Hangar Talk

The "Lightning" Newsletter

Sharing info between builders, flyers, and future customers.

First Quarter 2013 - Volume 6, Issue 1

2012 SL-1 Demo, Lightning of the "Quarter"

N337AL, the 2012 SL-1 Demo is pictured above at the recent Sebring Light Sport Aviation Expo in Sebring, Florida. Besides spending some time in the display booth, it flew many demo flights in both the demo fly-by pattern and also taking potential customers on demo flights.

This issue of the Lightning Newsletter starts the sixth year of newsletters since that first issue in February of 2008. Over the years I think the newsletter has been a big help for the entire Lightning community. It has been a source of information for builders, flyers, and potential customers, as well as a way for the factory and the dealers to keep the Lightning community up-to-date on news and potential safety issues. I think everyone agrees that it is worth the effort to continue it. So, here is another plea for someone out there to grab the stick and take command of the newsletter for a while. I think you will enjoy the experience and the newsletter readers will appreciate your efforts. More info below.
Blue Skies.
Buz Rich

Contents in this issue

Newsletter's Sixth Year and Future

This issue of the Lightning Newsletter will be a long one since there has been none for over a year. Nick and Mark talked me into doing another issue while we were at Sebring. Many of you will remember that I started the Lightning Newsletter back in February 2008 and wrote 36 monthly issues. After publishing the newsletter for three years, I felt it was time for someone new to "take the stick" to provide a fresh approach, possible new direction, and renewed interest. John Jenkins, a Lightning builder from Wisconsin, accepted the task and wrote 9 issues. Then the "factory guys" wrote the last issue in Jan/Feb 2012. Since there has been no newsletter for the past year, Nick and Mark (they just do not have the time) talked me into writing one more issue. We will call it a "quarterly" edition and hope that some other Lightning builder or flyer will agree to take on the task in the future. Over the years I enjoyed writing the newsletters because it gave me a chance to meet so many Lightning owners, builders, and flyers, and it helped me to continue my close association with the factory. So here is hoping that someone in the Lightning community will decide that the newsletter is important enough to take on that mission. You might be a current Lightning owner, builder, or maybe even someone that hopes to be a future Lightning flyer. The Lightning community needs you to volunteer. The newsletter is important to all of us, and you will immediately become "world famous". What a deal!

Please contact me at N1BZRICH@AOL.COM, or the factory guys at info@flylightning.net. Let us hear from you! Buz Rich

The 9th Light Sport Aviation Expo at Sebring

The ninth annual Sport Aviation Expo was once again held at the Sebring Regional Airport (SEF) in south central Florida, from 17 – 20 January. According to the organizers it was another successful four days of activities to support general aviation, and more specifically, the Light-Sport Aircraft industry. Over 160 exhibitors displayed Light Sport Aircraft and a variety of aviation-related products. In addition to aviation educational forums, the event also included a twilight airshow and a display of the Collings Foundation's B-17, B-24, and P-51.

Paul "Bear" Bryant's Lightning on display at Sebring.

Both Arion Aircraft and Jabiru USA were once again represented at the Sebring show. The show officially started on Thursday, with Wednesday designated as a "set up" day for the vendors. Pete and Barb had flown down the previous weekend to get ahead of the bad weather forecast between Tennessee and Florida. I met them at Sebring on Tuesday afternoon, but Nick and Mark were stuck in Tennessee due to the bad weather and they really couldn't arrive until Friday afternoon. So without a Lightning at Sebring to be on display in the booth, Paul "Bear" Bryant came to the rescue and volunteered his EAB Lightning as a display aircraft. Pete drove me over to St. Petersburg Wednesday late afternoon to pick up Bear's jet. I had a great flight out of the Tampa Class B area and got back to Sebring just before dark.

Hollis Babb, a Jabiru owner from Huntsville and volunteer at Sebring, took this great photo of Paul Bear Bryant's Lightning in the Arion display booth.

As to the flight in Paul's Lightning, I will tell an embarrassing story on myself about the flight from St. Pete International to Sebring. Bear's email address starts with N5PB and he and I exchange emails on a regular basis. My email address starts with N1BZ which was the N number on my Pitts, so naturally I assumed that Bear's airplane was N5PB. When I called St. Pete ground for a flight and taxi clearance I used the call sign N5PB. After ground came back with a clearance for 5PB, I heard Bear's voice say on his hand held, "It's N82PB." Of course I immediately looked on the panel and right there in front of me was N82PB. I think ground must have thought Bear's voice on the hand held was an instructor in the aircraft, because from that point on they called me 82PB. Yep, I had to buy the guys a beer for that one.

Mark and Max.

Nick and Tim Hund (from Norfolk, VA).

Nick flew the current SL-1 Lightning demonstrator (337AL) into Sebring on Friday afternoon, and shortly after that I took N337AL up for numerous fly bys in the airshow demo pattern. That was loads of fun. Nick also flew in the demo pattern on Saturday. By paying a little extra for being a Light Sport Expo "Partner" at the event, Arion gets a great booth location and also specific times in the fly by pattern when the announcer tells all about the aircraft while it is making its demo passes. The announcer always seemed enthusiastic when telling about the Lightning; however, he did make a "huge" error on Saturday morning as he announced that it was powered by another engine instead of a 3300 Jabiru. When I went over to correct him he was very apologetic and said he absolutely knew the Lightning had a Jabiru because he has a Jabiru 3300 in his Sonex.

Arion's current demonstrator, N337AL, at Sebring.

Familiar aviators, Ben and Katie, now work at Grand Rapids, in Michigan.

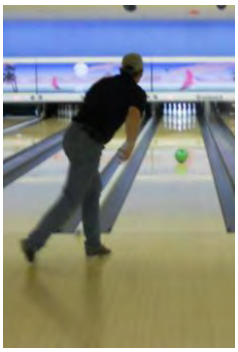
Barb and Greg

There was always a crowd looking at Bear's jet.
They couldn't believe it was over four years old.

All in all it was a great show. There were always a lot of people around the Lightning booth and most people could not believe that Bear's jet was over 4 years old. Several potential buyers got demo rides with Nick in 337AL and all expressed how much they enjoyed their flight. Most aircraft sales are finalized in the weeks or months after a show is over as potential buyers get home to think over the purchase, take at look at personal finances and get the final "OK" from the real boss. We are hoping that several of the shoppers at Sebring get the OK.

Besides the daytime fun at the Expo, the Tennessee group also enjoyed a variety of evening activities (other than eating and sampling the local libations). Below are some photos from the Jabiru verses Lightning Unlimited Bowling Extravaganza (J LUBE). The rules are simple, first you get lubed up, and then you roll the ball as hard as you can.

Katie, Barb, Pete, Nick, Max, and Ben.



Nick

Mark with 1 very big Army ball.

Who won the Inaugural J LUBE event? They were all too lubed up to do the math, but I think it was old number 42 that actually won.

The 2014 Light Sport Expo at Sebring is scheduled for Jan. 16-19. Hope many of you are able to attend. It was a fun show and got us down to warmer Florida weather – and that was great.

News from the Factory

A new member to the Lightning community and Otterback family

Mya Elizabeth Otterback **was born on the 25th of February to Nick and Dana Otterback. Congratulations to Dana and Nick. In the photo below it looks like Mya is holding up two fingers to signal she is starting up number 2 of a twin engine airplane. Right on, Mya!**

7lbs 2oz born Feb 25th @ 1220 AM

New Engine Choices for the Lightning

Arion aircraft is proud to announce that we are working with UL Power North America to design a factory supported engine package for the Lightning. Robert Helms from UL Power has been a big help and we are just a few short months away from having a firewall forward kit. Engine choices for now will be the UL350 130hp and the UL390 160hp engine. We look to fly the first factory installation around the Oshkosh timeframe.

The UL 350iS is 130 HP and the UL 390iS is 160 HP.

The truly modern UP Power engines feature FADEC (full authority digital engine control) with multi-point electronic fuel injection, and dual electronic ignition (with variable timing), excellent power-to-weight ratio, and high fuel efficiency in a conventional configuration: Air-cooled, direct drive, horizontally opposed four-cylinder.

The design of this new line of engines was based around critical issues such as reliability, light weight, excellent performance, a direct propeller drive and modern, proven technology.

- **-Modern Technology four-stroke, air cooled, four-cylinder opposed engine**
- **-Dual (redundant) electronic spark ignition (variable timing)**
- **-Multi-point electronic fuel injection with automatic altitude and temperature compensation**
- **-Electronic RPM limiter**
- **-Direct propeller drive**
- **-Wet sump forced lubrication with integrated pressure regulator**
- **-5 bearing crankshaft with thrust ball bearing**
- **-Ram air cooled cylinders and cylinder heads**
- **-High fuel efficiency**
- **-No carburetor icing problems**
- **-Excellent power to weight ratio**
- **-Electric fuel pump and pressure regulator to eliminate vapor lock and facilitate starting even under adverse conditions.**

The 130 HP version (UL 350iS) has a displacement of 3503 cc (213.77 cu in.), a compression ratio of 8.7:1, an installed weight of 172.8 lbs which includes all accessories, oil and exhaust. It has an oil capacity of .66 gal and uses unleaded automotive gasoline with a minimum of 98 octane, or 100LL AVGAS.

The 160 HP version (UL 390iS) has a displacement of 3900 cc (238 cu in.), a compression ratio of 9.1:1, and an installed weight of 220 lbs.

As a comparison to the above numbers, the 120 HP Jabiru 3300 (200 cu in.) has a compression ratio of 8:1, and an installed weight of 184 lbs.

