

If anything interesting happens, I will let you know. Editor

flare, touchdowns are a breeze. All in all an impression, not of an hot, difficult plane but rather one of safety and controllability.

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Another Resin Sydem?

Annual report Dutch Defiant Department;

In October we once again spent a very productive and pleasant three weeks at New Garden airfield working on N728LD.

Plans were for first flite this stay, but, as was to be expected a myriad of small electrical problems, fuel leaks, setting up the main gear (Cessna 210) hydraulics and getting the elevator pushrods to clear the longerons, slurped up the available time. We did, however, get to do some taxi-testing:

Directional control seems to be excellent with the propwash on the rhino rudder. On the fourth run to 50 knots the nose gear set up a magnificent shimmy which quickly snapped the linkage to the pedals, happily leaving me brakes for steering. My shimmy dampener is installed above the floor, and obviously leaves too much scope for the slop in the rest of the steering train to set up shimmy. A Cessna type dampener will be installed on the gear itself. Setting the axle at no load minimal trail evidently still produces enough trail at load (500 lbs) to result in shimmy. Of course negative trail at no load is not allowable.

Although some of my fears about test flying had now been verified, my trust in Defiant has been tremendously bolstered. John Steichen's very kind initiative to fly all the way from Chicago to allow me some stick&rudder time in N27EZ.

Defiant is really the easiest plane to fly, a beautifully light and natural feel to the stick. Engine out procedures, with some aft stick thrown in for kicks are laughably simple (just a few days before I had been kept on edge in a multi-course in a Seneca)

Approaches show a motorglider-like willingness to float, so with proper energy management in the circuit and not allowing yourself to pitch up excessively in the

As you can imagine we are now fairly



chomping at the bit to start flying, but will have to contain ourselves till spring. Albeit somewhat early we wish you all happy flying in 1997

Hank Timmer and Joe Stevens
Netherlands

Don Bohart

I have about given up on owning a Defiant. So-o-o, I have bought the Scaled Composite CM-144A. It is a two place canard (naturally). It is quite a plane, a much oversized Long EZ. 3000 lb. gross weight, separate front and rear canopies, 90 gals of fuel, 30.5 ft wing span. Engine is a TIO-360 with a three blade Hoffman prop, built in military style O2 system in the front only. It has an electric nose gear.

It has been a learning experience in getting the landings down. Fun flying. At 90 kts it was tested to 20+ hrs of endurance.

Editor: let's have some pictures
Don!

Resin Systems

This article in a recent **Central States Newsletter** underscores the need to become very very familiar with the resin systems that you are using, especially if you change to something else after working with a product that you have been happy with. I am republishing it because the topic is so important.:

In the April issue Chris Mitchell reports Hexcell (maker of Safe-t-Poxy type 8 Epolite 2427) resin had sold the resins to Fiber-Resin Corp.

The latest CP reports the new owner has discontinued the resin leaving many builders with a resin compatibility problem as other RAI approved resins have also been discontinued.

You may remember, in CI 77, that Scaled Composite stopped using the Safe-t-Poxy product when it was found to contain a very low percent age of MDA (a known carcinogen) and styrenes (highly allergenic).

Scaled Composites now uses a Gougeon Brothers Inc. (517 684 7286) resin

system that is free of MDA. This resin is called PRO-SET. I requested a technical information package and found it was designed for fabrication of fiberglass aramid, graphite, and hybrid composites using wet-layup, vacuum bag and resin infusion laminating methods.

PRO-SET Laminating Epoxies consist of four resins of different viscosity and three hardeners with different cure rates. Resins and hardener combine to create ten different epoxy mixtures, each with unique handling and cured physical properties. You need to select the proper resin/hardener combination. Some combinations require postcuring if final stage cure is to ever be reached. A call to Mike Melvil at RAF found they use the slow cure material and post cure it. Mike has constructed an entire airplane with it and has constructed his Long-EZ aux fuel tanks with it. He is very happy with the product!

PRO-SET mini pumps provide accurate dispensing of PRO-SET epoxy. One full stroke of the resin pump and one full stroke of the hardener pump provide a proper ratio.

