevalent when the air is dry; even more so in the winter time. During the summer, the air is generally more humid. The water in the air helps electrons move off you more quickly, so you cannot build up as big a static charge. What happened to Johnny could happen to anyone. Just be aware of the possibility and take appropriate caution. Johnny has come up with a great fix.

Engine Clinic:

Below is Pete Krotje's third article for this Engine Clinic section on the Bing altitude compensating carburetor. Thanks again, Pete. I invite all of you to submit future Engine Clinic articles so that this section can become a permanent part of future newsletters. Now, here are Pete's latest words of wisdom on the Bing Carb.

In the last two articles I discussed the forces that act on the Bing carb to affect mixture and then how to tune the carb to provide the right initial mixture for each individual airplane. One last topic remains: How does the carb change the mixture to compensate for altitude?? Here's where the —simple in concept" runs into the complex and interactive real world.

Let's start with the simplest factor in the compensation matrix: Carb Bowl Pressure. We all know from the previous articles that more pressure in the carb bowl will push fuel through the jets faster and that lower pressure will push fuel through at a slower rate. Therefore, when we climb to a higher altitude the ambient air pressure is less. Since the carb bowl vent supplies the pressure for the bowl and since the

bowl vent is ducted to the incoming air stream, the bowl pressure will vary with altitude. The result is that when we climb to a higher altitude the bowl pressure drops, slowing the flow of fuel through the jets. Slower fuel delivery results in a leaner mixture.

A good illustration of this phenomenon is the initial experience that Sonex had when they installed a 3300 Jabiru in the prototype aircraft. They left the bowl vent open to the cowl. Mixture was fine at full throttle climbing out. After they leveled out and picked up speed, the pressure in the cowl increased and since the vent was open to the cowl, the bowl pressure increased. The engine then belched black smoke and ran very rough. No combination of jets would solve the problem. The carb bowl pressure must equal the outside air pressure.

Now let‘s look at the forces on the diaphragm that affect mixture. Remember that the pressure on the bottom side of the diaphragm comes from the same ambient air source as the carb bowl vent. This force pushes up on the diaphragm. Lower air pressure at higher altitudes exerts less up pressure on the diaphragm. Remember that the up pressure is opposed by the spring‘s down pressure. So, with less up pressure from outside air and the spring pressure being constant, the spring will push the diaphragm down. That causes the jet needle to ride lower in the needle jet reducing the size of the opening for fuel to flow through. Smaller opening equals less fuel being able to flow. Less fuel equals a leaner mixture. The higher we fly the lower the air pressure, leading to a lower fuel flow rate. This provides less fuel to mix with the less dense air so the ratio of fuel to air remains the same as at lower altitudes.

Now, opposing these two factors is the vacuum or up force on the top side of the diaphragm. Remember from the earlier articles that the vacuum to the top side of the diaphragm comes from the engine and is shielded from the carb diaphragm by the throttle butterfly. Also, we must account for the fact that to maintain rpm as we climb it takes a wider throttle opening. So as we get to higher and higher altitudes we push that throttle in farther and farther to hold the same rpm. The farther the throttle is open the less ~~s~~hielding” the butterfly does, feeding more vacuum to the top of the diaphragm. This extra vacuum opposes the downward forces outlined in the previous two paragraphs and tries to pull the diaphragm up and increase fuel flow.

So there you have it – there is no one force or one thing that is adjusted in the Bing carb as we change altitudes. Some forces try to reduce flow while others try to increase flow. Several different forces work together (or maybe it‘s better to say ~~o~~ppose each other”) to keep the mixture in an acceptable range for economical operation.

Proper initial tuning to the aircraft and propeller characteristics set the initial stage for the right mixture. Then the variation in the forces that act on the carb influence the rate at which fuel is delivered, keeping the mixture where we need it to be.

Pete Krotje

For sales or service contact: www.usjabiru.com, email: info@usjabiru.com, phone: 931-680-2800

NOTE: Once again, it you have not attended one of the Jabiru engine seminars in Shelbyville, I highly recommend that you do so. The information presented on engine installation, operation, maintenance and overhaul is well worth the cost of attending the class. Call Jabiru USA to get scheduled.