Lightning to be featured in Aviation Consumer

Aviation Consumer, at: www.aviationconsumer.com is the independent online source for impartial and uncompromising evaluations of aircraft, avionics, accessories, equipment and more. They take no advertising, so their editorials have no pressure from any advertisers.

During December 2012 Rick Durden, the editor at Aviation Consumer came to Shelbyville to fly the current LS-1 demonstrator with Nick. He seemed to really enjoy the flight and had very positive comments about the experience. Look for his upcoming article in a future issue of Aviation Consumer.

Rick Durden, from Aviation Consumer, and Nick prepare for a Lightning flight.

Lightning Sales Update:

As we start a new year, I asked Mark to give us an updated total list of Lightning kits, LS-1 SLSAs, and ELSAs sold since the Lightning's first kit sales contracts were accepted at Sun-N-Fun in 2006. Below is his sales update as we start 2013.

Hi Buz!
Here are some quick numbers for you. 152 kits delivered so far, but Ryan should pick up #153 tomorrow. There are 117 total flying which includes 22 LS-1s. A couple more may flush out as I email dealers (there are some unknowns with Ryan, Greg and Dennis)

As far as Lightnings in other countries, Australia leads the pack of course, with 30 total airframes of which 2 are LS-1s. 16 are flying down under with one more very close (just awaiting inspection).

New Zealand – 1 (but I heard rumor of a second but have no idea how it got there if true)
Brazil – 2 (they FINALLY came and got the silver one. I have no idea if it has flown)
Canada – 1 (flying)
Germany – 1 (and hopefully Gerd will build another – he spoke with Nick today)
Russia – 2 (one flying, one under construction)
Norway – 1 (under construction – rec'd kit this past summer)
We're in the works of getting a dealer into South Africa. I will let you know how that progresses.

Also, you can mention our Facebook page if you'd like. www.facebook.com/flylightning.
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Recent Safety Alerts and Service Bulletins

Arion Aircraft recently issued a Safety Alert and a Service Bulletin for the SLSA and ELSA LS-1 Lightnings. All currently registered owners of the LS-1 will receive hard copies in the mail, but it is recommended that kit built Lightning owners also at least read these for educational purposes. They are located on the Arion Lightning web site listed below.

-AASA-1-1-2013 was an Arion Aircraft Safety Alert about possible elevator hinge pins working loose on the LS-1.

-AASB-1-12-2012 was about possible Spar Box cracking on the LS-1.

Note: All service bulletins and safety alerts can be found on the Lightning Web site at:
http://www.flylightning.net/service-bulletins.html

Spar Box Issues

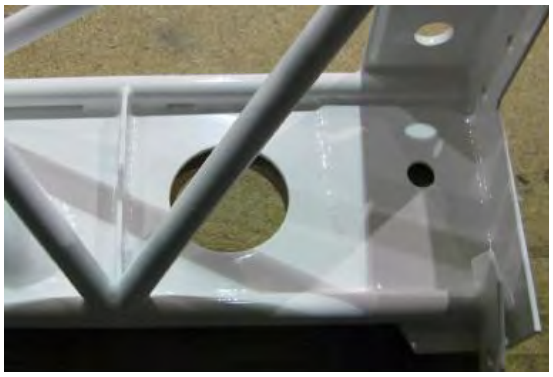
The spar box problems that the Service Bulletins refer to are primarily caused by the affected Lightning aircraft being subject to higher than expected landing loads. These higher than expected landing loads can be caused by either very hard landings, or the Lightning being landed over the 1320 pound gross weight limit on Light Sport models, or operation on extremely rough landing or taxi surfaces. The above situations on rare occasions can cause some cracking of the spar box tubes or deforming on parts of the

spar box. In either case, the Service Bulletins spell out the fix to the effected spar boxes and the fact that Arion Aircraft will fix the affected parts.

For cracked tubes, as shown below, the fix is a fully plated section.

Cracked forward tube at gear plate.

Cracked rear tube at compression V tubes.



Fix is a fully plated section.

For deformed sections, the fix is added compression tubes and gussets.

Deformation of rear ½" tube box

Deformation of lower socket plate

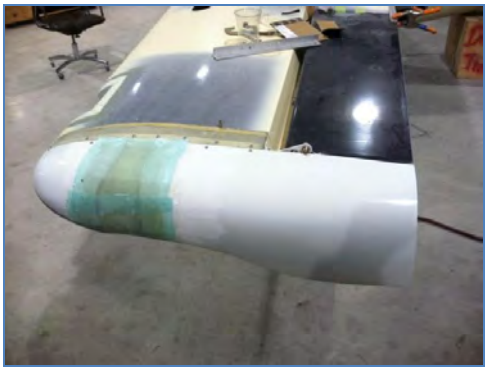
Photos below show the fixes.

Compression tubes added

Gusset added to lower plate

A Popular Wing Tip Mod

A popular modification to the Lighting is shortening the LSA wing tips. Those who are not flying in the LSA category do not need the extra wing area for stall speed. However the "winglet" tip does give added roll stability, better fuel economy, slightly slower stall speed and landing speed for the standard bullet tip, and just looks cool.



The shortened "winglet" tips being fitted to the new 2013 EAB demo.
Note: The photos are made with the wing upside down.

We have built up a set to send off to Custom fiberglass molding. Hopefully by the time Sun n Fun rolls around we will be able to sell them with the kit. The kit comes standard with the bullet tips; the option cost on the new wing tip will not be very much. There is only slightly more material involved and fabrication is about the same.

The above tips have been fitted to our new 2013 Experimental demo that is currently being built.

Setting Gear Toe the Easy way

A while back I walked out into the shop to find a spar box mounted upside down attached to a bench. The gear legs were installed and so were the lower sockets. Each socket had a ½" steel pipe placed in the end with a string drawn taught between the ends. Since our guys build a lot of planes they become very efficient at finding new ways to make things quicker and repeatable. Our finish crew thought that it might be easier to set the gear toe out of the aircraft where it could be done easily on the bench. Lasers, plumb bobs, and chalk lines can work but take time and once and while just don't work.

I think a picture tells a thousand words and the attached photos below do just that.

Assembly on the bench ready to drill. Note the ½" steel tubes and tight drawn string.

The string is tied to a small hole in the end of the tube and then the tube is inserted into the back of the axle. This locks the string in place. We do have a small hole drill in the tube the corresponds to the inboard axle bolt hole, this way a bolt can be passed thru the ½" steel tube and lock it in. Rotate the gear until the string is parallel to the steel tubes. Drill the ¼" holes in the spar box and you're done.

This works for both the EXP gear and the LSA gear, and can be done after box installation without wings installed for the final time.

EAB Gear

The EAB narrow gear has some camber built into the lower axles. This will cant the top of tire out, the thought was that with normal flying over time the gear would relax some and the tire should stand more or less vertical. This has not been the case with several aircraft, and this probably contributes to difficulty setting the toe, and aggravates shimmy with little tire contact. The lower axle weldment angle has been changed to give 2 degrees of positive camber, bringing the tires to more vertical position.

Also some aircraft have experienced separation of the lower socket at the end of the main gear leg. These aircraft had known hard landings at some point in the past. The cracks showed signs of corrosion in the crack and exposed gear leg suggesting damage that had been there some time. The lower gear leg receptacle on all lower main axle weldments, both EAB and LSA, have been sleeved since about the end of 2011. This gives doubled wall thickness and prevents the socket from sheering.

MK2 Tail

This year has brought a few changes to the Lightning design. One major change was the introduction of the MK2 tail. The reason for this is covered separately in this newsletter – see below. The tail was introduced in March of 2012 and production aircraft and kits since that time should have the new tail included. Also, all new kits and factory built aircraft starting this year will have the MK2 tail. The old molds have been destroyed and will no longer be used. If an aircraft needs a new tail for some reason in the future and it is fitted with the old design, the MK2 tail will be supplied.

Elevator Changes

All new kits also have the elevator balances removed. Early on, 2006, flight testing showed that the pitch control system was stiff enough to be free from flutter tendencies. There for the build manual showed how to modify the elevators/tail to eliminate those. The New elevators and horizontal tails are molded so that none of this work is required. This section of the build manual will soon be eliminated.

In 2008 we introduced the electric elevator trim tab. Since then the builder was required to fabricate this portion of the elevator. The trim tab and servo motor inspection cover have been molded into the new elevators as well. The build manual will remain unchanged for the time being; several aircraft are still under construction with the original design and must still be completed.

Airframe

The Lighting Design was originally molded with Epoxy resin. Since about mid 2011 all composite components are made using Vinylester resin. Vinylester has a substantially higher thermal deformation temperature of nearly 220degrees vs. epoxies 160 degrees. The Vinyl ester is a lighter resin with more consistent curing attributes. Since Vinylester is a hybrid of Epoxy and polyester resin the builder may still use products such as Aeropoxy to get a good structural bond with no worries.

MK2 Horizontal Tail for the Lightning
Evolution of a Design

By: Nick Otterback

Introduction

Throughout an airplane's design life it will undoubtedly go through many changes. Either the mission for the aircraft has changed, a design standard is different (assuming the designer uses one), or maybe the designer himself is just never happy. In this case all three are very relevant. The MK2 tail was designed because the Lightning has evolved. From the go fast machine we first conceived around a camp fire, to the refined ASTM compliant cross country ship that is it today. The following should help explain our decision for the latest step in the Lightning's evolution.

Why change the tail?