Another resin option has entered the

NOTE: PLEASE WHEN YOU WRITE THE DEFIANT NEWSLETTER WITH PAYMENT CHECKS. PLEASE WRITE THEM TO "JOHN STEICHEN". When they are written to the Defiant Flyer, sometimes I can sneak them by the bank, sometimes I cannot, and I have to return them to you to reissue

market. Former Hexcel product manager and Cozy Mark IV builder, Gordon Bowen, (801-394-5537), decided not to let Safe-t-Poxy technology die. He has introduced E-Z Pox, 9315 resin and 9317 hardener, a near exact replacement for Safe-t Pox.

It seems that the early 2427 system had stability problems and reacted to moisture and CO₂ in the atmosphere. It developed a "cottage cheese" consistency. The product has since been modified to be more tolerant but seems to still have stability problems in very humid areas. I have had a batch of styrene and MDA free 427 in my garage ratio pump for a year now and there has been no "cottage cheese" change in its consistency. I have kept a small light bulb burning in the epoxy cabinet to keep humidity down.

High moisture causes decrease in physical properties of all epoxies. Mike reports Scaled Composites uses desiccant in the epoxy pumps at their Mojave location. If they do that in dry Mojave imagine the humidity problems in Gulf coast states.

The E-Z Pox has been introduced to offer an alternative for those wanting a product with a 20 year history of performance. It seems less effected by high humidity than the 2427.

I contacted Gordon and he stated the E-Z Pox is much more stable than the 2427. He further directed me to contact Jeff Russell of AeroCad (910) 961-2238 to learn of the problems he had with the 2427 in a humid North Carolina environment. His article follows in this issue.

The latest Canard Pusher reports, "RAF can not comment on whether you should use E-Z Pox, which more than likely contains MDA. It is up to you to ascertain how much MDA is contained in E-Z Pox." If you decide to use E-Z Pox, RAF recommends the EZ-10 and EZ-84 combination. This system is available from Spruce (GA or CA) or Diversified Materials of San Diego.

A call to Mike Brown at Wicks (June 13) found that 2427 is in stock and will continue to be available as long as the manufacturer supplies it. At this time they are uncertain if they will market the E-Z Pox. PTM8W and the old RAE systems are also in stock. Mike indicated 2427 and PTM8W were not resins of his choice. He feels PRO-SET and E-Z Pox properties are far superior.

Amine Blush in Resin

Jeff Russell - AeroCad (NC) - We have used the following resins and have found very different results in our testing: Hexcel RAE 2426 resin and 2176, 2177 hardener,

Hexcel EPOLITE 2410 resin and 2183, 2184, 2187 hardeners, Hexcel EPOLITE 2318 resin and 2316 hardener, Hexcel 2427 resin and hardener, PTM8W 3660 resin and PR2032 hardeners (fast and slow) 5 different types, CLEARSTREAM EPOXY, WEST SYSTEMS 105-5 resin and 205, 206 hardeners for finishing, ALPHA - POXY for finishing, and RYCHOR EPOXY for finishing.

The climate conditions in which you work will most effect the way an amine base resin will work for you. The only non amine base resin system we have used is Hexcel's EPO LITE 2183 2184 and 2187 hardeners. The bad thing is these hardeners contain MDA and styrene. These Styrene-Monomer based systems dissipate water as they cure so that amine blush or other water related problems go away.

Amine blush is caused by high humidity and by the amine group in the resins and hardeners accepting CO₂ and H₂O. This is noticed as a white film around the lids of a laminate or by a thin film that gums up your sand paper. People often think their resins are not curing and that they have been supplied faulty materials. The real culprit is amine blush caused by high humidity and high temperature.

As temperature increases, the air can hold much more moisture and CO₂.

Higher temperature also increases the number of reactive sites available and sets up the perfect condition for amine blush to occur. With all this technical hoop set aside, most builders only want to know how to prevent amine blush or how to cure the problem that they now have on their laminate. The following are remedies for amine blush:

1. Use peel ply. Amine blush forms most generally on the outer most portion of the lay-up. By using peel ply the amine blush is removed when the peel ply is removed, leaving a laminate free of amine blush and ready for secondary bonding.
2. Use a high quality resin, or a fast hardener. The length of time that resin is uncured is the length of time of exposure for the formation of amine blush. Reduce this time and you will reduce the amount of amine blush.
3. Cap all resins as soon as possible. This reduces exposure to the elements that cause amine blush. (DO NOT USE EPOXY PUMPS) Humidity in the fiberglass and core material will effect how a laminate will turn out too.
4. Work in a controlled environment if possible. It is often hard to have a temperature and humidity controlled shop, but we can do our lay-ups at times when

the temperature and humidity is not extremely high as we frequently see it in North Carolina.