Upcoming Events:

6 June – Green Landings Open House at WV22.

27 July to 2 August - Oshkosh AIRVENTURE.

25-27 September (most likely date) - Lightning Fly-In at SYI.

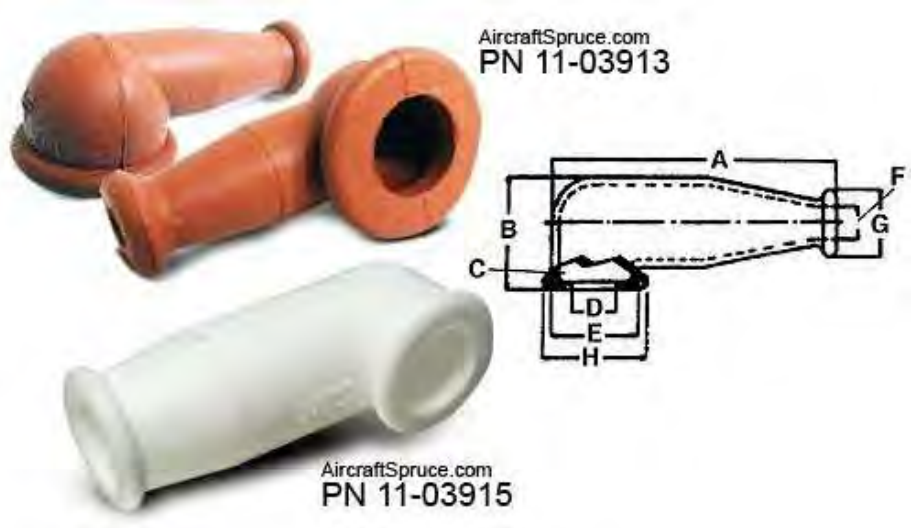
Lightning Skunk Works:

Here is a Top Secret photo of a **Special Light Sport Helicopter** being developed by ~~C~~hopper Pilots" **Tom and Al** from Lightning North Central. Although this prototype model is a small single seat test vehicle, the planned production model will utilize a standard Lightning fuselage with a Jabiru 3300 engine mounted vertically in the baggage compartment to power the rotor. When I saw **Tom and Al** at Sun N Fun they could hardly contain themselves with the excitement getting back to Wisconsin to fly this chopper prototype. They each could be heard saying something like, ~~"~~Whop, whop, whop, whop, whop, whop, whop, whop, whop." That's chopper pilot talk.

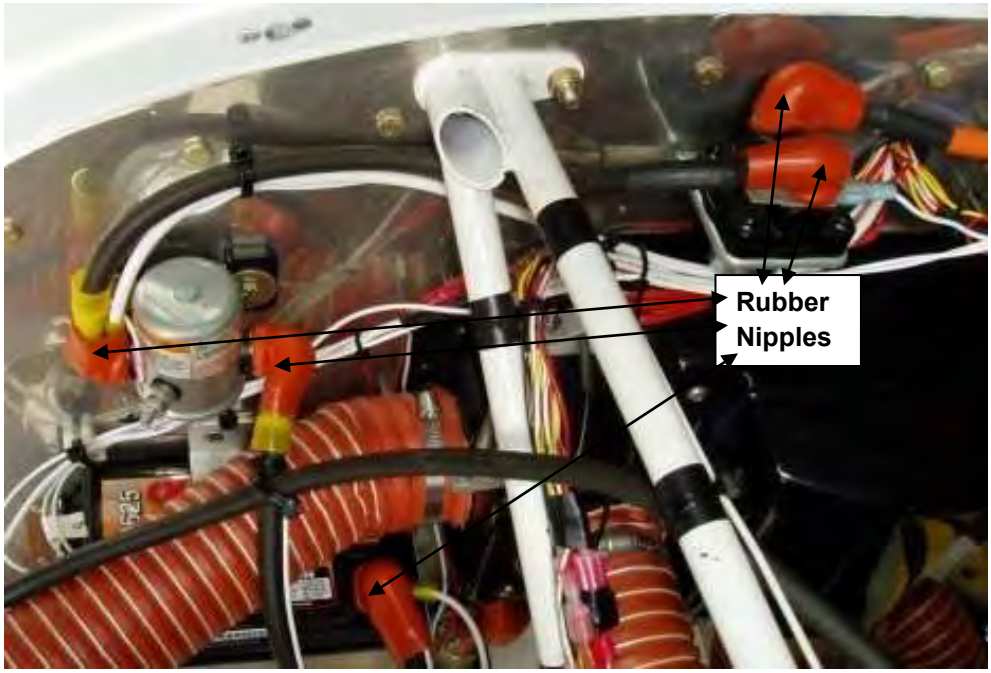
Technical Tips:

This tech tip is one of those things that is easy to do, adds a bit of a safety aspect when you have your cowling off and also tends to clean up the overall look of your engine compartment. The idea is to cover all major electrical connections on the battery, relay and solenoid with rubber electrical nipples. By covering these electrical connections you can prevent accidentally touching a positive terminal with some part that is grounded when you are working near these terminals with a metal tool. Obviously touching a positive and a negative with a tool will cause a major spark or electrical short. These rubber nipples have

a military spec number of MS25171, come in various sizes, and are available from many suppliers. The below picture is from Aircraft Spruce.



The photo below is of Linda Mathias's Lightning firewall and shows some of the rubber electrical nipples as they are installed on her airplane. One mod that she did in order to get the nipples to more easily fit over the large gauge wire was to cut off the aft end of the nipples so that the wire (or wires) would fit through the nipples. Looks good, does the job it was intended to do, and is easy to accomplish.



Other Items:

I live in Williamsburg, Virginia, a very historic area (did you know it was the first capitol of our country?), and when you include the nearby areas of Jamestown and Yorktown, you can cover a great amount of our county's history. Everything from the location of the English settlers' first landing and permanent settlement in 1607 on Jamestown Island, to major events of the Revolutionary and Civil Wars can be visited here. Downtown Colonial Williamsburg is, of course, a college town (William and Mary), and as such there are always lots of cultural events to attend. Recently I was kind of dragged to an event at a local museum. I say dragged because it had nothing to do with aviation and I was really not looking forward to spending even an hour or so chatting with non-aviation-minded people. Well the event actually turned into what I think was a kind of positive outcome as far as spreading the word about flying and aviation. Let me explain.

Without purposely doing so, I ended up wearing a sport coat that had a rather different looking pin on the lapel. Let's just say it had the outline of a fighter with the number 2 on it. While standing around the museum display area with a glass of red wine in one hand and probably an "I'm bored" look on my face, a rather good looking lady walked up and started talking about the displays. Shortly after that she noticed my lapel pin and asked what it was. I actually had to look at it to see which one I had on. I proudly announced it was my Mach 2 pin which is presented to anyone that pilots an airplane faster than twice the speed of sound. "Oh, you are a pilot", was her response, "that is really neat."

I am not going to bore you with the rest of the conversation except to say the museum event suddenly became fun as I got to talk about flying and tell her about the EAA's Young Eagles program. She really sounded astonished that she could get free airplane rides for her kids. Actually several other of her friends joined in the conversation and my hopes are that they really will take advantage of the Young Eagle Program.

I learned two things from the evening at the museum. First, our local EAA chapter is apparently not doing that great of a job of advertising the Young Eagle program in the local area. And second, I will try to remember to carry some Young Eagle brochures in my coat pocket when I go to a non aviation event – plus, of course, always remember to wear some type of aviation lapel pin. It pays to advertise.

Final Thoughts:

If you want to go really fast and burn a huge amount of fuel in a homebuilt aircraft, get one of these.

However, if you want to go fast, not burn much fuel,

and look great in a homebuilt aircraft,

get one of these!

Blue Skies,

Buz Rich

N1BZRICH@AOL.COM (Contact me directly for newsletter inputs – I need your help to keep this newsletter both interesting and informative.)

Yep, that is a "FOR SALE" sign on the nose gear of this USAF B-1 "Lancer". Any offers?

PS, it is not light sport ready. .