When the prototype came off the drawing board so to speak, it was a go fast "Machine" that was meant to get there quick and have fun doing it, be simple to build, and economical to operate. It was, but that mission soon changed. With the advent of Light Sport a new mission was becoming clear. The plane had to fly slower both in cruise and stall, and be somewhat more docile in handling. We all know what happened from here, longer engine mount to improve stability and CG range, longer wing tips with integrated winglets for slower stall and better roll stability, and a few other small improvements.

These were relatively simple changes to make the design meet the requirements for an LSA, and have worked well for the Lightning design. However as with most anything you change there is always something else that is affected. In broad design terms, an airplanes horizontal tail area should ideally be a percentage of the wing area, or at least within a range of percentages. Those ratios were very close to perfect with the small wing of 91sqft, but with the addition of the sport wing tips that percentage fell, though still within the acceptable range, to the lower end.

In 2011 a revised standard for the "Design and Performance" of an ASTM compliant LSA aircraft was accepted by the FAA. In particular was the section on control forces. Where the previous version simply required that stick forces increase with G load, the revised standard now required a specific increase to be met. The standard Lighting Horizontal Tail (HT) meets the new requirements but with little margin.

The thought of a larger HT has been in the back of my mind since the introduction of the Sport wing tips. That, coupled with a very evident shift in aircraft mission and customer base, it became clear a change was on the horizon. Late in 2011 we decided to build a new 2012 demo plane, what better opportunity than now to get moving on the biggest change to the Lighting design since 2008.

Original Horizontal Tail

New MK 2 Horizontal Tail

The Process

We wanted to keep as much of the old tail design as possible, this would make it easier for the homebuilder, the production crew for the LS-1, and cost of the part as it relates to kit and SLSA price. The main spars, close-out spars, attach points, hinges, bell-cranks, and elevators remain the same. All that needed to change was the airfoil for the HT. This realistically meant new skins on an existing proven frame.

To achieve the wing to tail area ratio that was ideal, a little over 3sqft would have to be added to the current tail. That meant the leading edge of the tail would be near square to the fuselage. Fortunately we were able to maintain some leading edge sweep and exceed the area requirement. The horizontal tail airfoil is a standard symmetrical type, on the smaller tail the cord and camber reduce in size but maintain the NACA plotting for that airfoil. The MK2 tail keeps the same airfoil shape but the size is retained from root to tip.

Our "plug" was built on a horizontal tail set fresh from Custom Fiberglass, this was to ensure that none of the attach points would move and geometry would remain unchanged. The process started by making very accurate jigs to check the airfoil shape along the tail span. We then bonded high density foam to the horizontal tail. After a few days of careful sanding and shaping the HT finally had the airfoil shape that matched our jigs perfectly.

The tails were then sent back Custom Fiberglass for the mold making process. Several weeks later a set of finished tails arrived for assembly. Building the tails and installing them is no different from the tails we have been using since 2006. Everything was built just as it has always been, and fitted up to the fuselage with no issues what so ever. The only change made was to the amount of elevator travel being rigged. Due to the larger size of the tail, the elevator would not need to have has much travel as the original. We reduced the throw from 25 degrees to 20 degrees of up, and kept the 15 degrees down we already had.

How does it fly - First Impressions

Like a Dream. This is the feel I have been wanting in a Sport Plane since we started the journey down the LSA road. The control harmony is excellent between pitch and roll, and the control forces are very natural. The pitch feel is great, when the aircraft is rolled over into a steep turn the plane just starts to talk

back to you with a very nice stick load. It is not like holding up a C172 in a turn, that's just too heavy, but it is enough to let you know you are loading up the airframe and pulling G's. It really lets the pilot get connected with the plane, and it just grooves better than it had before. After several more hours of flight testing the Elevator throw was reduced again to 15 degrees up and 10 degrees down, no other changes were made.

Stability

The pitch stability is a thing of beauty. Most well designed airplanes will come back to the trimmed airspeed, some quicker than others, but in general an airplane with this mission comes back to where it was. Stick free pitch oscillation tests are usually the norm for exploring general pitch stability. For comparison I will discuss both tails. All tests were done at gross weight and rearward CG locations.

At 100knts IAS with the standard tail; the aircraft is pulled up to about 10 degrees and then the stick is released. The aircraft will slow to around 80knts before coming over the top and heading back for 100knts. It will shoot thru and accelerate to near 130knts IAS before coming back up to 100knts. This is called a cycle, and the standard tail will eventually come back to 100knts in about 3 dampened cycles.

The MK2 tail will after about ½ a cycle come back to the 100knts. The aircraft does slow some initially to maybe 90knts and then instead of heading down for 100knts flattens out and accelerates back to 100knts. Very much improved indeed.

Other tests are completed such as reducing power, or adding power from trimmed flight. Both tails will seek the trimmed airspeed however the MK2 tail design continues to do this in less than ½ a cycle.

Flaps down pitch stability can prove difficult for any plane, the aircraft is draggy, usually is slower and has much less momentum, and in the case of a low wing a higher pitching moment induced by the flaps. Setup at 55knts IAS and full flaps, the standard tail when pitched up will slow slightly than pitch over to seek 55knts. However due to the smaller HT and flap moment the aircraft never pitched back up, it did not tuck or pitch down further than about the 10degrees it went up, but never did come back. Is this bad, no, it just shows that the HT tail is smaller than ideal for the intended mission.

Now onto the MK2 tail with the same test, the aircraft was set up the same way with flaps down and 55knts. The plane slowed slightly and pitched over, but as it accelerated thru 65knts the nose came up and continued to then slow back down in a slight climb to 55knts. Eventually after about 1 ½ cycles it stabilized back at the 55knt trimmed airspeed, absolutely perfect.

What does all this mean to the Pilot?

Takeoff - The standard tail requires a technique that the pilot holds some back pressure until the nose gets light and starts to come up. Once the nose come up the stick must be neutralized because the aircraft is not yet ready to fly and needs to gain some airspeed. This takes place very quickly and because the tail is smaller and elevator throw is greater, the pitch inputs are lighter and faster too.

The MK2 tail is much larger in size and has significantly less elevator throw for the same stick movement. This gives the pilot much more positive feedback during rotation, the stick feels heavier during acceleration. As the stick is pulled back to rotate the nose comes up slower and better matches the stick movement. Once in the air after rotation and the plane is accelerating even further the tail forces build and make the stick feel solid.

Stalls - The original HT has a bit more of an abrupt stall due to is smaller area. With a well rigged aircraft the nose will drop 10-15 degrees as the stall occurs. The recovery technique is to simply relax pressure and unload the aircraft so that the wing flies again, the aircraft will than accelerate on its own in a level flight attitude until a climb can be initiated. The natural response from a GA pilot it push the stick forward to help motivate a large heavier aircraft into the same position. That technique can give a good unexpected view of the ground with a resulting pull to a secondary stall. The stall and recovery of the

standard HT is not bad, just different. Specific Light aircraft flying techniques must be taught to insure happy stalling practice.

The MK2 tail is much what you would expect in a larger GA plane. Due to the added area the tail does an excellent job in holding the nose of the aircraft up during the break. When the break occurs the aircraft will break to near level flight maybe slightly nose low. Couple this with the improved stick to elevator movement, and you get more of a natural feel. You still are unloading the aircraft, you must to recover from the stall, but it's the stick movement and resulting pitch change that gives it a more normal look.

This all around improvement in slow flight and stall regime makes landings very manageable and easier in all flight conditions.

NOTE: With a very well rigged Lightning it is very possible to hold the aircraft in the stall and keeps wings level with the rudder alone. Our new demo 337AL demonstrates this perfectly.

Approaches - As stated before in the Stability discussion the standard tail is very happy to accelerate passed trimmed speed and right on to the ground with the flaps deployed. This requires that the pilot give good attention to airspeed control using their instruments and the well proven "pitch plus Power equals airspeed" method.

The new tail however prefers to fly on airspeed and this proves very handy when making stabilized approaches. If you are on final approach trimmed for say 60knts and you start to slow down, the stick gets heavy quickly letting you know you ought to put the nose back down. Vise versa if you start pushing on the stick to get down hill because your high, the stick will push back because it doesn't want to go faster than you have trimmed it for.

Landings - Because the tail is larger it is more stabilizing at slower airspeeds and can keep the nose up against the rotation moment of the flaps. Also as discussed earlier the elevator movement is less than the standard tail, while the stick movement remains the same. This lessens the pitch sensitivity during round-out and flare. The horizontal tail keeps the nose up during the flare by producing down force thru elevator change or airspeed change.

Take the standard tail for instance. If the pilot is landing in gusty conditions they might experience changes in wind velocity quickly and several times throughout the flare. This does require some stick movement to keep the nose at the correct attitude. A gust will increase the down force produced, if a small nose down input it not made the plane will gain altitude immediately. IF that wind goes away than a small pitch up input is made or the landing will be flat resulting in a bounce.

This is still true from an aerodynamic standpoint for the MK2 tail. However it is because the tail is larger and requires less elevator movement that results in less and smaller pilot inputs to stay on attitude. Since the MK2 tail can hold the nose up against the flaps there is little tendency for the nose to pitch over after a bounce or loss of the wind you were flying against.

This is an improvement against a PIO after a bounced landing. After a bounce the airspeed slows greatly and the angle of attack increases. With the standard tail normally what follows is a nose down attitude; this is due to the large flap pitch moment coupled with the pilots trying to avoid a stall. Again with the larger MK2 tail, it can hold up the nose against the flap moment and since the pilot inputs are dampened thru less elevator movement, the chance of PIO is less. Or in other words it mostly bounces flat with no pitch over.