5. Amine blush can be washed off with a clean cloth and warm water once the initial cure has occurred.

6. Sanding will remove the amine blush and also gum up your sand paper. Amine blush must be removed before subsequent or secondary laminates or lay-ups are initiated. If the amine blush is not removed, the interlaminar shear strength is only as strong as the amine blush. I find that the easiest method is to purchase a high quality resin that is not so susceptible to amine blush and use peel ply. By doing this, I get the best of both worlds. I get a resin that is easy to work with and that has higher qualities in virtually every area. I reduce sanding work and lighten my laminate by using peel ply. With these issues in mind, we use only EPOLITE 2183, 2184, 2187 hardeners which eliminate amine blush.

We, at AeroCad, have had bad results testing Amine base hardeners. On a glass to glass bond (tape glassing cured bulkheads in place to other cured glass) the tape glass would peel off like it was bonded to wax paper. We also found fully cured laminates to have poor peel strength between plies. Vacuum bagging also produced the same reaction.

We deal with 80 to 90 percent humidity in our areas most of the time. We feel you should always test your resin systems to see if these types of problems come up. Most of our peel strength problems were seen in the wintertime. The longer the cure rate the more moisture that seemed to creep into the laminate. We had material reps examine the problems we found in our testing and, surprisingly, no answers came from them.

Our fix is to just use Styrene monomer base hardeners.

RAF is in the desert with almost no humidity so they will not have our high humidity problems. Use oil resins as if you are a Guinea pig in your area. TEST-TEST-TEST until you know the resins will work for your needs in your area.

We also found that the T_g (glass transition temperature) was not what the resin manufacturer said it was. We took nose struts made of S-2 glass and sample resin from manufacturers and post cured it, slowly stepping up to 190°. We would then let it cool and re-heat it to 160° then 170° and so on until the resin became rubbery. Some samples would only reach 160° and others maybe 180°. Are resin manufacturers lying to us as end users? They told us to expect 10-20% lower T_g

values because we were not in THEIR lab. If that is the answer you can expect from them, you had best TEST - TEST - TEST.

Brian Martinez

Whats new with my projects? Well, we continue to debug the Q-200. I got past the induction problems last spring. That was an education in trouble shooting tank venting and a resultant loss of head pressure on reaching flight speed. Running around the pattern with less than

hear from someone with new resin ideas for the fuselage, specifically those involving resins with higher glass transition temperatures. The front cowl is close to final in moldline and represents a reduction of front firewall surface area, again trying for smaller wetted area and lighter weight. The aft cowl is provisional for now but does not have final bulges formed in the moldline for horizontal opposed aircraft cylinders (i.e., might work as is for a narrow auto engine conversion). The current fuselage configuration has a surface area of 181.2

cooling air from the front engine? Is the per plans cooling updraft because the lowest pressure exhaust is on top of the cowl?

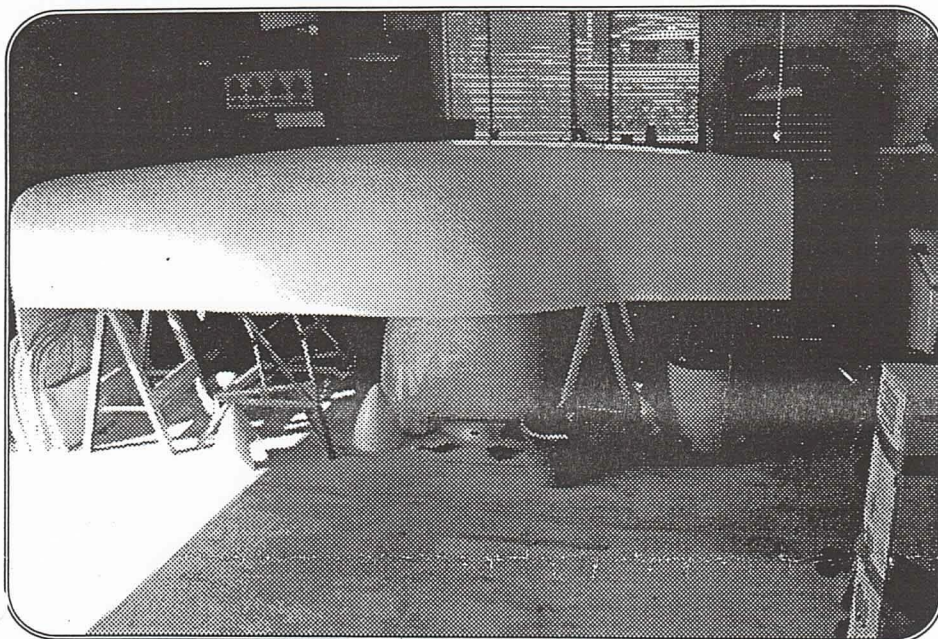
Editor: I think the front up draft cooling was Rutan's best guess in 1978. It is my opinion that most of the flying Defiants are used as flying station wagons. Little if any airflow work has been done on the Defiant fuselage. When you get your Defiant flying, You will be the expert. You are in virgin territory.

On other issues, I met up with Dan DeLong who is also in a hangar up at Mojave. Dan's project is well along with some very nice design details. I've seen Mark Shinnick fly out several times after fixing a nose gear collapse problem. George Best built a nice airplane with good lines. Sure would like to get a ride. Carl Meade just moved into the local area and was good enough to come over and take a look at the fuselage plug and offer some good suggestions. All and all, there are a lot of good people around making the project environment very rich. Anybody talk to Chris Smale lately? I'd really like to hear about that Mazda conversion and that computer instrument panel. So guys, WHATS THE BRIEF?

Brian Martinez

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50 percent power is not very exciting or safe. One does, however, give thanks to the string of designers of that 70's era who were approaching the design problem from the minimalist side..to say they don't need much power to stay up. Running at 180 KTAS currently, I'm looking for places to steal an extra 15 MPH and loose about 20 degrees of excessive oil temperature. Another thing to pass on is "starting from a known position". I started flight testing with an Ellison TBI on my O-200 right out of the hangar. That led me down all kinds of blind alleys, because while the Ellison was working just fine, I was always in doubt about where the problem was. So, start with the tried and true Marvel (which is where I am now) and when you have all the rest of the boogy men sorted out..you move up to the better TBI stuff!

Also enclosed are several of the graphic dumps of my "Defiant lofting studies". The picture I sent along shows the left hand fuselage plug which I completed this fall as the first part of trying to mold the body with more accurate compound curves and reduced surface area. I'd really like to

sq ft with internal volume of 138.41 cu ft. Does anyone know how this compares with the per plans fuselage? I'm still having a few file importing problems between some of the programs so its still up in the air whether I will be able to get a mesh run with PMARC for flow field and pressure distribution. (Has) Anybody else worked this problem for this configuration? Anybody know what the low and high pressure distribution looks like for the Defiant aircraft? Anybody got any idea how turbulated the air is as it enters into the aft prop and how does this change due to builder variation?

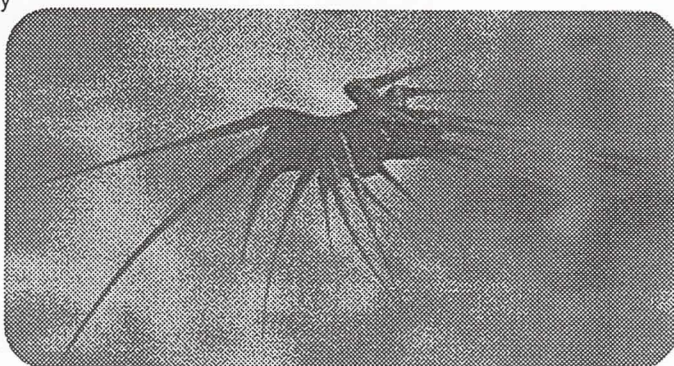
(Editor: Big time

turbulence and big time

variations.) There are a lot of award winning variations of the Long eze/Vari-eze/Cozy/Velocity aft cowlings (some with tuft or oil tested flows). What do the Defiants look like and what's the best? Where is the optimum place to dump

Editor: I have not heard from Chris Smale lately. I am expecting great things from you guys out there. So far the Defiant has not benefited from a coordinated redesign of the fuselage shape. The design is just about 20 years old and ripe for evolution. It is a trusty workhorse dreaming to be a stallion.

You may want to consider some of the airflow ramifications of the mystery canard that was photographed above the LosAngles basin just



recently. How can they get by not painting it white?

And with this we end 1996!
Happy New Year, and....
Live Long and Prosper