Closing thoughts

Is there anything wrong with the standard tail? No, over 110 aircraft are flying with the standard tail with some 40 or so under construction. IT has proven a stable reliable platform with many thousands of hours of flight time.

Was it worth improving upon? Yes, most definitely. To think ones airplane design is perfect is a flaw; everything can be better, even by the smallest amounts. I was once told that if all you are doing is flying

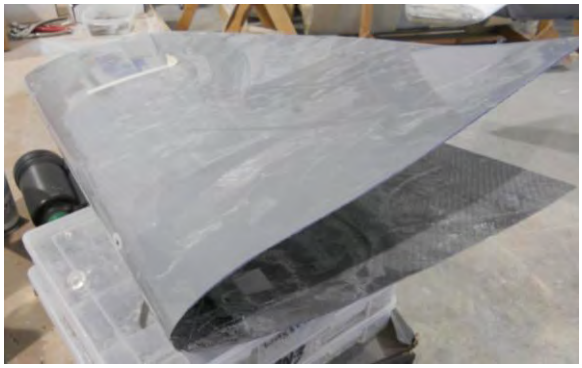
around without purpose than you better find a different hobby. You should always try to become better in aviation, practice something every time you fly, or educate yourself on a new piece of avionics, whatever it may be just advance your understanding of it (aviation).

I think aircraft design is the same. Don't just sit on the same old design for years to come and think there is nothing wrong with it. Maybe it is as simple as designing a new access door for easier maintenance, or an entirely new horizontal tail. Either way, always continue looking to improve things, that is the only way anything evolves.

Modifying flying Lightnings with the Larger MK 2 Stab

Many owners of currently flying Lightnings have expressed an interest in modifying their aircraft to the new larger horizontal tail, now known as the MK 2 Stab. Here are some photos that I made while Lynn Nelsen was in Tennessee modifying his currently flying Lightning. The photos show the installation process for the cuffs that are available to go over the original stabs to give the larger stab area. Remember, new Lightnings come with the larger stab from the factory and don't need the cuffs.

Paint and gel coat are removed as shown to get a good base for the epoxy glue.



Cuffs are made of carbon fiber material.

Cuff glued over original stab.

The prototype Lightning that started it all. Arion continues to improve a great airplane.

Another Factory Change being incorporated into the Lightning

The photo on the left below shows the original engine exhaust and how the lower cowling must be cut out to make room for the exhaust tube to exit the engine compartment. The photo on the right below shows the newest configuration which does not require the lower cowling to be cut out. It makes for a much cleaner looking installation and probably helps cool the engine compartment since the cowling air dam or "lower lip" is not compromised.

This new exhaust design was developed by Sam Kite, a current Lightning owner and flyer, who is a strong supporter of the Lightning community. Sam is also a Tennessee Walking Horse aficionado who also has a large horse training facility in Shelbyville near the airport. During last October's Lightning Homecoming and Fly-In he showed many of us around that facility one morning while the weather was too bad for flying. Very impressive.

Arion has the modified exhaust available and will exchange if for your new unused exhaust for $150.00 plus shipping. If you want to convert a used muffler, sent it to Arion and they will modify it for the same price. Turn time to convert a used muffler is about 2-3 weeks.

October 2012 Lightning Homecoming and Fly-In

Once again we had a great Lightning Homecoming and Fly-In at the factory in Shelbyville. Everyone in attendance had a great time, enjoying the flying, hangar talk, the food, and the annual creeper races. As always, Nick brought everyone up on the latest developments to the LS-1 as well as the kit Lightning, and some things to look for in the future.

Russia (Max Voronin) and Germany (Gerd Nowack) square off in the CRAP drag race (Creeper Racing Association of Professionals).

Sam Kite (with hat) and Gerd's wife, Uli.

I took this photo of "Moostang" Mike working on the 2013 EAB demo during the Lightning Homecoming.

These photos give a progress report on Nick's Pitts project. His O-360 Lycoming is installed.

Current Lightning Dealers or Representatives


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


Lightning Southwest, Greg Hobbs, 18750 West Avra Valley Rd, Marana, AZ 85635, 520-405-6868 www.lightningaircraftwest.net


Mid Atlantic Region, Green Landings Flight Center, Ryan Gross, 309 Takeoff Dr, Hedgesville WV 25427, 304-754-6010, www.greenlandings.com


Lightning North Central, Tom Hoffman, 3015 Shady Ln, Neenah, WI 54956-9509, (920)-585-9704


Lightning New York - Jabiru Power Solutions, LLC, Dave Jalanti, 136 Millbrook Rd, Hudson NY, 12534, Kline Kill Airport, Ghent NY - Identifier NY1, (518) 929-4307, dave@jabirups.com


Lightning Florida, Moonshine Aviation, LLC, Max Voronin, 917 Biscayne Bay Unit #5, Deland FL, 32724, 386-873-9995, www.moonshineaviation.com


Midwest, Heart of America Aviation LLC, Jack Gonzenbach, 12906 W 122nd St, Overland Park KS, 66213, (913) 890-3052, jgonzenbach@flyhoaa.com


Western Light Sport, Sullivan Equipment and Leasing, Jay Sullivan, Hanger#23, Redlands Municipal Airport (KREI), Redlands CA, Cell 909-362-7294, Office 909-307-5757, FlyLightningLS1@gmail.com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South Africa-Flylightning SA, Deon Lombard, Petit Airport, Pretoria, Phone 0834196613 or 0723122717, deonandpamela@yahoo.com

News from the Dealers

Other than seeing Greg Hobbs, the Arizona dealer, and Max Voronin, the Florida dealer, at the Sebring Light Sport Expo this past January, I have not heard from any other dealers. Remember dealers, the newsletter is your chance to let the Lightning community know about what is new at your location and any other news you would like to share. Basically, free advertising!

News from Builders and Flyers

Buz's Recent Engine Experience

Just before Thanksgiving 2012 I was flying back to Williamsburg, VA, after being in Franklin to fly my J3 Cub. About 12 to 15 miles out I noticed a slight vibration which after 3 to 5 seconds or so, became a major vibration. I immediately started climbing (trading airspeed for altitude) while checking instruments and my engine analyzer. I had been cruising at about 1500 feet and 150 mph or so. Looking at the engine gages I saw number one cylinder's EGTs and CHTs were dropping off, so I knew number one was not producing any power. I figured the engine would run fine on 5, but started looking for alternate landing areas on my way back to Williamsburg just in case. When I was about 3 or 4 miles out and ready to start descending on a long left base the engine died when I pulled the throttle back. An attempt to restart was unsuccessful. I had about 100 mph at that time and the prop continued to rotate until I slowed to about 80 or 85 on base. I landed OK and even had enough energy to turn off the runway so I didn't even close the airport. Pulling the plane back to the hangar I noticed a slow drip of oil hitting the aft end of the nose wheel pant which I thought was curious. After pulling the cowl I took the valve cover off #1 and noticed the #1 exhaust valve push rod was showing off to the side of the rocker arm. My hope at that time was that somehow the valve had gotten too much lash and that readjusting to the normal .01 setting would make things right. (My engine has solid lifters.) But that didn't explain why the engine had quit.

Next I removed the #1 cylinder's spark plugs and that is when I knew I had a larger problem than the valve just being out of adjustment. Both spark plugs had the electrodes completely smashed so that is when I knew I must have a broken valve that had been "bumping" around in the head. After removing the head I saw the exhaust valve head imbedded in the top of the piston. Also, the piston had a hole in it and that is when the "light bulb" came on and I knew exactly why the engine had quit. The hole in the piston allowed oil from the sump to get into the head, and then anytime the intake valve would open oil would get into the intake system. Eventually there was enough oil in the intake system that it got into the carb. When I reduced power on base, the lesser amount of fuel/air mixture was apparently overcome by the oil in the carb. So not being a diesel engine it wouldn't run with all that oil in the carb, thus, engine failure. The oil I saw dripping on the aft end of the nose gear wheel pant was dripping out of the air intake scat hose that goes into the carb. Now even the oil drip made sense.

Head damage

Piston w/ screw driver in hole

Piston w/ valve head imbedded

Above photos show damage caused by broken valve while engine was running.

I pulled the engine off of N31BZ and in December drove to Shelbyville to get their help on fixing the problem. After only a week the engine was ready for a test run. Besides just fixing the number one cylinder, piston and head problem, at 800 hours I thought it smart to do the 1000 hour top at the same time. But after talking things over with the guys and seeing the damage to the piston skirt and resulting metal parts in the oil sump, I decided to do a major over haul instead. Not because it was needed, but because when I sell the airplane in the future, the low time since major on the engine should be a selling point. The Jabiru engine guy, Roger Hodge, as well as Pete said the engine really looked clean and great on the inside with absolutely no signs of over-heating. In fact they were amazed that it looked so good with 800+ hours. They said to keep doing what I have been doing as far as running it and maintenance.

What caused the number one exhaust valve to fail? Where it broke was just below the valve head, not where it contacts the valve guide or the valve seat, and the break was a straight across, clean break, so apparently it was a metallurgy problem from day one when that particular valve was produced. I guess the darn things are made by humans.



Left: Piston photo showing broken skirt and bent rod.
Center: Pieces of broken piston found in oil sump. Right: Normal exhaust valve with 800+ hours and the broken exhaust valve stem.

Hole and valve head imbedded in piston.

Two things from this experience really impressed me. First, the "5 cylinder diesel" Jabiru kept running for well over 5 minutes until I reduced power for the landing. That really impressed me, especially when I looked inside the engine to see how much damage had been done to the piston, the cylinder and the head, plus the amount of broken parts from the piston skirt that were in the sump. It is a sturdy engine.

Roger Hodge, Jabiru USA's A&P mechanic.

Test runs on a cold December day.

Second, this experience confirmed for me that the Jabiru guys in Tennessee are top notch. They were great to work with, provided outstanding support (even changing their work schedule to help me out), they have all the parts on hand for any engine issue and without a doubt, they are the experts on the Jabiru engine.
Buz

Selwyn checks in with an update on his test flying.

I've finished my test flying with very little in the way of changes required, two turns on one flap linkage to correct a slight right wing low tendency was about it. I built mine without the optional sump cooling duct and had some oil temperature problems as the weather warmed up so last week I fabricated and installed the sump duct and cut the air entry in the cowl under the spinner. Oil temperature has dropped by around 15 C and the introduction of additional air into the lower cowl does not seem to have affected the airflow over the cylinders, CHT's have not changed, so I'm happy with the result. My thought is that the sump cooling is an essential mod in this environment.

The picture is us taxiing out for first flight.

Merry Christmas and a Happy New Year to all!

If you are building, keep at it because the result is fantastic. If you are flying, go fly some more and wipe that silly grin off your face. :D
Cheers,

Selwyn
Kit 66

Gary Winkler **sent the following photo and info almost a year ago during the time frame when no newsletters were being produced. I'm happy to include it in this issue.**

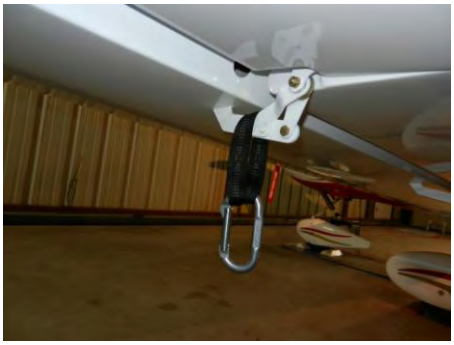
On 30 March 2012, my mother, Jane Winkler, turned 80 years old. For her birthday she wanted to go flying in my Lightning, N428GW. We took off early in the morning and flew out to breakfast returning later in the morning. N428GW can be flown from either side, so once we took off, my Mom flew left seat the entire flight for a total of 2.4 hours.
Gary

Gary Winkler and his Mom on her 80th birthday.
Happy Birthday, Jane.

Gary Barnett (gbsss@bendbroadband.com) sent this info on his tie down straps.

Tie Downs for the Arion Lightning LS-1

As you all know the Lightning doesn't have wing tie downs as you find on most general aviation aircraft. The recommended wing tie down location is the outer flap brackets. The tie downs you usually find at most general aviation transient areas consist of either old ropes covered with sand and other grit or chains. Both will damage the paint and or the metal of the flap brackets. The following is a solution to that problem.



We purchased six feet of the strongest nylon strapping used in technical rock climber harnesses and three oval Carabiners at REI Coop for $21.66. We cut the nylon strapping into 18 inch lengths, folded them back on each end approximately five inches and had an upholstery shop (for $10) sew the loops with heavy duty nylon thread. Total cost $31.66. You feed one end of the strap over the outer flap bracket and hook the Carabiner through the two loops and then tie the plane down with either chain or ropes through the other end of the Carabiner. The total weight of the straps and Carabiners is small and we keep them and nylon tie down ropes in a small bag behind the seat in the plane.

Wayne Patterson (Wayne@lpwa.net) reported on his Lightning build in Western Australia.

Things are taking shape with my Lightning over here in Perth Western Australia. I'll send some interior shots after I've wired up the panel. I'll take it down to the airfield soon - it has lived in my garage for too long now..... (about 3 years!). Cheers!

Wayne Patterson
(08) 9444 3156
PO Box 2358 Yokine South WA 6060

Fitting brakes

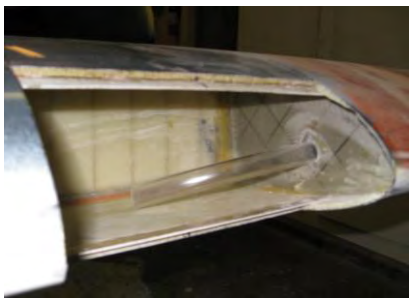
Plane on driveway.

John Drane (jdrane1@yahoo.com) sent in photos of Greg Hobbs' display at the 2012 Cactus Fly-In and the engine school at Greg and Crystal's hangar.

Greg's engine school and display at the Cactus Fly-In.

Bernard Melendez, Jr. (n45bm@yahoo.com) continues to share his building experience and photos with the Lightning community,

Below are photos on how I made a tube access from the wing tip lights to the landing lights area for running wires. Basically, I glued a short piece of 1/2" CPVC (plumbing) pipe to a section of plastic that I cut out from a junction box. I then attached a piece of 5/8 O.D. plastic tubing to it, safety wired it and pop riveted it to the wingtip sail. Next, I made a 1/8" aluminum piece to match the foot print of the light, drilled and tapped the machine bolt holes, epoxied it to some balsa wood and carved and fitted it to the wing tip. The rest was filled with micro and resin to shape.



The left photo below shows yours truly sanding the outboard aileron hinge attach area where I added 6 plies of 8 oz. cloth. This is for reinforcing this area because I plan on extending the ailerons about 9" outward, or longer. The next photo I am sanding and adding the glass cloth.

I'm a glutton for punishment, so I just had to build my own wing boarding steps. That's also known as "El Cheap-o".

My final rudder re-shaping of the top and bottom, a strictly cosmetic change to suit my preferences.

It's my sincere wish that these photos help others in their build or that they inspire them to continue their projects. If anybody wants detailed drawings of any of my mods, they can send me a SASE and I'll send them a copy. My email is n45bm@yahoo.com.

Best regards,
Bernardo Melendez, kit #110

Bernardo's first EAB was a Corby Starlet.

Reader Feedback

Over that past year or so many Lightning owners and readers have requested an update on the ARIS program that is being developed to improve an aircraft's flight through areas of turbulence. I first reported on this program in the January 2011 issue of the Lightning Newsletter. Eventually we hope to use an Experimental Light Sport Lightning for the manned test profiles. Below is an update of the ARIS program and progress to date.

Update on ViGYAN's ARIS Program

This is an update on the ARIS (Automatic Ride Improvement System) program that I wrote about in the last newsletter that I produced back in January of 2011. As a brief background update on the ARIS program, ViGYAN, Inc., a NASA contractor, located in the NASA Langley Research Center in Hampton, Virginia, provides aerospace research and development services to a wide range of government (including NASA) and corporate clients. Their business areas include: wind tunnel testing, scientific and engineering software development, and computer technology support. To give you an idea of the type of company that ViGYAN is, two of their recent general aviation projects were, first, developing a way to make composite aircraft able to take lightning strikes, and second, having real time weather available to the pilot in the cockpit. Both of these developments have had a tremendous impact on making general aviation safer.

My highly modified Esqual LS (Lightning Stuff) which has many Lightning fiberglass parts and all Lightning welded parts installed. N31BZ is being used to gather test turbulence data for ViGYAN's ARIS program.

The ARIS program that ViGYAN is working on is an amazing project with the goal of developing a system that will be able to dampen much of the turbulence that general aviation and commercial aircraft encounter; a major breakthrough for all of aviation in terms of comfort and safety. The system that ViGYAN has developed and tested in a wind tunnel is called the Active Ride Improvement System (ARIS) and their analysis from the ongoing wind tunnel tests indicates that approximately 93% of the turbulence / gust lifts that aircraft encounter can be dampened or alleviated with the system.

How the ARIS system really works is still proprietary information, so I can't talk in detail, but here is the testing plan.

-Phase one testing was the wind tunnel tests and that went very well - we can show that the system will dampen about 93% of the turbulence that the model is flown through.
-Phase two was supposed to be NASA providing us with a UAV (unmanned aerial vehicle) to install the system on for unmanned flight tests.
-Phase three will be installing the ARIS on an Experimental Light Sport Lightning for me to accomplish the manned test flights.

For now just let me say we have made some progress, but the big hold up continues to be funding. I am still flying additional flights to gather more turbulence data for the additional wind tunnel flight tests on an as needed basis. Unfortunately, NASA funding has been cut drastically and they have not been able to provide a UAV for ARIS testing. So ViGYAN, with their own money, had a 9 foot wing span Radio Controlled test model built and they are currently installing ARIS on this model for the unmanned test flights. Flight testing should start soon. If that goes well, we will once again go to NASA with a funding request that will be used to purchase a Lightning kit.

Initial flights to record turbulence were made in my aircraft with a ViGYAN engineer in the right seat (left photo). Recent flights have been with just the very accurate accelerometer that measures forces in the pitch, roll, and yaw axis. This very small piece of equipment is also a self-contained Inertial Navigation System, a GPS, a magnetometer, and other capabilities. Everything is fed into a laptop computer that records all the data.

The follow up plan, after we have the manned flight tests in the modified Lightning complete, will be to invite every aviation magazine to go flying with us to demonstrate ARIS to them and hopefully get lots of free advertisement. After the magazine writers have flown we will invite all avionics manufacturer that make auto pilots to go flying as we see them as the real customer to buy the rights to the ARIS. We have already applied for a patent and that is looking good according to the patent people.

The reason we want to prove the system on a light sport aircraft like the Lightning, is that if it works on a lightly loaded, long aspect wing airplane, it should work on anything else. The long range view is that every aircraft from commercial airliners, business aircraft, and all modern general aviation aircraft will want the system. Commercial airlines lose billions every year due to turbulence as they have to either slow down or fly around large areas of turbulence. Of course the B-1 and B-2 have systems that smooth out turbulence, but those systems cost millions where as the ARIS using a mass produced sensor like we have will be relatively inexpensive and work through small servos like the auto pilots have.

8 April 2012 Trip to Shelbyville, By Lynn Nelsen

I had planned on going to Shelbyville TN (SYI) to get some help with a couple of maintenance items. However the weekly forecast showed rain showers from middle TN to south FL. I was attempting to make sense out of the hourly readings from several stations along the route of flight. It appeared that the trip could be made VFR, and when I looked at the current satellite view, I decided I could go as long as I went early in the day, so I hurried up and threw some clothes in an overnight bag and headed out (it was 0530). I got airborne about 0610 as the first rays of sunlight were appearing in the east. I forgot to lower my flaps for takeoff (I could not read the check list in the light from my instruments) but other than adjusting the take off run, it was not a problem.

While climbing to 8500 feet, I attempted contacting Tampa approach for flight following. After 3 attempts I switched to Orlando approach and got immediate attention. The sky was CAVU and baby's bottom smooth with the sun's early light coming from the east. Man, I thought what a perfect day for a 5 hour flight to SYI. (I had about 17 mph headwinds) Everything went as planned until I was back with JAX center after passing Valdosta. JAX I could not see any problem with that, but I did notice the indication of clouds way off in the distance.

About the time I was switched to Atlanta approach control, I could see that I was going to have to either climb or descend to stay clear of the clouds. I decided to climb as the sky's above appeared clear. So I announced to ATL that I was leaving 8500 for 10,500. ATL rogers and reminds me to stay out of the TCA. About 15 minutes after getting to 10,500 I could see that I had to climb higher if I was going to stay clear of the clouds. I did not know how long I was going to have to be above 10,500 so I broke out my finger pulse oximeter and my emergency oxygen supply (after hearing Buz Rich talk about his oxygen system I had purchased the oximeter and an oxygen system (MH Copilot hand held oxygen system)). I put the oximeter on my left fore finger and the reading stabilized at 88%. Gee I thought my oxygen is already a little low, but I'm OK, as I was climbing to 12,500.

Now, as I climbed, I could see how the clouds were definitely higher to the 11 o'clock position. About this time ATL tells another aircraft on the frequency that there was an area of precip about 40 miles wide. I figure I do not want to enter this stuff and plan to stay as far east as necessary. Within a few minutes at 12,500 I can see that I am not high enough to stay out of the clouds, so I call ATL (center now that I am above the TCA) and tell them I need to climb to 14,500. As I take a couple breaths from the oxygen, I check my oximeter and see that I am still reading 88%.

I have also changed my heading from 338 degrees to 015 degrees to stay out of the clouds. I can see that I will not be able to keep the required VFR distance from the clouds, but hope to just stay clear. As I get to 16,500, I can see that I am able to change my heading to 355 degrees, so I am at least at the right altitude for the heading. However, I am barely 500 feet over the clouds. It does look like I will be able to descend and turn back to my original heading for SYI in a short while. About this time I am over the top of the Atlanta TCA and they are concerned that I will interfere with aircraft leaving ATL. ATL center is giving several aircraft clearances and calling me as VFR traffic at 16,500. In particular, I remember ATL telling a Southwest airplane climbing through the clouds that they should be clear soon. Southwest reports passing 15,000 still in the clouds, so I call ATL and tell them that I am only about 500 feet above the clouds. The Southwest flight called clear of clouds at 16.500 and traffic in sight (I never did see them). About this time I was waiting for the call to tell me to please call phone # --- when I get on the ground.

A few minutes later, after taking several deep breaths of oxygen -seeing my oximeter show 77%- I was able to tell ATL I was descending from 16,500 to 14,500 as I flew towards the northwest. I could see that I was going to be able to descend further, but I was still over the TCA (goes up to 12.500), so I called ATL and asked for clearance into the TCA for 8,500. Center tells me to stand by and gets the clearance from approach control. I level off at 8,500 above a broken layer and figure I have it made. My oximeter is reading 88% and I am headed out of the TCA.

About 50 miles further, I see the broken clouds beginning to become more of a solid layer. It is too far to SYI to be concerned yet, as I have still not crossed the Tennessee River. (Maybe it will get better) Sure enough, it does not. The clouds turn to solid overcast. I am listening for the SYI weather, but am still too far away. I hear another plane call Memphis center 20 miles west of SYI asking for their clearance, and I

am thinking gee if they got on top at 3500 maybe I can find a way to get down. At 50 miles from SYI, I finally hear the Wx. (1100 overcast, 2300 overcast with light winds and visibility more than 10 miles) I continue inbound looking at every dark spot in the clouds hoping there will be a hole. No luck. Then at about 20 miles I see what looks like a crack in the cloud tops. As I get closer, it appears to be a little bigger. When I am about a mile away, I suddenly see a reservoir below the clouds. Off comes the power, down goes the nose, and I drop through the slit in the overcast. As I get lower, the opening actually gets wider, and I turn left and right looking for traffic. I stop the decent below the clouds at 1700, and return to my heading for SYI. Off to my right, I see Tullahoma airport in the clear with sunshine. (Maybe I would have seen that hole and maybe not.)

There are no more openings in the overcast as I proceed in to Shelbyville to land on runway 36. SOMEONE is definitely looking out for me. Thank You!

News from Our UK Correspondent – Clive James

Clive James, our UK correspondent, who has built a Jabiru 160 and an Esqual, sent in the following update on his Esqual modifications and test flying.

Esqual in England: I had been hoping to report I had finally obtained a full UK permit on my Esqual in this newsletter. However I am still patiently waiting for the paperwork to be processed having submitted a final successful flight test some 4 months ago. Getting the Esqual permit is a long story and maybe one day I'll write it all down. For now I thought it might be interesting to list all the mods and improvements that I did on the Esqual on its journey to flying as well as it does now.

As with most builds where the aircraft wasn't built for the engine there are compatibility issues, some worse than others. I was envious watching the Lightning builds where everything seemed to me made to fit. Also the Lightning has been further developed, as I'm sure Francesc would have done with the Esqual, as the lessons were learned. Having help from Danny in Belgium, who was building slightly ahead of me, and Pete and the guys in the US was really beneficial and although some things were awkward some I had the benefit of hind sight. Those who have seen the Esqual manual will know why you had to make certain aspects up as you went.

The list of mods goes like this:

Brakes- I stuck with the original brakes, probably a mistake, though I can now lock the wheels up and hold the plane on full power. I have changed the geometry of the master cylinder pedals twice and added a second caliper to each wheel (thanks again Bob). A few weeks ago I re-piped the brakes with 3/16 and that has firmed them up, I had hoped to remove one caliper but after getting used to the stopping power I had I'm sticking with two calipers per wheel. I did have loads of trouble with air in the brakes for the first 2 years and finally found it was the brake valve, stripped and serviced it twice but only fix was to sling it in the bottom of the tool box.

Trim- Using trim with elastic linkage actually increases instability so as one of my UK acceptance issues was stability, the bungee linkage had to go and on went the Mac Servo and flap from Arion. The flap has been doubled in size from the first fit out and is now hands off of full flap on approach.

Wing rear attachment bolt area- This was beefed up in the plane and the wing with a good stack of extra layers of glass to firm up the connection and stop the flexing.

Nose leg- I had the opportunity to get a free nose leg after a runway excursion and so my Esqual now has a Lightning nose leg, wheel and forks. The geometry of this set up is a little better for steering.

Spats- I bought a set of Lightning spats and, whereas I like the nose one, the main gear spats (pants) look too big to me, and as soon as I get the time, I will refit the Esqual spats. Leg fairings look good and finish it off nicely.

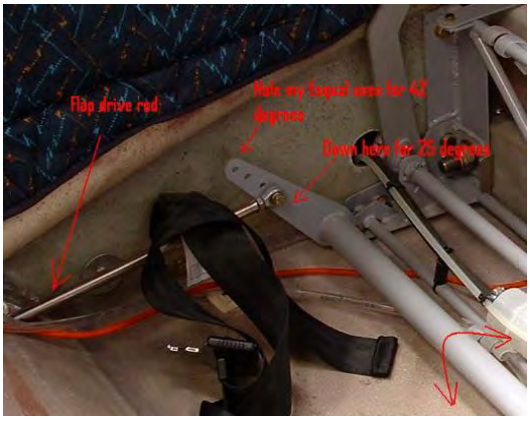
Cowls- Having been around Jabs and talking with folk, reading lists, etc., I knew the cooling issues. I was very careful with the ducts and made a sweet job of the fit from the Rotax cowls. Head cooling was OK from the start, but after advice from Dave McCorkdale, I fitted a drop skirt to his design and bingo, all was good, very good. That was until I got a picture from Spain and saw how sweet the Esqual looked with the Lightning cowls. I had to have them. The two pictures below have different cowls.

Oil Cooler- The oil cooler was on the left after I moved it from the Vol Mediterrani location which was the cowl outlet. It fitted inside the cowl on the left as it was small enough. I did however have the battery on the left. Can't remember why it had ended up there. It was clear though for year round operation a bigger cooler was needed and it would need to go on the right. Here I should have moved the battery and re-wired everything. Maybe one day. The oil cooler is behind the HUGE NACA style scoop on the right hand picture above.

Engine Mount- I have an Arion Esqual mount and that puts the engine 17mm further forward. Don't know if it was intentional but when I got the new mount it was apparent that my old Rotax cowls wouldn't fit. Good job the cowl and the mount were on the same order. Fact they wouldn't fit made the cowls free as they then became parts of the runway excursion repair and claim previously mentioned. At this point we were 5 years down the road and it was about time I was having some luck.

Rudder pedals- Seems I wasn't the last to find out about the pedal issue, I was nearly the last. When standing on my single caliper brakes after a too long a landing I could no longer steer and veered off the runway. Discussion with Nick about the issue and he e-mailed me a photo that showed the strap fitted to the lightning pedals. My Esqual pedals quickly had a strap. The strap supports the top quadrant and stops the pivot bolt from bending and locking the pedals up when you stand on the brakes.

Flaps- During early flight testing it was easily apparent that full flap reduced pitch authority significantly. The LAA engineer sat in the plane in simulated approach at height and pushed and pulled on the stick with little effect. The Esqual I have has the massive flaps. The maximum flap has been reduced in stages but now we have hands off trim on approach at full flap. Full pitch authority and only a slight pitch up in 'go around' that is easily held while flaps are retracted and trim reset. The Esqual flap drive arms came with predrilled holes to reduce flap travel but we have gone quite a bit further than that. Approach and take of is flown at 10 degrees and full flap is 16.5.



Horizontal Stabilizer and trim- The LAA base their flight requirements on JAR VLA. This sets a sensible standard of stability without compromising the sporty feel. As first flown the Esqual, with a pull back on the stick would reach for the sky until it ran out of speed when it would fall out the sky. Similarly, if the stick was pushed it would dive for the deck and speed would increase until the pilot's bottle went and it was pulled up. The trim I had fitted was a push pull combination with a set pull on the elevator drive rod and a reverse pull on the elevator linkage under the seats. It took some fiddling between the two to get a balance and it was possible to achieve some sort of balanced flight. How they found the situation above at all acceptable in Spain I don't know. Using trim with elastic linkage actually increases pitch instability if it is fitted in the manner the Esqual used it.

If you think about it this way it's easy to figure. The bungee is a constant force at a particular setting; in the Esqual case it is always lifting the nose by lifting the elevator up. This force sets the elevator against the airflow according to the balance of the aircraft in the air. If you disturb the stick and the plane slows the force on the elevator will drop, with the bungee force the same the elevator will be lifted as the two forces try to get back in balance. This will slow the aircraft and the speed will drop, less force on the elevator, same bungee and you are into a vicious circle that makes the plane climb to the stall. Going the other way, disturb the plane so it goes faster and more airflow overcomes the bungee force and the nose will drop, go faster and so on. It was clear the bungee trim had to go. As luck would have it Arion had also moved away from the bungee trim and were selling a kit of parts to convert to the servo trim with a flap. Quickly sourced and fitted the stability tests showed an immediate improvement.

'Dag' is an Aussie phrase suggesting something doesn't look as good as it could. Indeed the Esqual with the elevator hanging down it looked 'dag' to counter this it was suggested I could add a little up bungee using the old system so the elevator was just below the horizontal but generally following the sleek lines of the aircraft, it looked much better. Back to the flying then and some stability tests. Blast, hardly any improvement from the previous characteristics. I expected at least step change for the good. Right who cares about the 'dag look, the rubber bands go into the back of the hangar and off we go again. No longer did the plane climb to the stall when disturbed though it did slow to almost that speed. Pitching forward the speed increased but stabilized in a nose down attitude. So getting there, but still not enough.

What next- We had to get radical and after a chat with Nick (as in appendicitis, get well soon!) it was clear 'you need to make the tail heavier as it speeds up' , the only way, move the stabilizer, here I was listening to the suggestion I moved the tail about, wow!. How much? Drop the front of the stabilizer 3/16" or 3 degrees was the estimate. So at this point I was really glad I had never glassed the tail on. The adjustment, whilst time consuming, was actually quite easy. Lifting the front of the stabilizer would involve some serious glass work and frankly look 'dag' so the best option was to raise the back. The rear mount is two small holes and some clamping forces. Small amount of glass work, holes filled and re-drilled and we had 3 degrees on the digital level. Slight displacement of the stabilizer from the 'Karman' at

the rear but not easily noticed. Back into the aircraft we were in business, positive pitch stability without killing the general handling of the aircraft. One more tweak, the trim flap has been increased in size slightly from the first fit out and plane is now hands off of full flap on approach. I believe most lightings/Esquals ended up with larger trim flaps than was original envisaged.

From the explanation above, no bungees and the forces are relative to airflow over the controls and there is no constant 'pull' on the control rod. The elevator forces increase as the speed increases. The trim forces are from airflow and they increase as the speed increases. The stabilizer the same, now pointing down slightly at the front, more speed and airflow gives more lift pushing the tail down.

Stall strips- I know a lot of folk don't like these and I didn't before I fitted mine. I have heard of them actually speeding an aircraft up. However, the stall on my Esqual was fine but it was a bit of a 'wild ride' the ground appearing in the canopy front quite quickly. JAR VLA calls for a clear warning prior to the stall (not a beeper) and no more than 30 degree wing drop. Also the standard roll out of a turn. So stall strips were recommended and I sourced some aluminum ones from the Technam dealer that were for the 92. They were about a foot long. I packed them with flock and epoxy to give them a good surface and glued them on. During the test flying all was well though there were a couple of tests that showed an imbalance. We put it down to our weights and tank imbalances. The signals approaching the stall are great, buffeting the plane the stick for a good while until the actual stall. You'd have to be a corpse not to notice. The flight test results were written up by the 83 year old test pilot and submitted. He did mention the increased wing drop one way though said it wasn't much more than the other way. The LAA being the LAA they weren't happy, though it took 3 months to find out and we were testing again. This time with a short additional piece of strip on the left. Through the test again and it was all classic stuff. Well within the JAR VLA requirements only problem was I now have a little more stall strip on one wing than the other. Why didn't think of it before? But examining the strips, found that I'd fitted the right one with a slight twist and one end is slightly higher than the other. Dark hangar to blame…. When I get time I'll refit the right stall strip and remove the add one which is currently taped into place.

What's not been done?

Tanks- These aren't modified and I'm really glad. During the build I learned of the Shelbyville approach to making true wing skin tanks. Extra capacity, we all like lots of fuel. Anyhow, I resolved to go back to them later. Now I'm really glad I still have the polythene tanks. No alcohol issues.

Sloshing compound- Has anyone found a sloshing compound that works with alcohol yet? Really works, after a few years? I have a Jab 160 I need to slosh for Mogas.

Ah, the other day I managed to get my wife to fly in the Esqual with me. She's a confirmed high wing fan and has always avoided the plane before. We flew about an hour away to Sywell, originally a WW2 Air Base for Tiger Moth training. Now they boast a smooth concrete runway. Whilst taxiing out to leave after lunch I heard and felt it, the dreaded shimmy!! With aeroplanes there's always something! Stick to grass fields - that must be the answer…

A bit of color to finish, or rather almost black and white- In the UK we don't get a lot of snow, though some areas this winter might argue. In the East where I live we get the best weather in the UK, snowy season no exception, so we had our picturesque dusting which never stayed on the roads. Some rather nice pictures were taken by my wife.

Happisburgh Lighthouse

Windmill at Thurne Mouth

Hospital in Norwich

Hopefully I'll soon have full permit news and the champagne will be out!
Clive

Upcoming Events

Sun-N-Fun, Lakeland, Florida, April 9 - 14, 2013

Nick's Lightning forum at SNF is scheduled for Wed 4/10 @ 1100 and for Sat 4/13 @ 0900.
Both are in room 11 in the Forum Building which is the Lakeland Air Academy building.
The Lightning get together at the Lightning booth (same location) is on Fri 4/12 @ 1200.
I hope to see many of the Lightning community at Sun-N- Fun.

Virginia Regional Festival of Flight, Suffolk (SFQ), VA, 3, 4 May, 2013

AirVenture, Oshkosh, Wisconsin, 29 July – 4 August, 2013

6th Annual Lightning Homecoming and Fly-In, Shelbyville, TBD October 2013.

Note: The Homecoming and Fly-In will probably be the first weekend in October, but KSYI will be starting a taxi way and ramp reconstruction project in May/June which may cause a delay.

The 2014 Light Sport Aviation Expo in Sebring, FL, is scheduled for Jan. 16-19.

Past Sun-N-Fun Photos – Yes, lots of fun.

Safety

This first safety entry came in from Tex Mantel.

Buz, glad to have seen you at Sebring, but wished we had more time to talk. I want to thank you for a little word of wisdom you gave me but maybe didn't realize at the time. Your story about the engine running rough then failing was great. You said the first thing you did was trade airspeed for altitude (or climb**). I never thought to do that, and I now have it burned into my mind and pass it on to other pilots. Please include that tip in your safety tips which you always had in the past newsletters.**
Again, Thanks.
Tex

In any emergency situation the most important initial actions are:

- **First - Maintain aircraft control**
- **Then - Analyze the situation then take appropriate action**
- **Land as soon as practicable.**

In other words: Do not forget to FLY THE AIRCRAFT (and Climb if that is appropriate).

The next safety entry is a question on crosswinds I recently received and my answer.
What is your personal limit for direct crosswind for landings?

The real answer is "It depends". In the past the highest direct cross wind I have landed my Esqual in is a reported 17 knots and it handled that with no problem. However, before I would deliberately plan a flight that would require a landing with greater than 15 knots crosswind, I would look at several factors. The most important one would be how current or how proficient I am at the time – meaning, "Have I flown lots lately and am I on top of my flying game?" Next factor would be the airport and runway environment that the landing would be at. How wide is the runway? Are there any trees or buildings along the runway length that might cause turbulence along with the cross wind? And finally, is the weather forecast for the winds to be steady or are there large gust factors to be dealt with. I guess maybe another factor would be how important is the flight - meaning am I just flying for fun or do I really need to make the flight for some other important reason. So for all of the above thoughts, that is why I say it depends.

I have landed the Lightning in much higher cross winds than my own Esqual, but that was just because I have encountered higher cross winds when flying a Lightning. During the test flying phase for the Lightning the highest cross wind I encountered was 15 knots, so that is the listed cross wind limit listed in the flight manual (Pilot Operating Handbook). However since that was written, I have landing it in much higher cross winds with no problem. On one occasion the airport unicom operator actually told me after the landing that the cross wind during my landing was 30 knots, but I don't think it was actually a direct 90 degree cross wind. But the point of talking about that landing is that all other factors looked good to even try the landing with that high a wind. I had flown lots very recently and felt "on top of my game". The runway was wide and there were no other runway environmental factors to cause turbulence, and the wind was steady with no big gusts to deal with. So hopefully you see why I said "It depends".

One other thought is - as with all landings, always be ready to go around if things don't look good. After the go around you can either try again, or divert to another airport.
Blue Skies,
Buz

This last Safety suggestion is a result of a recent encounter that Nick had with a very dangerous, a very angry, and a very wild animal.

For several days something had been knocking stuff over in Nick's hobby room. Then Dana called him while he was flying RC and said to him, "Get your A$$ home, it's a squirrel and it just ran thru the living room". Dana had cornered it in the bedroom. Nick rushed home and it took him 10 minutes to catch it with a towel. His comment to me was, "Did you know squirrels growl like cats?" He went on to say, "This one did and he was one pissed off chubby little nut lover. It ran like the wind when I let him go; made a B line for the hills." So based on the above, Nick's new tactical call sign will be either Anti Nut Lover, Hunter, Trapper, or Squirrely.

"I dare you to catch me, Nick."

Technical Tips

Setting the Wing Angle of Incidence

Setting the incidence on a Lightning wing is critical to get the aircraft to fly straight and level. The builder's manual gives the technique and the jig shown below works very well and allows you to be accurate as you set the incidence. Arion has a drawing of the jig if anyone would like it.

What the factory guys do is place the jig 18" out from the root. Set one wing based on the molded wing root. Once set we put a digital level on the top of the jig and get a measurement.

We than place the jig on the other wing and clamp the level in place. We hold the wing at the same angle as the left and drill the holes that set the angle of incidence in that wing.

Flap System Free Play “Fix”

The flap system often has some free play in it between the torque tube and rod ends. It may be possible to move the flap by hand up and down a few degrees. If you are trying to adjust roll it is possible that 1 or 2 turns of the rod ends will not help because the flap is “flying up” in the air until the free play is gone.

Try adding “up stops” like the one in the picture below. The stops can be made from 1/8" thick aluminum angle, 1.5" by 1.5" size, and installed with #8 hardware. The only free play left is in the rod ends and there will be very little of that. This has made rigging new aircraft easier here and kept any visual flap displacement to a minimum.

Flap “Up Stop” to remove flap free play.

Winter Operation

The next technical tip on “” is from Carl Beatrice, (flyers.nh@comcast.net). Carl and Pat live in New Hampshire, so he is well qualified on cold weather starts.

Although winter should be mostly behind us just a helpful reminder for you folks in colder climate. About 80% of all engine wear comes from your start sequence, so taking these steps is very important. When temperatures drop below 40 degrees (some say below 32 degrees) you should think of a way to preheat your engine. There are many methods including propane burners, electrical sump heat and cylinder bases. With the lightning, a few of us keep a 75 watt trouble light on the bottom of the cowling. Be careful of any hot part of the light touching the cowling. I also have a couple of hair dryers to direct heat on the cylinders. After engine is preheated, place Master switch on and fuel boost pump on to put fuel in carburetor (4-7 seconds). Place choke full out and throttle closed. Place Master switch off, and then hand pull prop through 6-8 blades. Then proceed with a normal start. Take a couple of minutes and let engine run @ low RPM (800-1000) before advancing power for taxi. When normal temps are reached proceed with take off.

Winter offers some of the finest flying conditions, with the colder and clear air the airplane performs better and provides enjoyable flying. If spring has already arrived when you read this, retain the notes for next winter.
Carl

Carl and Pat’s Lightning

Parking Brakes

The next tech tip entry, having to do with parking brakes, is from Tex Mantell who lives in New York. Tex can be reached at wb2ssj@frontiernet.net.

For those using the Matco parking brake, you might add to your starting check list, to make sure it's in the off position. Today I found that it's possible for the brake pressure to bleed off if the plane sits for a while. You put your feet on the brakes while starting and you can't apply the brakes for the valve is shut closed. You could move forward with no brakes. I almost hit another plane.

For Sale: **Tex also has a Lightning brake cover set (fairings for the wheel pant and gear leg junction) for sale, as shown below. Tex said he would accept the first offer of $75.00 or the closest offer to that amount.**

Brake cover fairing set

Tex's Lightning, N251TM

Other Items

For you guys that live in Florida, please know that the "cold weather guys" that live further north envy you, especially during the winter months. That's one reason why we enjoy coming to Florida for the Sebring and Sun N Fun shows. There are quite a few Lightning owners and flyers in the Sunshine State. In the past, the "Florida Lightning Squadron" guys have often planned weekend fly-ins to various airport locations so they can get together and enjoy the friendship and share information about flying the Lightning. Well below is a suggestion for a future "Florida Lightning Squadron" trip.

One of the guys I met this year at the Sebring show, John Fazzini, is developing an airpark near Lake Wales, which I think is close to Frost Proof where Lynn Nelson lives on an airpark. John came by the Lightning booth and invited any Lightning pilots to fly into his airpark for a visit. His airpark is Ridge Landing Airpark (4FL5), which you can learn more about at:

http://www.ridgelandingairpark.com/

1-800-701-0781 Ext. 4000

Nick and Buz on a recent cross country flight.

Flight Level 320 cruising at Mach .85

ARION AIRCRAFT LLC

Lightning Skunk Works

Is Arion Aircraft being copied by an "upstart" aviation company? It looks that way.

Aerion Corporation, an American aerospace firm based in Reno, Nevada, has announced that it is developing a concept for a supersonic business jet, called the Aerion SBJ. If produced, it would allow practical non-stop travel from Europe to North America and back within one business day. The target price is $80 million, with development costs ranging to $3.0 billion, and is set to be produced in 2015.

The Aerion SBJ's key enabling technology, supersonic natural laminar flow, has been demonstrated in transonic wind tunnel tests and in supersonic flight tests conducted in conjunction with NASA. Data from the Aerion-designed calibration fixture aboard a NASA F-15B in the summer of 2010 are being used to guide the design of a second test surface to be flown in early 2013. The new test surface will provide large extents of laminar flow and be shaped so boundary layer instabilities grow relatively slowly and smoothly. These characteristics will facilitate good boundary layer imaging of the roughness and step-height experiments that will be performed in this next phase. The experiments are intended to influence future laminar flow airfoil manufacturing standards for surface quality and assembly tolerances

Artist's rendering of Aerion SBJ in flight

Not to be outdone, our own Arion Aircraft has just released a photo of their own recent development work that will fly on April 1 of this year. Stay tuned for updates.

NCC-1701 will meet the light sport requirements with four exception: gross weight, max cruise speed, holds more than two, and does not have just one internal combustion propeller driven engine.

Final Thoughts – Suggestions for the New Year

Here's hoping that 2013 will be a super year for the Lightning community. I would like to recommend some activities for all of us who love to fly. Try to fly more often this year so that you get the max enjoyment from your airplane and the tremendous freedom that flying represents. Also, make an effort to take someone flying at every opportunity. It can be a Young Eagle or an old buzzard, just share the freedom of flight with someone so that they can see the joys of flight that we all enjoy so very much. You may end up inspiring a future pilot, or convincing a neighbor of yours that flying is a great pastime, or even sowing the seed in another pilot for building or buying a Lightning sometime in the future. All of these are good things. Another suggestion is to join an EAA chapter if you are not already a member. If you are a member, get involved by flying Young Eagles and by presenting a program on the Lightning. I also suggest that you get your local EAA chapter newsletter editor to include a link to the Lightning web site in the chapter publication or on their web site. All of these are good ways to spread the word about this great airplane that we all love to fly. My last suggestion for you is that you start planning now to attend as many fly-ins as you can this year. I hope to see each of you at Sun-N-Fun, Oshkosh, and, of course, the Annual Lightning Homecoming and Fly-In in Shelbyville. And if you are still debating whether or not the Lightning is the airplane for you, 2013 is the year to take that demonstration flight and order your Lightning. You will be glad that you did! In terms of looks, performance, quick build time, handling qualities, and economical operation, I am convinced that the Lightning is the best aircraft out there for the sport flying mission.

Blue Skies,

Buz Rich

N1BZRICH@AOL.COM

(Contact the factory in Tennessee for future newsletter inputs – they will need your help to keep the newsletter both interesting and informative. (mark@flylightning.net or info@flylightning.net)